The University of Tokyo

Center for Spatial Information Science

External Evaluation Report

June 9, 2025

Table of Contents

Table of Contents 1
Part I: Self-Evaluation of the Center 2
Preface 3
Chapter 1. Overview of CSIS 4
Chapter 2. Organization 6
Chapter 3. Budget, Financial Closing and External Funds 15
Chapter 4. Research Activities 47
Chapter 5. International Exchange 96
Chapter 6. Intra-university Collaboration and Human Resource Development in Education and Research 99
Chapter 7. Status of Activities as Joint Usage/Research Center 110
Chapter 8. Other Research Exchange and Information Dissemination Activities 112
Chapter 9. CSIS Future Plans 121
Part II: External Evaluation of the Center 123
Chapter 1: Method of External Evaluation 124
Chapter 2: Summary of the External Evaluation 125
Appendices 134

Part I: Self-Evaluation of the Center

Preface

The Center for Spatial Information Science (CSIS) at the University of Tokyo was established in April 1998 as an intramural joint-use institution. In April 2006, CSIS became a national joint-use facility to support researchers within and outside the university in the field of spatial information science. In April 2010, the center made a new beginning as the Certified "Joint Usage/Research Center"* for Spatial Information Science. CSIS was certified again as the same in April 2016 and April 2022.

We have prepared this self-assessment report to objectively summarize the achievements of the center. The period covered primarily spans from the preparation of the previous self-assessment report (April 2017) until recently. We appreciate your honest opinions and advice regarding these achievements and its future activity plans.

*Translator's Note: The MEXT Joint Usage/Research Center Program, established by Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT), designates inter-university research institutes and university-based centers as hubs for nationwide academic collaboration. These centers provide shared access to large-scale facilities, specialized equipment, and valuable resources, enabling researchers to collaborate across institutions.

Chapter 1. Overview of CSIS

History of the Center for Spatial Information Science (CSIS)

The history prior to the establishment of CSIS goes back to the “recommendation for a national cartography museum (tentative name)” at the 104th meeting of the Science Council of Japan in 1988. To develop a research institution as proposed in the recommendation, the “National Geographical Information Science Research Center Establishment Preparation Committee” was created along with a sub-organization the “Establishment Preparation Association for the Geographical Information Science Research Center at the University of Tokyo” in 1996. In 1997, a formal request for the center's establishment was submitted by numerous relevant academic societies and overseas research institutes to the Ministry of Education, Science, Sports and Culture. On April 9, 1998, CSIS was established as an intramural joint research center at the University of Tokyo. CSIS was approved as a provisional Nationwide Joint-use Facility by the Council for Science and Technology of the Ministry of Education, Culture, Sports, Science and Technology in September 2004, and began operating as one of the Nationwide Joint-use Facilities in 2005. In 2006, CSIS was officially approved as a Nationwide Joint-use Facility. In April 2010, CSIS made a new beginning as a “Joint Usage/Research Center for Spatial Information Science” to strengthen the foundation of academic research in Japan and further expand academic research. CSIS was subsequently re-certified as a Joint Usage/Research Center in April 2016 and April 2022.

Spatial Information Science

The field of spatial information science develops systematic and versatile methods for constructing, managing, analyzing, integrating, and communicating spatial data (i.e., natural, social, economic, and cultural data with location information) and studies their applications in other fields. Furthermore, it is a core academic field that reinterprets all information of the universe, from nature and the society/economy to culture, from the perspective of spatial position, expansion, and change to achieve “knowledge structuring” with a focus on space.

Spatial information science has actively utilized geographical information systems (GIS) since the 1960s. Therefore, spatial information science is closely linked to geography and information science. It is also strongly associated with various areas of engineering such as urban and civil engineering; various areas of the humanities and social sciences such as economics, sociology, and archaeology; and various areas of biology and medicine such as ecology and medical sciences. This is because drastic advancements can be produced in terms of academic and social applications when existing information is reinterpreted from the perspective of spatial location. Contemporary society is overwhelmed with vast volume of data and information. Thus, it has become an urgent issue to find new knowledge and value from these data and information and make them useful to real-world and human problems. Spatial information science is highly regarded as an academic field capable of providing methods and techniques to address these challenges.

Objectives of the Establishment of CSIS

CSIS contributes to the achievement of the following goals.

1) Creating, developing, and spreading spatial information science

CSIS aims for the formation and growth of the center by implementing leading-edge research that is highly creative and unique in the area of spatial information science, and seeks to create, develop, and spread a new academic discipline through multidisciplinary integration and collaborative efforts.

2) Developing of the Spatial Data Infrastructure for Research

Research in spatial information science requires a large volume of geospatial data. However, much time and effort is needed to produce this data. Recently, a significant amount of data is sold by public organizations and the private sector, but it is unrealistic for individual researchers to gather such resources on their own. Important data created by individuals often remain unused and overlooked. Therefore, CSIS creates data that is commonly used and of high academic value through independent agreements and developing/implementing systems that allow researchers in Japan and overseas to use such data to support research in many fields.

3) Promoting joint industry-government-university research

Research in spatial information science has the character of basic scientific research as well as applied and policy-oriented scientific research. Joint research between industry, the government, and universities is essential to the field. For example, research on the standardization of geospatial data requires joint work with related government agencies, while venture research in new industries requires joint work with the private sector. Therefore, CSIS provides a platform to foster such joint research.

Systems to Support Nationwide Joint Research

As stated in 2) of the above goals of the establishment of CSIS, research in the field of spatial information science requires a diversity of data. However, it is often difficult for individual institutions and researchers to gather such data. Therefore, CSIS has established the following support systems and frameworks.

1) Providing the Spatial Data Infrastructure for Research

CSIS gathers a large volume of diverse spatial data for research purposes and provides such data as part of a “Spatial Data Infrastructure for Researchers.” Because application and evaluation procedures for joint research by the review committee are processed electronically, researchers can access the data shortly after their application through the Joint Research Assist System (JoRAS), an originally developed web-based system. CSIS also promotes joint research by providing tools for data processing and analysis, as well as systems for e-learning, to the public.

2) Partner Organization Meeting

CSIS has a Partner Organization Meeting consisting of representative researchers in various research fields who belong to partner institutions across Japan (18 universities and 1 government agency) and CSIS faculty members. This meeting includes a survey of requests regarding the content and form of the data items contained in the Spatial Data Infrastructure for Researchers and the services provided, as well as the evaluation of the activities of CSIS.

Chapter 2. Organization

Research Advisory Board

The Research Advisory Board (equivalent to the Steering Committee of Joint Usage / Research Center), of which at least half of the members are academic experts from outside of the university, exists as an organization to deliberate and provide advice regarding the center's research plans and joint usage and research initiatives.

Steering Committee

The Steering Committee comprises professors, associate professors, lecturers, and others of the university and deliberate important matters related to CSIS under the supervision of the Director.

Faculty and Staff

As of October 1, 2024, the members of CSIS are as follows: 15 full-time faculty members (5 Professors, 2 Associate Professors, 5 Lecturers, 1 Project Lecturer, 1 Assistant Professor, and 1 Project Assistant Professor), 7 joint-appointment faculty members (4 Professors, and 3 Associate Professors), 15 project faculty and researchers (1 Project Professor, 1 Project Associate Professor, 4 Project Assistant Professors, and 8 Project Researchers), and 6 research support staff members. These members are engaged in the educational and research activities of the center. In addition, to promote spatial information science nationwide, CSIS collaborates with 20 Visiting Professors and Visiting Associate Professors from 18 universities across Japan, encompassing national, public, and private institutions*, as well as one researcher from the Geospatial Information Authority of Japan (GSI). Furthermore, it conducts research with 125 Visiting Researchers and 30 Visiting Research Associates. By cooperating with many individuals in this way, CSIS is able to fulfill its role as a Joint Usage/Research Center. For details of the members, please refer to the following table.

Core Members

Name	Position
Yoshihide Sekimoto	Director / Professor
Ikuho Yamada	Vise-Director / Professor
Kaoru Sezaki	Professor
Takashi Oguchi	Professor
Takaaki Takahashi	Professor
Daisuke Kurisu	Associate Professor
Dinesh Manandhar	Associate Professor

Name	Position
Yuuki Nishiyama	Lecturer
Yoshiki Ogawa	Lecturer
Yuki Otsu	Lecturer
Renhe Jiang	Lecturer
Takahiro Yoshida	Lecturer
Yanbo Pang	Project Lecturer
Kotaro Iizuka	Assistant Professor
Yuriko Yazawa	Project Assistant Professor

*Translator's Note: In the Japanese context, universities are categorized into three types: National (kokuritsu), established and funded by the national government; Public (kouritsu), established and funded by local governments, such as prefectural and municipal authorities; and Private (shiritsu), operated independently by private organizations.

Joint-Appointment Members

Name	Position	Affiliation
Yasushi Asami	Professor	Graduate School of Engineering
Shin-ichi Nakasuka	Professor	Graduate School of Engineering
Yukio Sadahiro	Professor	Interfaculty Initiative in Information Studies
Hiroki Kobayashi	Professor	Information Technology Center

Name	Position	Affiliation
Dai Yamazaki	Associate Professor	Institute of Industrial Science
Kentaro Honma	Associate Professor	Institute of Industrial Science
Yuya Shibuya	Associate professor	Interfaculty Initiative in Information Studies

Project Members

Name	Position
Shun Shiramatsu	Project Professor (Fixed-term)
Toshikazu Seto	Project Associate Professor (Fixed-term)
Deeksha Arya	Project Assistant Professor
Yuuki Iwai	Project Assistant Professor
Dongyuan Li	Project Assistant Professor
Mayumi Mizobuchi	Project Assistant Professor (Fixed-term)
Yuriko Umeda	Project Researcher

Name	Position
Puneet Jeph	Project Researcher
Jue Ma	Project Researcher
Shenglong Chen	Project Researcher
Hiroshi Omata	Project Researcher (Fixed-term)
Ryuichi Matsushima	Project Researcher (Fixed-term)
Asaki Fujino	Project Researcher (Fixed-term)
Miyuki Shirasawa	Project Researcher (Fixed-term)

Administrative Staff

Name	Position
Yusuke Kimura	Technical Support (Project Researcher)
Ai Suzuki	URA (Project Academic Specialist)
Kazue Sakata	Administrative Staff
Shinobu Iizumi	Administrative Staff
Yuko Miyata	Administrative Staff
Yukiko Jennings	Administrative Staff

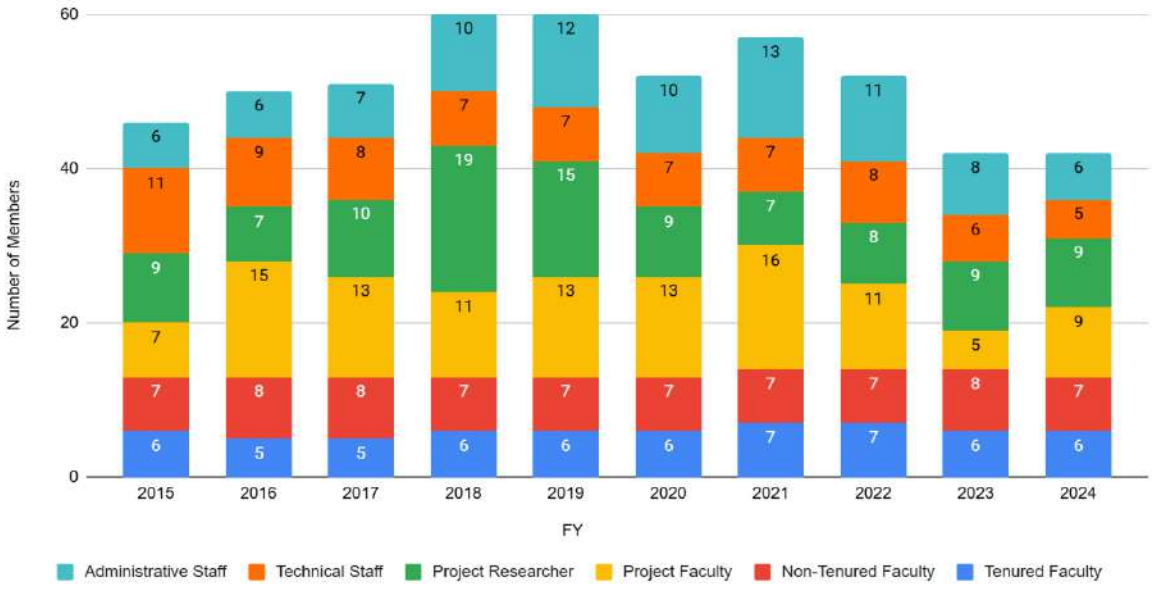
Visiting Members

Name	Affiliation	Position
Nobuaki Kubo	Tokyo University of Marine Science and Technology	Visiting Professor
Kallidaikurichi Easwaran Seetharam	Asian Development Bank Institute	Visiting Professor
Koji Makanae	Miyagi University	Visiting Professor
Hiroaki Inatsugu	Waseda University	Visiting Professor
Masahiko Shoji	Musashi University	Visiting Professor
Keiji Yano	Ritsumeikan University	Visiting Professor (Domestic Bases)
Ryohei Nakamura	Okayama University	Visiting Professor (Domestic Bases)
Yasuhiro Mitani	Kyushu University	Visiting Professor (Domestic Bases)
Wanglin Yan	Keio University	Visiting Professor (Domestic Bases)
Masahiko Onozato	Hokkaido University	Visiting Professor (Domestic Bases)
Kazuya Mori	Kyoto University	Visiting Professor (Domestic Bases)
Fumiharu Mieno	Kyoto University	Visiting Professor (Domestic Bases)
Keiji Kimura	Nara University	Visiting Professor (Domestic Bases)
Hisamitsu Miyauchi	University of the Ryukyus	Visiting Professor (Domestic Bases)
Tomoko Sekine	Nihon University	Visiting Professor (Domestic Bases)
Hiroshi Yarai	Geospatial Information Authority of Japan	Visiting Professor (Domestic Bases)
Morito Tsutsumi	University of Tsukuba	Visiting Professor (Domestic Bases)
Kazuhiro Yamamoto	Osaka University	Visiting Professor (Domestic Bases)
Keiichi Okunuki	Gunma University	Visiting Professor (Domestic Bases)
Fumiko Ito	Tokyo Metropolitan University	Visiting Professor (Domestic Bases)
Kentaro Nakajima	Hitotsubashi University	Visiting Professor (Domestic Bases)
Mio Kasai	Hokkaido University	Visiting Professor (Domestic Bases)
Hitoshi Saito	Nagoya University	Visiting Associate Professor (Domestic Bases)
Yuzo Suga	Hiroshima Institute of Technology	Visiting Researcher (Domestic Bases)
Atsushi Suzuki	Rissho University	Visiting Researcher (Domestic Bases)
Hiroyuki Kawano	Nanzan University	Visiting Researcher (Domestic Bases)

Faculty and Staff (Core Members) who were at CSIS from April 2017 - March 2024 and are currently affiliated with other organizations.

Name	Position	Period
Ryosuke Shibasaki	Professor	1998/6-2023/3
Yukio Sadahiro	Professor	2012/10-2019/3
Yuzo Maruyama	Associate Professor	2001/3-2017/10
Yuichi S Hayakawa	Associate Professor	2009/4-2018/8
Xuan Song	Associate Professor	2019/4-2024/3
Yuya Shibuya	Associate Professor	2022/1-2024/3
Takahiko Kusakabe	Lecturer/Associate Professor	2016/4-2022/3
Shonosuke Sugasawa	Lecturer/Associate Professor	2018/4-2023/3
Mariko Nakagawa	Lecturer	2016/4-2021/3
Kentaro Honma	Lecturer	2018/9-2019/3
Hiroki Kobayashi	Assistant Professor/ Lecturer /Associate Professor	2013/9-2020/3
Naoya Fujiwara	Assistant Professor	2014/4-2017/5
Yuki Akiyama	Assistant Professor	2016/4-2020/3
Hisatoshi Ai	Assistant Professor	2016/4-2022/3
Akira Nishizawa	Project Professor	2015/10-2020/3
Chihiro Shimizu	Project Professor	2019/4-2022/3
Satoru Nakajo	Project Associate Professor	2012/10-2017/9
Atsushi Koshio	Project Associate Professor	2021/8-2023/3
Toshikazu Seto	Project Lecturer	2013/6-2021/3
Hiroyuki Miyazaki	Project Assistant Professor	2016/4-2021/3
Masatomo Suzuki	Project Assistant Professor	2019/4-2020/10
Hiroki Baba	Project Assistant Professor	2020/4-2020/12
Hongjik Kim	Project Assistant Professor	2021/4-2021/12
Tomohito Honda	Project Assistant Professor	2021/4-2022/3
Hideki Kaji	Project Assistant Professor/Project Researcher	2016/4-2023/3
Kazuhiko Nakamura	Project Researcher	2013/4-2018/9
Yuki Fukushima	Project Researcher	2014/4-2017/5
Koichi Miyashita	Project Researcher	2017/10-2019/9
Sunyong Eom	Project Researcher	2019/3/-2021/5
Yuki Miyoshi	Project Academic Specialist	2015/5-2022/11

The following graph shows the changes in the number of faculty and staff from 2015 to 2024. The total number of faculty and staff has shown a slight downward trend. The number of non-tenured and tenured faculty members has not changed significantly, but the number of project faculty members/researchers and administrative staff has increased or decreased significantly. This may be partly due to the fact that when faculty members transfer in and out, project faculty members, researchers, and administrative staff employed by the faculty member's project also transfer in and out.



Number of Faculty and Staff

Research Division

CSIS comprises the following research divisions to promote spatial information science:

1) Division of Spatial Information Analysis

This division develops methods for extracting spatial characteristics such as the shape and distribution of various spatial phenomena including landforms, hydrology, vegetation, society, culture, language, and economy. The division also develops and applies spatial analysis theory to uncover the underlying mechanisms. In addition, the division developed a system to support spatial decision-making that contributes to the planning processes of real society, for example, to predict future phenomena or analyze policies.

2) Division of Spatial Information Engineering

This division conducts research on various techniques and integrates and mines methods to efficiently obtain an enormous volume of data connected to location and time generated by various sensors dispersed throughout a real space. Furthermore, data reflecting the conditions of real spaces dispersed on the Internet are collected. This division also studies extensive applications based on spatio-temporal data such as data visualization, location information services, and future prediction.

3) Division of Spatial Socio-Economic Research

The aim of this division is to promote theoretical and empirical studies on diverse social and economic phenomena, focusing on their spatio-temporal characteristics. Furthermore, the division develops methods to statistically analyze the spatio-temporal data needed in empirical analyses. It also constructs spatio-temporal databases that are made available to researchers across Japan to enhance empirical research in the social sciences, in particular, in urban and regional economics.

4) Division of Joint Usage and Research

This division reconstructs scattered spatial data and spatial knowledge to compile a spatial information base. It conducts research and development activities focused on environments that support research and educational activities related to these data and that use them in sophisticated applications. In addition to designing, implementing, and validating initiatives directed at the development of research communities, this division studies the environments, methods, and systems needed to promote social applications of the spatial information base.

5) Division of Spatial Formation for Innovation Hubs and its Evaluation (Social Cooperation Research Departments, October 2024-)

This division investigates the formation of innovation hubs from a spatial perspective. It analyzes the location dynamics of startups and the effectiveness of innovation promotion measures implemented in incubation facilities both quantitatively and qualitatively so as to obtain insights into regional and spatial developments that attract new startups and support their growth.

6) Division of Space System and Geospatial Information Engineering (Social Cooperation Research Departments, July 2016 - June 2021) + Division of Global Geospatial Information (Corporate Sponsored Research Programs, April 2016 - March 2021) (commonly known as “Division of Space System and Geospatial Information Engineering”)

Supported by private companies and foundations, this division aims to strengthen technology regarding spatial information management/distribution infrastructure in Japan, and to develop platforms for various spatial data, utilizing a network of hub universities overseas, particularly in Asia. The division also deals with a wide variety of spatial information, for example, space utilization, and is actively involved in making policy recommendations for geo-spatial projects, particularly in the public sector, and promoting human resource development and education.

7) Division of Real Estate Information Science (Corporate Sponsored Research Programs, April 2019 - March 2022)

This division comprehensively organizes micro data related to real estate transactions, transaction prices, and real estate use, and promotes the development of statistical indicators that enable a real-time understanding of the actual state of the real estate market, as well as empirically clarify real estate-related issues arising in urban areas due to population decline and aging.

Collaborative Research Organization for the Digital Spatial Society (DSS) (April 2020-)

To foster the development of new academic fields at the University of Tokyo by integrating disciplines across existing organizational boundaries, the "Collaborative Research Organization" system was established in 2016. This system enables multiple departments to collaborate on research as an official entity. Building on this foundation, the “Collaborative Research Organization for the Digital Spatial Society (DSS)” was launched in April 2020, with CSIS serving as the coordinating department to advance interdisciplinary research in spatial information science. As of October 1, 2024, 18 departments, including CSIS, are participating in this initiative, and the Corporate Sponsored Research Programs have been established under DSS.

1) Division of Global Spatial Data Commons Initiative (May 2022-)

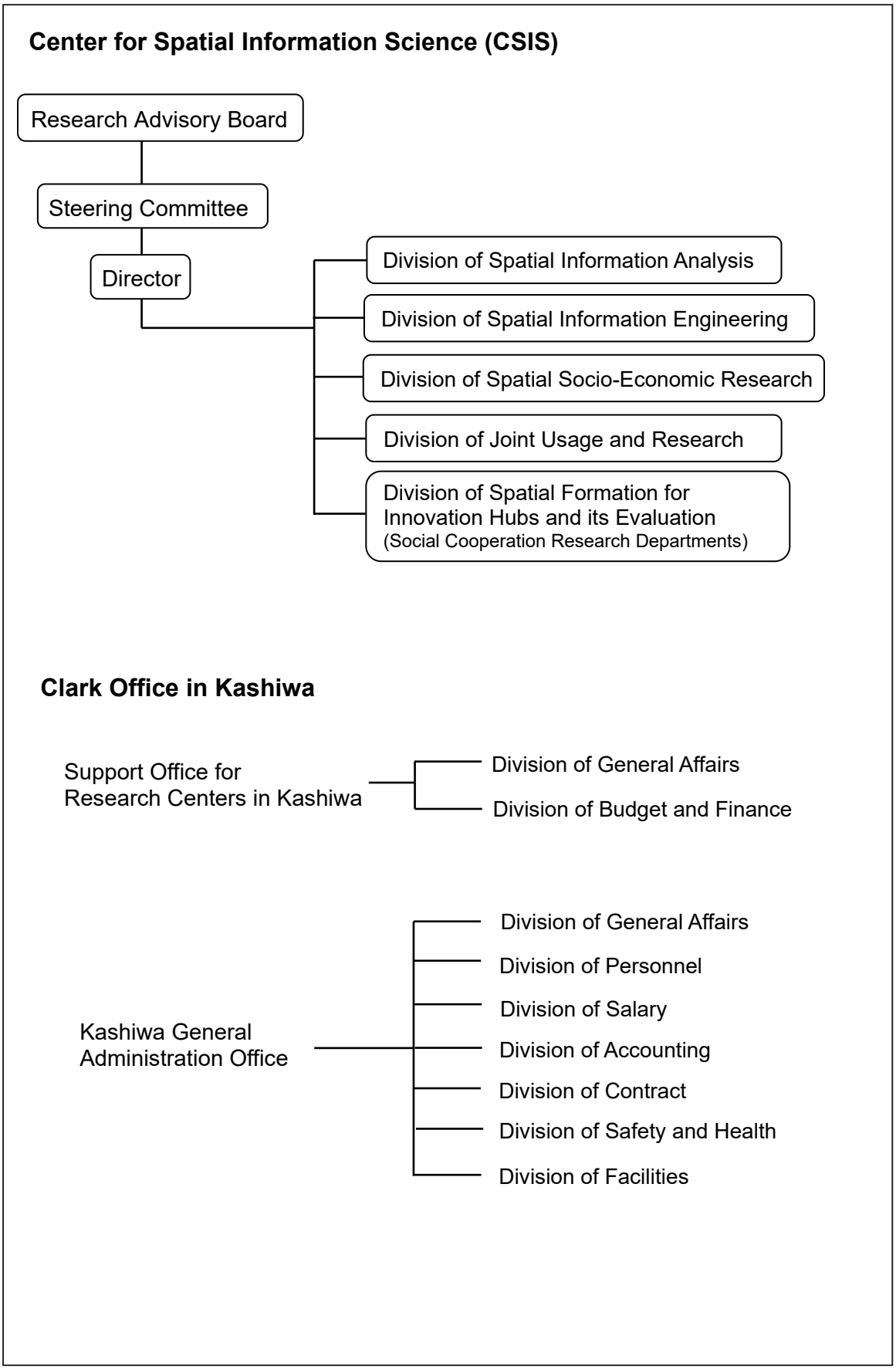
This division promotes the self-directed social deployment and operation of digital twins in each region by implementing digital twins for entire cities and supporting the emergence of technologies to resolve various local issues from the private sector and other stakeholders. Consequently, the division aims to form global spatial data commons. Additionally, the division provides data handling and training for private companies and local governments to promote human resource development.

2) Division of Civic Tech Design Initiative (July 2024-)

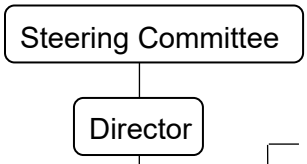
This division promotes the use of data and digital applications for regions and communities through the involvement of diverse stakeholders such as citizens and local businesses, with the Collaborative Research Organization for the Digital Spatial Society. Additionally, the division creates and develops learning and practice opportunities in various regions where each person can be proactively and consistently involved in the solution development process. And it provides opportunities for diverse dialogues, co-creation and experiences and builds a foundation to nurture and support activities that raise the digital power of the community through a bottom-up approach.

Organization Chart

(As of October 1, 2024)



Collaborative Research Organization for the Digital Spatial Society (DSS)



Research Divisions

- Division of Global Spatial Data Commons Initiative
- Division of Civic Tech Design Initiative

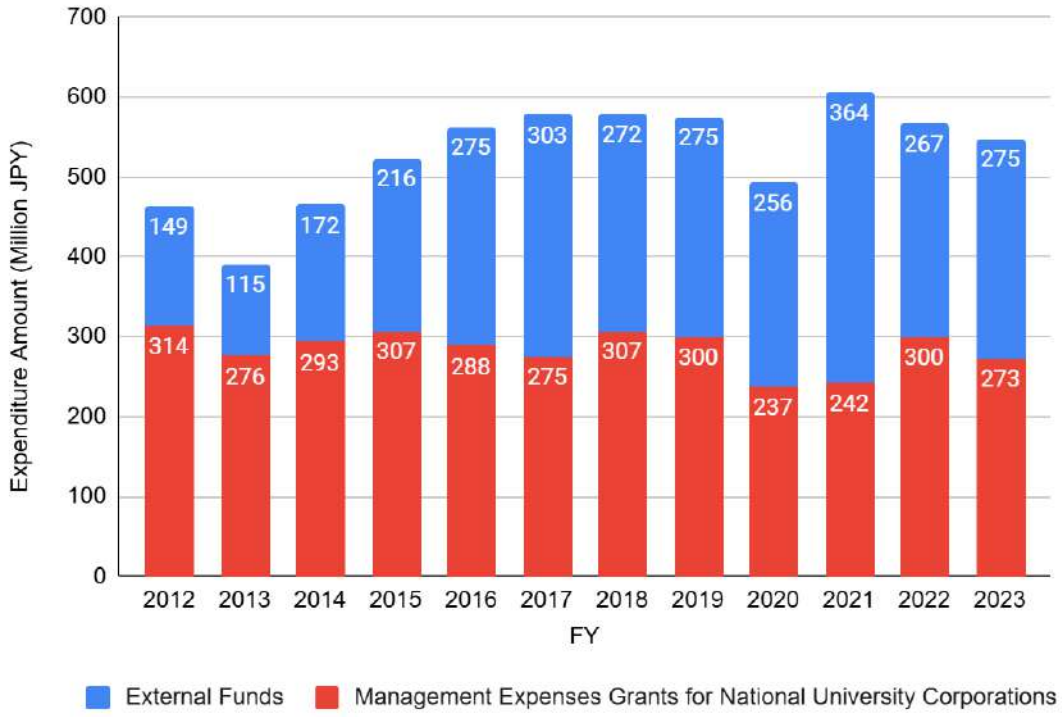
Participating Departments within the University

- CSIS
- Graduate School of Medicine
- Graduate School of Engineering
- Graduate School of Humanities and Sociology
- Graduate School of Science
- Graduate School of Agricultural and Life Sciences
- Graduate School of Economics
- Graduate school of Arts and Sciences
- Graduate School of Frontier Sciences
- Graduate School of Information Science and Technology
- Interfaculty Initiative in Information Studies
- Earthquake Research Institute
- Institute of Industrial Science
- Historiographical Institute
- Atmosphere and Ocean Research Institute
- Research Center for Advanced Science and Technology
- Institute for Future Initiatives
- Information Technology Center

Chapter 3. Budget, Financial Closing and External Funds

Expenditure Settlement Amount

The total expenditure settlement amount for FY2023 was 548 million yen (JPY). The amount of the Management Expense Grant has shown a slight decrease, while external funds have continuously exceeded 250 million yen since FY2016, covering about 50% of the total expenditures.



Trends in Expenditure Amounts

Research Expenses

Research expenses per faculty member have fluctuated between 21-26 million yen, with about 70-80% of the funds coming from external funds. 2 million yen is allocated to support internal young researchers (Chapter 6).

[Million JPY]

FY	Number of faculty members (a)	Total research expenses (including external funds) (b)	Total research expenses (excluding external funds) (c)	Amount allocated to research divisions (researchers) as research expenses (d)	Research expenses per one faculty member (including external funds) (b)/(a)	Research expenses per one faculty member (excluding external funds) (c)/(a)	Research expenses per one faculty member (amount allocated to research divisions (researchers), etc. as research expenses) (d)/(a)
2017	25	619	123	15	24.8	4.9	0.6
2018	24	608	154	13	25.3	6.4	0.5
2019	26	673	137	13	25.9	5.3	0.5
2020	26	601	120	11	23.1	4.6	0.4
2021	30	682	154	12	22.7	5.1	0.4
2022	25	530	139	13	21.2	5.6	0.5
2023	19	436	128	18	22.9	6.7	0.9

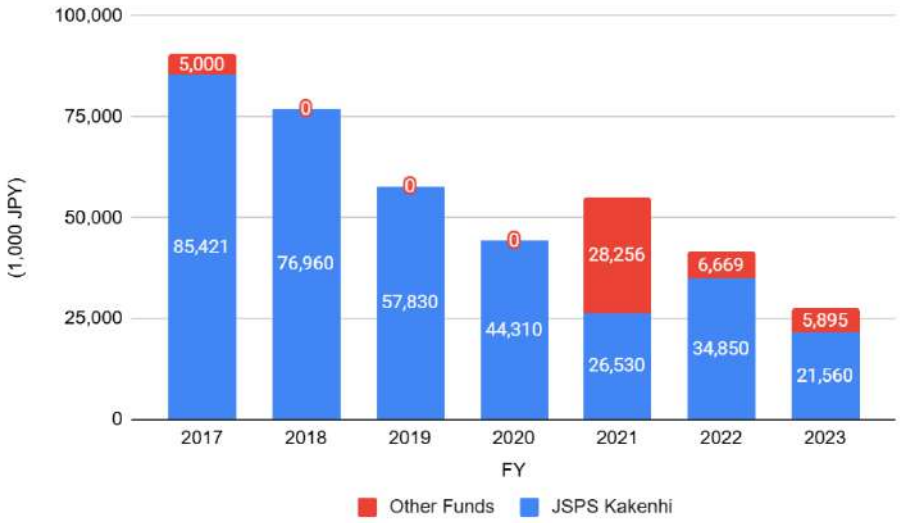
*The definitions of research expenses and each expense item in (b) and (c) are synonymous with those used in the Report of "Survey of Research and Development" (Statistics Bureau, Ministry of Internal Affairs and Communications): Personnel expenses, raw materials, purchase of property, plant, and equipment, purchase of intangible assets, lease payments, and other expenses.

*Research expenses in column (d) are the total amount of basic expenses such as Management Expense Grant that were actually allocated to research departments and researchers as research expenses, excluding external funds.

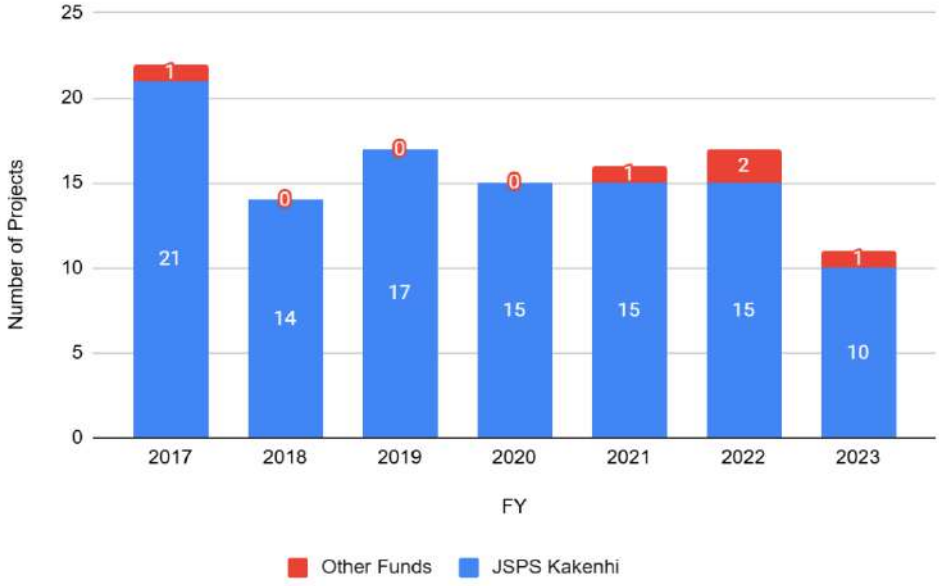
*External funds include Grants-in-Aid for Scientific Research, other grants, commissioned research, joint research with the private sector, and scholarship donations. The Grant-in-Aid for Scientific Research does not include the Grant-in-Aid for Young Scientists and the Grant-in-Aid for Incentive Research.

Research Projects Selected for Grants, including the Grants-in-Aid for Scientific Research Program (JSPS Kakenhi)

The following graph shows the change in the amount and number of Grants-in-Aid for Scientific Research*, and other funds from FY 2017 to FY 2023. Both the amount and the number of cases are on a downward trend, with a total of 27.46 million yen in scientific research grants, etc., and a total of 11 grants adopted in 2023.



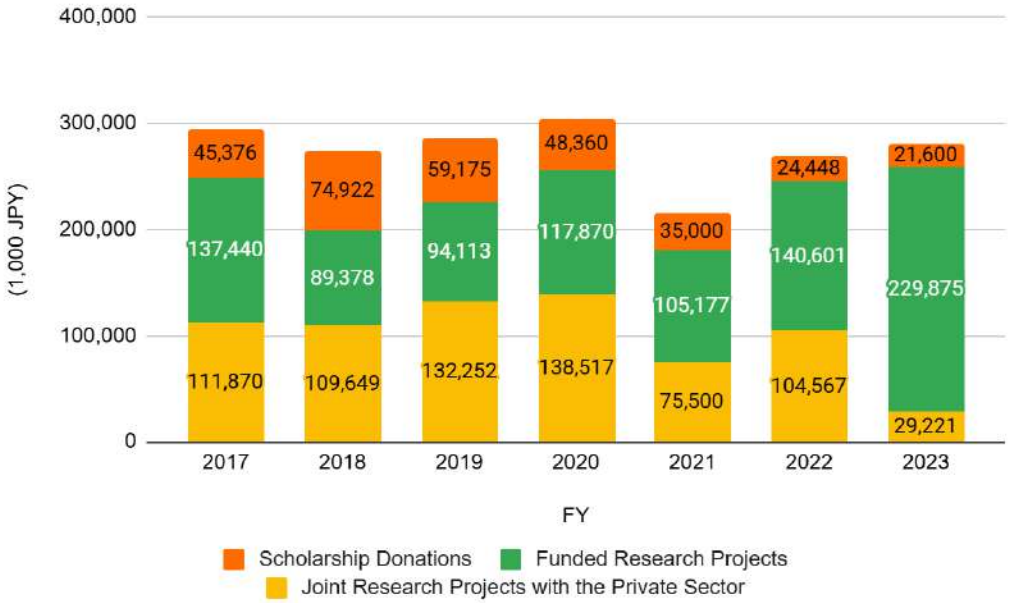
Trends in the amount of JSPS Kakenhi and other funds



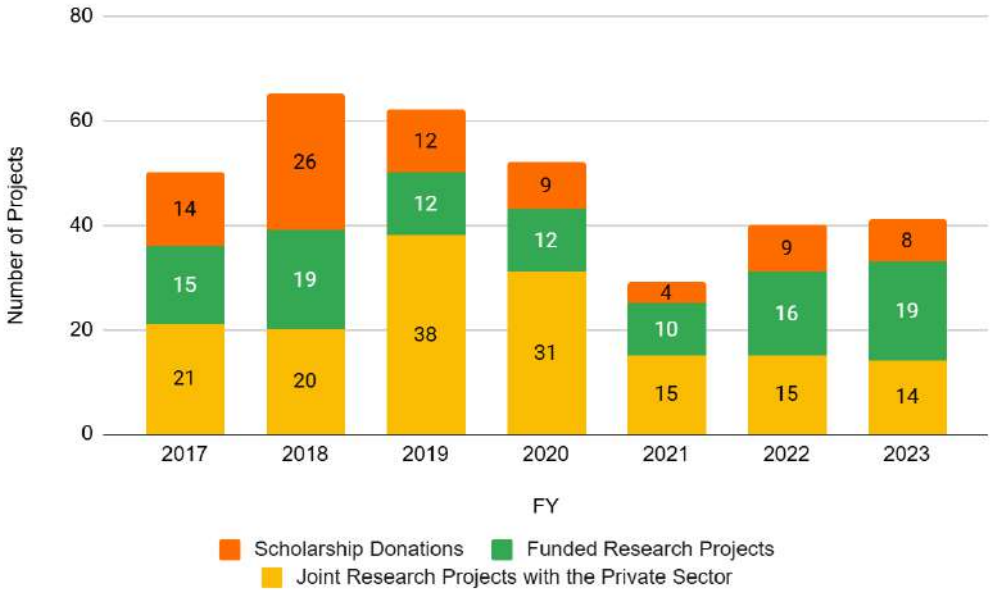
Trends in the number of funded JSPS Kakenhi and other funds

*Translator's Note: Grants-in-Aid for Scientific Research Program (JSPS Kakenhi) is a competitive research funding program administered by the Scientific Research Grant Committee of the Japan Society for the Promotion of Science (JSPS).

The graph below shows changes in the amount and number of external funds (scholarship donations, funded research projects, and joint research projects with the private sector, etc.) excluding Grants-in-Aid for Scientific Research (JSPS Kakenhi), from FY 2017 to FY 2023. Although the number of cases has slightly decreased, the funding received has remained at around 250 million yen, and since FY2021, funded research expenses have accounted for over 50% of the total.



Trends in the amount of external funds (excluding JSPS Kakenhi)



Trends in the number of external funds (excluding JSPS Kakenhi)

The following table shows the breakdown of scientific research funds (by research category) for each fiscal year.

Research Category		FY 2017				
		Number of projects			Amount (JPY 1,000)	
			Applied	Accepted	Total	Above: Direct expense
Grants-in-Aid for Scientific Research			(Projects)	(Projects)		Below: Indirect cost
	Grant in Aid for scientific Research on Innovative Areas (Research in a Proposed Research Area)	New	1	1	**4,420**	3,400
		Cont.		0		1,020
	Grant-in-Aid for Scientific Research (S)	New	0	0	**0**	
		Cont.		0		
	Grant-in-Aid for Scientific Research (A)	New	2	0	**9,760**	7,900
		Cont.		1		1,860
	Grant-in-Aid for Scientific Research (B)	New	3	2	**34,640**	27,800
		Cont.		4		6,840
	Grant-in-Aid for Scientific Research (C)	New	7	0	**1,430**	1,100
		Cont.		1		330
	Grant-in-Aid for Challenging Exploratory Research	New			**3,453**	2,793
		Cont.		3		660
	Grant-in-Aid for Challenging Research (Exploratory)	New	6	0	**0**	
		Cont.				
	Grant-in-Aid for Young Scientists (A)	New	4	0	**9,098**	7,478
		Cont.		2		1,620
	Grant-in-Aid for Young Scientists (B)	New	6	2	**6,110**	4,700
		Cont.		3		1,410
	Grant-in-Aid for Research Activity Start-up	New	0	0	**1,040**	800
		Cont.		1		240
	Grant-in-Aid for Publication of Scientific Research Results	New	0	0	**0**	
		Cont.		0		
	Grant-in-Aid for Special Purposes	New	0	0	**0**	
		Cont.		0		
	Fund for the Promotion of Joint International Research	New	1	1	**15,470**	11,900
		Cont.		0		3,570
Subtotal		New	New	**6**	**85,421**	**67,871**
		Cont.	Cont.	**15**		**17,550**
Others						
	Aids by MEXT other than Grant-in-Aids	New	1	1	**5,0000**	5,000
		Cont.				
	Aids by ministries other than MEXT	New			**0**	
		Cont.				
	Research funds by private sector	New			**0**	
		Cont.				
Subtotal		New	**1**	**1**	**5,000**	**5,000**
		Cont.	**-**	**0**		**0**
Total		New	**31**	**7**	**90,421**	**72,871**
		Cont.	**-**	**15**		**17,550**

Research Category		FY 2018				
		Number of projects			Amount (JPY 1,000)	
			Applied	Accepted	Total	Above: Direct expense
Grants-in-Aid for Scientific Research			(Projects)	(Projects)		Below: Indirect cost
Grant in Aid for scientific Research on Innovative Areas (Research in a Proposed Research Area)		New	0	0	**4,420**	3,400
		Cont.		1		1,020
Grant-in-Aid for Scientific Research (A)		New	2	1	**24,310**	18,700
		Cont.		1		5,610
Grant-in-Aid for Scientific Research (B)		New	8	2	**18,720**	14,400
		Cont.		2		4,320
Grant-in-Aid for Scientific Research (C)		New	0	0	**0**	0
		Cont.		0		0
Grant-in-Aid for Challenging Research (Pioneering)		New	1	0	**0**	0
		Cont.		0		0
Grant-in-Aid for Challenging Research (Exploratory)		New	3	2	**4,680**	3,600
		Cont.		0		1,080
Grant-in-Aid for Young Scientists		New	3	1	**1,820**	1,400
		Cont.				420
Grant-in-Aid for Young Scientists (A)		New			**5,460**	4,200
		Cont.		1		1,260
Grant-in-Aid for Young Scientists (B)		New			**2,080**	1,600
		Cont.		2		480
Grant-in-Aid for Research Activity Start-up		New	0	0	**0**	0
		Cont.		0		0
Grant-in-Aid for Publication of Scientific Research Results		New	2	0	**0**	0
		Cont.		0		0
Grant-in-Aid for Special Purposes		New	0	0	**0**	0
		Cont.		0		0
Fund for the Promotion of Joint International Research (Until FY2017)		New			**15,470**	11,900
		Cont.		1		3,570
Fostering Joint International Research (B)		New	1	0	**0**	0
		Cont.				0
Subtotal		New	**20**	**6**	**76,960**	**59,200**
		Cont.	**-**	**8**		**17,760**
Others						
Aids by MEXT other than Grant-in-Aids		New	0	0	**0**	0
		Cont.		0		0
Aids by ministries other than MEXT		New	0	0	**0**	0
		Cont.		0		0
Research funds by private sector		New	0	0	**0**	0
		Cont.		0		0
Subtotal		New	**0**	**0**	**0**	**0**
		Cont.	**-**	**0**		**0**
Total		New	**20**	**6**	**76,960**	**59,200**
		Cont.	**-**	**8**		**17,760**

Research Category		FY 2019				
		Number of projects			Amount (JPY 1,000)	
			Applied	Accepted	Total	Above: Direct expense
Grants-in-Aid for Scientific Research			(Projects)	(Projects)		Below: Indirect cost
	Grant in Aid for scientific Research on Innovative Areas (Research in a Proposed Research Area)	New	1	0	**0**	0
		Cont.		0		0
	Grant-in-Aid for Scientific Research (S)	New	0	0	**0**	0
		Cont.		0		0
	Grant-in-Aid for Scientific Research (A)	New	1	0	**19,500**	15,000
		Cont.		2		4,500
	Grant-in-Aid for Scientific Research (B)	New	4	1	**14,430**	11,100
		Cont.		2		3,330
	Grant-in-Aid for Scientific Research (C)	New	5	0	**1,430**	1,100
		Cont.		1		330
	Grant-in-Aid for Challenging Research (Pioneering)	New	1	0	**0**	0
		Cont.		0		0
	Grant-in-Aid for Challenging Research (Exploratory)	New	2	2	**7,410**	5,700
		Cont.		1		1,710
	Grant-in-Aid for Young Scientists	New	7	3	**7,280**	5,600
		Cont.		2		1,680
	Grant-in-Aid for Young Scientists (A)	New			**6,630**	5,100
		Cont.		1		1,530
	Grant-in-Aid for Young Scientists (B)	New			**650**	500
		Cont.		1		150
	Grant-in-Aid for Publication of Scientific Research Results	New	0	0	**500**	500
		Cont.		1		0
	Fostering Joint International Research (A)	New	0	0	**0**	0
		Cont.				0
	Fostering Joint International Research (B)	New	0	0	**0**	0
		Cont.		0		0
Subtotal		New	**21**	**6**	**57,830**	**44,600**
		Cont.	**-**	**11**		**13,230**
Others						
	Aids by MEXT other than Grant-in-Aids	New	0	0	**0**	0
		Cont.		0		0
	Aids by ministries other than MEXT	New	0	0	**0**	0
		Cont.		0		0
	Research funds by private sector	New	0	0	**0**	0
		Cont.		0		0
Subtotal		New	**0**	**0**	**0**	**0**
		Cont.	**-**	**0**		**0**
Total		New	**21**	**6**	**57,830**	**44,600**
		Cont.	**-**	**11**		**13,230**

Research Category		FY 2020				
		Number of projects			Amount (JPY 1,000)	
			Applied	Accepted	Total	Above: Direct expense
Grants-in-Aid for Scientific Research			(Projects)	(Projects)		Below: Indirect cost
Grant-in-Aid for Transformative Research Areas (A)	New	1	0	**0**		
	Cont.					
Grant-in-Aid for Transformative Research Areas (B)	New	0	0	**0**		
	Cont.					
Grant-in-Aid for Scientific Research (S)	New	0	0	**0**		
	Cont.		0			
Grant-in-Aid for Scientific Research (A)	New	2	0	**15,990**		12,300
	Cont.		1			3,690
Grant-in-Aid for Scientific Research (B)	New	3	0	**9,100**		7,000
	Cont.		2			2,100
Grant-in-Aid for Scientific Research (C)	New	3	0	**1,300**		1,000
	Cont.		1			300
Grant-in-Aid for Challenging Research (Pioneering)	New	1	0	**0**		
	Cont.		0			
Grant-in-Aid for Challenging Research (Exploratory)	New	3	0	**4,030**		3,100
	Cont.		2			930
Grant-in-Aid for Early-Career Scientists	New	4	3	**13,390**		10,300
	Cont.		5			3,090
Grant-in-Aid for Research Activity Start-up	New	0	0	**0**		
	Cont.		0			
Grant-in-Aid for Publication of Scientific Research Results	New	1	1	**500**		500
	Cont.		0			
Grant-in-Aid for Special Purposes	New	0	0	**0**		
	Cont.		0			
Fostering Joint International Research (A)	New	0	0	**0**		
	Cont.					
Fostering Joint International Research (B)	New	0	0	**0**		
	Cont.		0			
Subtotal	New	**18**	**4**	**44,310**		**34,200**
	Cont.	**-**	**11**			**10,110**
Others						
Aids by MEXT other than Grant-in-Aids	New			**0**		
	Cont.					
Aids by ministries other than MEXT	New			**0**		
	Cont.					
Research funds by private sector	New			**0**		
	Cont.					
Subtotal	New	**0**	**0**	**0**		**0**
	Cont.	**-**	**0**			**0**
Total	New	**18**	**4**	**44,310**		**34,200**
	Cont.	**-**	**11**			**10,110**

Research Category		FY 2021				
		Number of projects			Amount (JPY 1,000)	
			Applied	Accepted	Total	Above: Direct expense
Grants-in-Aid for Scientific Research			(Projects)	(Projects)		Below: Indirect cost
Grant-in-Aid for Scientific Research (S)	New				**0**	
	Cont.					
Grant-in-Aid for Scientific Research (A)	New	2	0		**0**	
	Cont.					
Grant-in-Aid for Scientific Research (B)	New	3	2		**17,810**	13,700
	Cont.		2			4,110
Grant-in-Aid for Scientific Research (C)	New	4	1		**2,340**	1,800
	Cont.		1			540
Grant-in-Aid for Challenging Research (Pioneering)	New	1	0		**0**	
	Cont.					
Grant-in-Aid for Challenging Research (Exploratory)	New	1	0		**0**	
	Cont.					
Grant-in-Aid for Early-Career Scientists	New	6	1		**4,810**	3,700
	Cont.		2			1,110
Grant-in-Aid for Research Activity Start-up	New	1	1		**1,560**	1,200
	Cont.					360
Grant-in-Aid for Publication of Scientific Research Results	New	1	1		**500**	500
	Cont.					0
Grant-in-Aid for Special Purposes	New				**0**	
	Cont.					
Fostering Joint International Research (A)	New	1	0		**0**	
	Cont.					
Fostering Joint International Research (B)	New	1	1		**2,730**	2,100
	Cont.					630
Subtotal	New	**21**	**8**		**29,750**	**23,000**
	Cont.	**-**	**7**			**6,750**
Others						
Aids by MEXT other than Grant-in-Aids	New				**3,220**	3,220
	Cont.					
Aids by ministries other than MEXT	New				**0**	
	Cont.					
Research funds by private sector	New				**25,036**	25,036
	Cont.					
Subtotal	New	**0**	**0**		**28,256**	**28,256**
	Cont.	**-**	**0**			**0**
Total	New	**21**	**8**		**58,006**	**51,256**
	Cont.	**-**	**7**			**6,750**

Research Category		FY 2022				
		Number of projects			Amount (JPY 1,000)	
			Applied	Accepted	Total	Above: Direct expense
Grants-in-Aid for Scientific Research			(Projects)	(Projects)		Below: Indirect cost
Grant-in-Aid for Scientific Research (S)	New	0	0	**0**		0
	Cont.		0			0
Grant-in-Aid for Scientific Research (A)	New	2	0	**0**		0
	Cont.		0			0
Grant-in-Aid for Scientific Research (B)	New	2	1	**16,640**		12,800
	Cont.		3			3,840
Grant-in-Aid for Scientific Research (C)	New	2	0	**1,170**		900
	Cont.		1			270
Grant-in-Aid for Challenging Research (Pioneering)	New	0	0	**0**		0
	Cont.		0			0
Grant-in-Aid for Challenging Research (Exploratory)	New	3	1	**3,250**		2,500
	Cont.		0			750
Grant-in-Aid for Early-Career Scientists	New	5	0	**6,890**		5,300
	Cont.		5			1,590
Grant-in-Aid for Research Activity Start-up	New	0	0	**1,560**		1,200
	Cont.		1			360
Grant-in-Aid for Publication of Scientific Research Results	New	1	1	**500**		500
	Cont.		0			0
Grant-in-Aid for Special Purposes	New	0	0	**0**		0
	Cont.		0			0
Grant-in-Aid for JSPS Fellows	New	1	1	**1,200**		1,200
	Cont.		0			0
Fostering Joint International Research (A)	New	1	0	**0**		0
	Cont.					0
Fostering Joint International Research (B)	New	0	0	**3,640**		2,800
	Cont.		1			840
Subtotal	New	**16**	**4**	**34,850**		**27,200**
	Cont.	**-**	**11**			**7,650**
Others						
Aids by MEXT other than Grant-in-Aids	New	1	1	**6,169**		6,169
	Cont.		0			0
Aids by ministries other than MEXT	New	1	1	**500**		500
	Cont.		0			0
Research funds by private sector	New	0	0	**0**		0
	Cont.		0			0
Subtotal	New	**2**	**2**	**6,669**		**6,669**
	Cont.	**-**	**0**			**0**
Total	New	**18**	**6**	**41,519**		**33,869**
	Cont.	**-**	**11**			**7,650**

Research Category		FY 2021				
		Number of projects			Amount (JPY 1,000)	
			Applied	Accepted	Total	Above: Direct expense
Grants-in-Aid for Scientific Research			(Projects)	(Projects)		Below: Indirect cost
Grant-in-Aid for Scientific Research (S)	New				**0**	
	Cont.					
Grant-in-Aid for Scientific Research (A)	New				**0**	
	Cont.					
Grant-in-Aid for Scientific Research (B)	New	2	0		**5,460**	4,200
	Cont.		1			1,260
Grant-in-Aid for Scientific Research (C)	New	1	0		**0**	
	Cont.					
Grant-in-Aid for Challenging Research (Pioneering)	New				**0**	
	Cont.					
Grant-in-Aid for Challenging Research (Exploratory)	New	1	0		**3,250**	2,500
	Cont.		1			750
Grant-in-Aid for Early-Career Scientists	New	4	3		**8,060**	6,200
	Cont.		3			1,860
Grant-in-Aid for Research Activity Start-up	New	1	1		**500**	500
	Cont.		0			0
Grant-in-Aid for Publication of Scientific Research Results	New				**0**	
	Cont.					
International Leading Research	New				**0**	
	Cont.					
Fostering Joint International Research	New				**0**	
	Cont.					
International Collaborative Research	New	0	0		**4,290**	3,300
	Cont.		1			990
Home-Returning Researcher Development Research	New				**0**	
	Cont.					
Subtotal	New	**9**	**4**		**21,560**	**16,700**
	Cont.	**-**	**6**			**4,860**
Others						
Aids by MEXT other than Grant-in-Aids	New				**0**	
	Cont.					
Aids by ministries other than MEXT	New	1	1		**5,895**	5,895
	Cont.					
Research funds by private sector	New				**0**	
	Cont.					
Subtotal	New	**1**	**1**		**5,895**	**5,895**
	Cont.	**-**	**0**			**0**
Total	New	**10**	**5**		**27,455**	**22,595**
	Cont.	**-**	**6**			**4,860**

Research Projects Funded by Grants-in-Aid for Scientific Research (FY 2017-2023)

Those represented by a faculty member affiliated with the Center.

Research Project	Research Category	Principal Investigator	Project Period
Animal-Touch and Go for Wildlife-Borne Devices	Grant in Aid for scientific Research on Innovative Areas (Research in a Proposed Research Area)	Hiroki Kobayashi	2017-2018
DeepMob: Learning Deep Models from Big and Heterogeneous Data for Next-generation Urban Emergency Management	Grant-in-Aid for Scientific Research (B)	Xuan Song	2017-2019
Advanced use and optimization of high-density point cloud data in geomorphology: Detection of changes in watershed topographic environments and beyond	Grant-in-Aid for Scientific Research (B)	Yuichi Hayakawa	2017-2019
The study of open geospatial information application for participatory data driven society	Grant-in-Aid for Young Scientists (B)	Toshikazu Seto	2017-2019
Time information network for Wildlife Wearable Sensors	Grant-in-Aid for Scientific Research (A)	Kaoru Sezaki	2018-2020
Urban and regional economic problems in an aging society	Grant-in-Aid for Scientific Research (B)	Takaaki Takahashi	2018-2022
Development of quality assessment methodologies for road data of OpenStreetMap	Grant-in-Aid for Scientific Research (C)	Hiroshi Kanasugi	2018-2020
A general procedure for detecting geographical patterns	Grant-in-Aid for Challenging Research (Exploratory)	Yukio Sadahiro	2018-2019
Location analysis of historical monuments based on the latest geomorphological knowledge: scientific association of history and landforms	Grant-in-Aid for Challenging Research (Exploratory)	Takashi Oguchi	2018-2020
Statistical Methodology for Stabilizing Grouped Data Analysis	Grant-in-Aid for Early-Career Scientists	Shonosuke Sugasawa	2018-2020
Language barriers, skill transferability, and immigrants	Grant-in-Aid for Early-Career Scientists	Mariko Nakagawa	2018-2020
A study of satellite-based mapping of real estate price and its applications	Grant-in-Aid for Scientific Research (B)	Ryosuke Shibasaki	2019-2021
High-dose spatial visualization using animal-wearable microphone network	Grant-in-Aid for Challenging Research (Exploratory)	Hiroki Kobayashi	2019-2021
Study for Development of Dynamic Geodemographic Using Geospatial Information and Big Data	Grant-in-Aid for Challenging Research (Exploratory)	Yuki Akiyama	2019-2021

(*) Translator's note: The English title is a provisional translation by the translator.

Research Project	Research Category	Principal Investigator	Project Period
Development of planning support methodology for enhancing daily life accessibility through integrated land-use, facilities, and transportation planning	Grant-in-Aid for Early-Career Scientists	Sunyong Eom	2019-2021
A real-time optimization for disaster-relief distribution in heterogeneous crowdsourcing	Grant-in-Aid for Early-Career Scientists	Haoran Zhang	2019-2021
Real-time Disaster Self-evacuation with LBS and AR Enhanced Analogue Disaster Maps for Foreign Tourists--System Design and Effectiveness Tests	Grant-in-Aid for Early-Career Scientists	Ruochen Si	2019-2021
An Online Adaptive Boosting Ensemble Approach to Human Mobility Prediction at a Metropolitan Scale	Grant-in-Aid for Early-Career Scientists	Zipei Fan	2020-2021
Acquisition of Action Strategies by Deep Reinforcement Learning: Recovery Planning for Company's Earthquake and Tsunami Damage	Grant-in-Aid for Early-Career Scientists	Yoshiki Ogawa	2020-2022
Obsolescence and Renovation Effects in the Housing Market: Unveiling the Life Cycle of Residences (*)	Grant-in-Aid for Early-Career Scientists	Masatomo Suzuki	2020-2022
Analysis of Correlation between Estimated Apartment Vacancy Rate and Housing Characteristics	Grant-in-Aid for Early-Career Scientists	Hiroki Baba	2020-2022
Explore the natural environment and human life using digital maps, smartphones, drones, and 3D printers! (*)	Grant-in-Aid for Publication of Scientific Research Results	Takashi Oguchi	2020-2021
Implementation and Evaluation of Natural Geography and Disaster Education Using Online GIS-Based Teaching Materials (*)	Grant-in-Aid for Scientific Research (B)	Takashi Oguchi	2021-2023
New Developments in Bayesian Modeling for Large-Scale Data (*)	Grant-in-Aid for Scientific Research (B)	Shonosuke Sugasawa	2021-2024
Avoid or acclimate? The Effects of noise on personality traits of green sea turtles in coastal habitat.	Grant-in-Aid for Scientific Research (C)	Hiromi Kudo	2021-2023
Empirical analysis on relationships between misinformation and disinformation in cyberspaces and socioeconomic situations	Grant-in-Aid for Early-Career Scientists	Yuya Shibuya	2021-2023
Post-disaster Recovery Monitoring based on Multi-Source Remote Sensing Imagery and Deep Learning	Grant-in-Aid for Early-Career Scientists	Zhiling Guo	2021-2023
Development of human-participatory people flow simulation	Grant-in-Aid for Early-Career Scientists	Yanbo Pang	2021-2023
Development of a spatial regression model under constant sum constraint based on compositional data analysis (*)	Grant-in-Aid for Early-Career Scientists	Takahiro Yoshida	2021-2024

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Research Project	Research Category	Principal Investigator	Project Period
A study of the geographic heterogeneity of the impact of sanctuary city policies on public safety	Grant-in-Aid for Research Activity Start-up	Yuki Otsu	2021-2022
Explore the natural environment and human life using digital maps, smartphones, drones, and 3D printers! (*)	Grant-in-Aid for Publication of Scientific Research Results	Takashi Oguchi	2021
Mass movements and sediment disasters in Romania: integrated understanding from physical and social approaches	Fund for the Promotion of Joint International Research (Fostering Joint International Research (B))	Takashi Oguchi	2021-2025
Heterogeneous Graph Neural Network based Federated Mobile Crowdsensing	Grant-in-Aid for Scientific Research (B)	Zipei Fan	2022-2024
Fundamental research for the creation of a global people flow data commons	Grant-in-Aid for Challenging Research (Exploratory)	Yoshihide Sekimoto	2022-2023
Explore the natural environment and human life using digital maps, smartphones, drones, and 3D printers! (*)	Grant-in-Aid for Publication of Scientific Research Results	Takashi Oguchi	2022
Development of Bayesian models for trend estimation of functional data (*)	Grant-in-Aid for JSPS Fellows	Tomoya Wakayama	2022-2024
Mobile phone mobility data based pseudo human mobility generation	Grant-in-Aid for Scientific Research (C)	Haoran Zhang	2023-2025
Analysis of the Impact of Law Enforcement on the Number of Perceived Crimes (*)	Grant-in-Aid for Early-Career Scientists	Yuki Otsu	2023-2025
Multi-task learning based post-disaster mapping via multi-modal remote sensing observations	Grant-in-Aid for Early-Career Scientists	Wei Yuan	2023-2025
Interpretable and Generalizable Pedestrian Trajectory Prediction in Crowds	Grant-in-Aid for Early-Career Scientists	Xiaodan Shi	2023-2025
A Platform for Detecting Postpartum Depression through Passive Mobile Sensing	Grant-in-Aid for Early-Career Scientists	Yuuki Nishiyama	2023-2025
Development of new causal inference and machine learning methods for spatio-temporal data (*)	Grant-in-Aid for Early-Career Scientists	Daisuke Kurisu	2023-2025
Explore the natural environment and human life using digital maps, smartphones, drones, and 3D printers! (*)	Grant-in-Aid for Publication of Scientific Research Results	Takashi Oguchi	2023
Integrated Dynamics Monitoring and Application for Land and Maritime Transport through Observation Data Collaboration	Grant-in-Aid for Scientific Research (B)	Yoshiki Ogawa	2024-2026

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Research Project	Research Category	Principal Investigator	Project Period
AIGMob: Conditional Generative AI for Fine-grained Urban Mobility Simulation	Grant-in-Aid for Scientific Research (B)	Renhe Jiang	2024-2026
Development of a data infrastructure for building resilient regional economic networks against behavioral change (*)	Grant-in-Aid for Scientific Research (B)	Takahiro Yabe	2024-2026
Construction of Digital Disaster Prevention Geomorphology through the integration of advanced research, technology, and education (*)	Grant-in-Aid for Scientific Research (B)	Takashi Oguchi	2024-2027
Systematization of efficient creation and update techniques for urban-scale 3D building data using generative AI technology (*)	Grant-in-Aid for Challenging Research (Exploratory)	Yoshihide Sekimoto	2024-2025
Development and application of MobilityGPT, a generative AI model based on large-scale mobility data (*)	Grant-in-Aid for Early-Career Scientists	Yanbo Pang	2024-2025
Global Road Damage Detection with privacy-preserved collaboration	Grant-in-Aid for Early-Career Scientists	Deeksha Arya	2024-2028
Analyze terrain and disaster prevention information using the latest digital mapping technology! (*)	Grant-in-Aid for Publication of Scientific Research Results	Takashi Oguchi	2024
Spatio-temporal analysis of big data and Bayesian modeling for building smart stations (*)	Grant-in-Aid for JSPS Fellows	Yanxiu Jin	2024-2025

(*) Translator's note: The English title is a provisional translation by the translator.

Those in which faculty members belonging to the Center are the contributors.

Research Project	Research Category	Principal Investigator	Project Period
Fusion of sensing and simulation of tsunami damage assessment towards innovation of disaster medical system	Grant-in-Aid for Scientific Research (S)	PI: Shunichi Koshimura (Co-I: Ryosuke Shibasaki)	2017-2021
Mathematical Modelling of ransport Network Management under Large Scale Natural Disaster	Grant-in-Aid for Scientific Research (A)	PI: Yasuo Asakura (Co-I: Takahiko Kusakabe)	2017-2020
Evaluation of new technologies in mapmaking and geospatial information from human/society aspects	Grant-in-Aid for Scientific Research (A)	PI: Yoshiki Wakabayashi (Co-I: Masatoshi Arikawa/ Toshikazu Seto)	2017-2020
Early interaction between highlanders and lowlanders in Central Eurasia: archaeological research on the economic basis of the emergence of mounted pastoralist societies	Grant-in-Aid for Scientific Research (B)	PI: Shogo Kume (Co-I: Yuichi Hayakawa)	2017-2020
Development of location optimization model for balancing residential shrinkage and improvement of safety for natural disaster using big data	Grant-in-Aid for Scientific Research (B)	PI: Kenichi Tsukahara (Co-I: Yuki Akiyama)	2017-2020
Worldwide urban network system in low-carbon society with agglomeration economies	Grant-in-Aid for Scientific Research (B)	PI: Takatoshi Tabuchi (Co-I: Takaaki Takahashi)	2017-2021
Trip frequency change model of public transport passengers at local city in Japan	Grant-in-Aid for Scientific Research (C)	PI: Hiroaki Nishiuchi (Co-I: Takahiko Kusakabe)	2017-2019
Transport and land use model for next generation mobility and its uncertainty analysis	Grant-in-Aid for Challenging Research (Exploratory)	PI: Makoto Chikaraishi (Co-I: Takahiko Kusakabe)	2017-2019
New developments in compositional data analysis	Grant-in-Aid for Challenging Research (Exploratory)	PI: Morito Tsutsumi (Co-I: Takahiro Yoshida)	2017-2022
Challenges and new developments to the most important issues in spatial econometrics	Grant-in-Aid for Scientific Research (A)	PI: Morito Tsutsumi (Co-I: Shonosuke Sugasawa/Takahiro Yoshida)	2018-2022

(*) Translator's note: The English title is a provisional translation by the translator.

Research Project	Research Category	Principal Investigator	Project Period
Spatial economic analysis on demographics and regional policies	Grant-in-Aid for Scientific Research (B)	PI: Yasuhiro Sato (Co-I: Takaaki Takahashi)	2018-2021
Visualization of care for disaster risk reduction and development of holistic optimization tools on the community	Grant-in-Aid for Scientific Research (B)	PI: Sakiko Kanbara (Co-I: Yuki Akiyama)	2018-2021
Crowdsourced Geographic Information Trust: Focusing on Coverage, Accuracy, and Diversity (*)	Grant-in-Aid for Scientific Research (B)	PI: Yuichiro Nishimura (Co-I: Toshikazu Seto / Hiroshi Kanasugi)	2018-2021
System design for constructing networked virtual sensors	Grant-in-Aid for Scientific Research (C)	PI: Yoshito Tobe (Co-I: Kaoru Sezaki)	2018-2020
Development of living environment by community participatory monitoring	Grant-in-Aid for Challenging Research (Exploratory)	PI: Sakiko Kanbara (Co-I: Hiroyuki Miyazaki)	2018-2020
Framework for analyzing spatial and spatiotemporal distributions of points	Grant-in-Aid for Scientific Research (B)	PI: Yukio Sadahiro (Co-I: Ikuho Yamada)	2019-2021
Estimation of building stock using satellite observation data	Grant-in-Aid for Scientific Research (C)	PI: Kenji Sugimoto (Co-I: Yuki Akiyama)	2019-2021
Bayesian spatio-temporal modeling of income inequality	Grant-in-Aid for Scientific Research (A)	PI: Kazuhiko Kakamu (Co-I: Shonosuke Sugasawa)	2020-2024
Real estate markets and macro economy	Grant-in-Aid for Scientific Research (A)	PI: Chihiro Shimizu (Co-I: Hiroki Baba / Masatomo Suzuki)	2020-2024
Distributed Cooperative Learning Analytics for Developing Communities	Grant-in-Aid for Scientific Research (A)	PI: Shinichi Konomi (Co-I: Kaoru Sezaki)	2020-2024
Design of Continuous Accessible Routes Using Human Flow Simulation on Large-Scale Network	Grant-in-Aid for Scientific Research (B)	PI: Kentaro Homma (Co-I: Takahiko Kusakabe)	2020-2022

(*) Translator's note: The English title is a provisional translation by the translator.

Research Project	Research Category	Principal Investigator	Project Period
Smart Terroir: Use of Vineyard Site Evaluation Protocols to Determine Suitability of Vineyard Location and Choice of Cultivar	Grant-in-Aid for Scientific Research (B)	PI: Nobusuke Iwasaki (Co-I: Takashi Oguchi)	2020-2022
Realization of the Micro Population Census by Deep Learning Using Satellite Images in Developing Countries	Grant-in-Aid for Scientific Research (B)	PI: Yuki Akiyama (Co-I: Yoshiki Ogawa / Shonosuke Sugasawa / Hiroyuki Miyazaki / Satoshi Miyazawa)	
Mapping seasonal demography and mobility for malaria elimination	Grant-in-Aid for Scientific Research (C)	PI: Ayumi Arai (Co-I: Hiroshi Kanasugi / Apichon Witayangkurn)	2020-2023
Digital twin computing for enhancing resilience of disaster medical system	Grant-in-Aid for Scientific Research (S)	PI: Shunichi Koshimura (Co-I: Ryosuke Shibasaki)	2021-2025
Development and application of a toolbox for spatial inference with incomplete spatial information (*)	Grant-in-Aid for Scientific Research (A)	PI: Keiichi Okunuki (Co-I: Takashi Oguchi/Ikuho Yamada)	2022-2026
Creating consensus and disaster mitigation care through awareness of disaster risk	Grant-in-Aid for Scientific Research (B)	PI: Sakiko Kanbara (Co-I: Hiroyuki Miyazaki)	2022-2025
Disentangling the relationship among forest structures, riverine environmental regimes, and biodiversity under climate change	Grant-in-Aid for Scientific Research (B)	PI: Nobuo Ishiyama (Co-I: Kotaro Iizuka)	2022-2025
Evaluation of sustainable health systems by applying socioeconomic geography, economic, and spatial informatics. (*)	Grant-in-Aid for Scientific Research (A)	PI: Yuichi Imanaka (Co-I: Yoshihide Sekimoto)	2023-2027
Development of spatio-temporal analysis methods for event patterns (*)	Grant-in-Aid for Scientific Research (B)	PI: Yukio Sadahiro (Co-I: Ikuho Yamada)	2023-2025
Planning and evaluation method of local production for local consumption type energy project combined with renewable energy purchase system	Grant-in-Aid for Scientific Research (B)	PI: Yujiro Hirano (Co-I: Takahiro Yoshida)	2023-2025
Exploring social values of personal activity data obtained through data portability right	Grant-in-Aid for Scientific Research (B)	PI: Ryosuke Shibasaki (Co-I: Xuan Song/ Zipei Fan)	2023-2025

(*) Translator's note: The English title is a provisional translation by the translator.

Research Project	Research Category	Principal Investigator	Project Period
Development and Implementation of Participatory Urban Design Methodology for the Introducing Climate Change Mitigation and Adaptation Measures	Grant-in-Aid for Scientific Research (B)	PI: Akito Murayama (Co-I: Takahiro Yoshida)	2023-2027
Building a pseudo people flow development platform (*)	Grant-in-Aid for Scientific Research (C)	PI: Takehiro Kashiyama (Co-I: Yoshiki Ogawa/ Yanbo Pang)	2023-2025
Real-time global logistics simulation system considering all transport modes and applications to policy analysis	Grant-in-Aid for Scientific Research (A)	PI: Ryuichi Shibasaki (Co-I: Yoshiki Ogawa)	2024-2027
Realizing Micro Population Data at the Building Scale in Developing Countries Using Satellite Image and AI	Grant-in-Aid for Scientific Research (B)	PI: Yuki Akiyama (Co-I: Yoshiki Ogawa / Hiroyuki Miyazaki)	2024-2026
Happiness and Urban Green Infrastructure: An Empirical Analysis Using Multiple Indicators	Grant-in-Aid for Scientific Research (B)	PI: Katsunori Furuya (Co-I: Yuriko Yazawa)	2024-2026
Extracting spatial heterogeneity latent in inter-regional relations: Advanced representation of spatial interactions and spatial correlation structures	Grant-in-Aid for Scientific Research (B)	PI: Ryo Inoue (Co-I: Takahiro Yoshida)	2024-2027
Development of a model for analyzing the population by attribute in narrow urban areas to promote local exchanges. (*)	Grant-in-Aid for Scientific Research (B)	PI: Wataru Nakanishi (Co-I: Takahiro Yoshida)	2024-2027
Development of methods for evaluating district's residential environment by physical density index considering complex physical urban form.	Grant-in-Aid for Scientific Research (B)	PI: Hiroyuki Usui (Co-I: Ikuho Yamada)	2024-2028

(*) Translator’s note: The English title is a provisional translation by the translator.

Other Subsidies

(Unit: JPY 1,000)

Breakdown of other subsidies (FY 2017-2023)			
Project name and Grant program	Ministries	Amount	Term
SPRING-GX (Support for Pioneering Research Initiated by the Next Generation)	Japan Science and Technology Agency	15,284	2021-2023
Project Proposal System by University Researchers	Tokyo Metropolitan Government	25,036	2021
Health, Labor and Welfare Policy Research Grants	National Institute of Public Health	500	2022
Grant for Enhancing the Functions of National Universities	MEXT	5,000	2017
Total		45,820	

*The amount received shall be the total amount for the above period.

*Translator's note: The English project name is a provisional translation by the translator.

Acceptance of External Funds

(Unit: project, JPY 1,000)

		FY2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024 (Apr-Sep)
Joint research projects with private sector	Count	21	20	38	31	15	15	14	7
	Amount	111,870	109,649	132,252	138,517	75,500	104,567	29,221	29,252
Funded research projects	Count	15	19	12	12	10	16	19	9
	Amount	137,440	89,378	94,113	117,870	105,177	140,601	229,875	136,919
Scholarship donations	Count	14	26	12	9	4	9	8	12
	Amount	45,376	74,922	59,175	48,360	35,000	24,448	21,600	35,190
Total	Count	50	65	62	52	29	40	41	28
	Amount	294,686	273,949	285,540	304,747	215,677	269,616	280,696	201,361

Joint Research Projects with Private Sector

The main research topics for each fiscal year are listed, up to five items.

*Translator's note: The English research title is a provisional translation by the translator.

FY 2017 (Unit: JPY 1,000)

Research Title	Private Sector and Others	Amount	Term
Research on disaster prevention systems using geospatial information in the Asian region	PASCO CORPORATION	41,405	2016-2018
"Habitat Innovation" Project	Hitachi, Ltd.	25,853	2017
Support for the development of human resources to accommodate the increased use of quasi-zenith satellite systems and the efficient implementation of empirical experiments overseas	NEC Corporation	16,480	2016-2017
Consideration of international joint project model towards the establishment of a system for integrating space technology and geospatial information technology to enhance disaster prevention abilities in ASEAN	Japan Space Forum	13,002	2016-2017
Climate Change and flood and storm surge hazard assessment in Vietnam	Asian Development Bank	11,100	2017-2018

FY 2018 (Unit: JPY 1,000)

Research Title	Private Sector and Others	Amount	Term
“Habitat Innovation” Project	Hitachi, Ltd.	29,400	2018.4-2019.3
A mixed method approach leveraging high frequency date to understand transport in Sri Lanka	LIRNEasia	17,995	2018.9-2020.8
Research on disaster prevention systems using geospatial information in the Asian region	PASCO CORPORATION	17,457	2018.5-2019.5
Implementation of common tools or platforms that contribute to marine and fisheries resource management, and study surveys for satellite constellations and data sharing models based on multilateral cooperation	Japan Space Forum	3,773	2018.4-2019.3
Research on integrated analysis of space system data and geospatial information	Mitsubishi Heavy Industries, Ltd.	3,497	2018.4-2019.3

FY 2019 (Unit: JPY 1,000)

Research Title	Private Sector and Others	Amount	Term
Surveys and research on the utilization of high-precision positioning overseas	Mitsubishi Electric Corporation	20,000	2019
Research on disaster prevention systems using geospatial information in the Asian region	PASCO CORPORATION	17,664	2018-2020
Research on content sites to find the right city for you.	Recruit Sumai Company, Ltd.	16,200	2019-2021
Quasi-Zenith Satellite System Signal Authentication Verification Experiment	NEC Corporation	12,600	2019-2020
Estimated distribution of vacant houses in Wakayama Prefecture	Wakayama prefecture	5,881	2018-2020

FY 2020 (Unit: JPY 1,000)

Research Title	Private Sector and Others	Amount	Term
Quasi-Zenith Satellite System Signal Authentication Verification Experiment	NEC Corporation	38,110	2019-2020
Research on disaster prevention systems using geospatial information in the Asian region	PASCO CORPORATION	18,129	2018-2021
Research on content sites to find the right city for you.	Recruit Sumai Company, Ltd.	16,200	2019-2021
Survey and research for the promotion of high-precision positioning applications including QZSS in Oceania and Southeast Asian countries	Space Systems Department, Kamakura Works, Mitsubishi Electric Corporation	11,000	2020
Using Innovative Data Sources for Economic Impact Assessment	Asian Development Bank	8,240	2020-2021

FY 2021 (Unit: JPY 1,000)

Research Title	Private Sector and Others	Amount	Term
Research on disaster prevention systems using geospatial information in the Asian region	PASCO CORPORATION	28,775	2018-2022
Research on content sites to find the right city for you.	Recruit Sumai Company, Ltd.	16,200	2019-2021
Building a rent estimation model	Daito Trust Construction Co., Ltd.	5,500	2019-2021
Automatic parking by using traffic sensor data stream and past trajectory	Shanghai Maicon Technology Co.,Ltd.	5,000	2019-2022
Estimated distribution of vacant houses in Wakayama Prefecture	Wakayama prefecture	4,378	2021

FY 2022 (Unit: JPY 1,000)

Research Title	Private Sector and Others	Amount	Term
Research on disaster prevention systems using geospatial information in the Asian region	PASCO CORPORATION	21,614	2018-2022
Automatic parking by using traffic sensor data stream and past trajectory	Shanghai Maicon Technology Co.,Ltd.	6,635	2019-2022
Empirical study for practical application of a method for estimating the distribution of vacant houses	Wakayama prefecture	4,423	2022
Development of Upgrade Recycling Technology for Aluminum Resources to Establish a Resource Recycling Society	AIZOTH Inc.	2,976	2022
Research on infant context detection using wearable devices	First Ascent inc.	1,648	2022

FY 2023 (Unit: JPY 1,000)

Research Title	Private Sector and Others	Amount	Term
Investigation of factors influencing the number of visitors to a commercial facility and derivation of a model for forecasting the number of visitors and sales	SoftBank Corp.	9,482	2021-2023
Automatic parking using traffic sensor data streams and historical trajectories	Shanghai Maicon Technology Co.,Ltd.	6,635	2020-2024
Development of Upgrade Recycling Technology for Aluminum Resources to Establish a Resource Recycling Society	AIZOTH Inc.	2,804	2023
Analysis and modeling of vehicle travel data considering spillover effects of traffic anomalies	Toyota Motor Corporation	2,654	2023-2024
Research on sensor data processing and its utilization obtained from smartphones	Yahoo Japan Corporation	1,947	2021-2024

April to September 2024 (Unit: JPY 1,000)

Research Title	Private Sector and Others	Amount	Term
Spatial formation and evaluation of innovation centers	MITSUBISHI ESTATE CO., LTD.	14,939	2024-2027
Automatic parking using traffic sensor data streams and historical trajectories	SM Technology	4,600	2020-2024
Analysis and modeling of vehicle travel data considering spillover effects of traffic anomalies	Toyota Motor Corporation	2,920	2023-2024
Development of Upgrade Recycling Technology for Aluminum Resources to Establish a Resource Recycling Society	AIZOTH Inc.	2,804	2024
Research on sensor data processing and its utilization obtained from smartphones	Yahoo Japan Corporation	1,947	2021-2024

Funded Research Projects

The main research topics for each fiscal year are listed, up to five items. MEXT: Ministry of Education, Culture, Sports, Science and Technology, JST: Japan Science and Technology Agency, NEDO: New Energy and Industrial Technology Development Organization, NILIM: National Institute for Land and Infrastructure Management, MLIT: Ministry of Land, Infrastructure, Transport and Tourism.

*Translator's note: The English research title is a provisional translation by the translator.

FY 2017 (Unit: JPY 1,000)

Research Title	Organization	Amount	Term
Use of social big data and research and development of basic technologies Project B: New use of social big data and research and development of basic technologies	National Institute of Information and Communications Technology	50,776	2016-2017
Development of support services to fight malaria through collaboration of space, UAV, and IoT technologies (R&D Promotion for National Issues)	MEXT	49,816	2016-2017
Spatial information correction mechanism for mounted sensors for wild animals (Strategic Basic Research Program)	JST	35,854	2016-2017
Human resource development program to solve social problems using space systems to realize global learning and growth (R&D Promotion for National Issues)	MEXT	22,074	2016-2017
Power-saving technology for spatio-temporal information network using a network of wildlife-mounted sensors and construction of a verification field (small-scale research and development in peripheral technologies and related issues for projects implemented by the IoT Promotion Department for the realization of an IoT society)	NEDO	19,998	2017

FY 2018 (Unit: JPY 1,000)

Research Title	Organization	Amount	Term
Development of Malaria Control Support Services through Collaboration of Space, UAV, and IoT Technologies	MEXT	19,946	2018.4-2019.3
Spatio-temporal information correction mechanism for wildlife mounted sensors	JST	15,067	2015.10-2019.3
Building an Innovative Network for a Continental Monitoring Network to Contribute to NTD Control in Africa: Deployment Based on Batch and Simultaneous Diagnostics Technology	National Institute of Biomedical Research and Innovation (NIBIO)	11,180	2018.4-2019.3
Establishment of an integrated disaster data acquisition and utilization environment	JST	7,020	2014.10-2020.3
Building a Platform for Wise Use Realization of CI-PI	JST	6,890	2018.10-2020.3

FY 2019 (Unit: JPY 1,000)

Research Title	Organization	Amount	Term
Technological research and development of base layout and transportation management for multi-scale transportation coordination	NILIM	49,995	2019-2020
Construction of a platform for realization of CI-PI's Wise Use（RISTEX)	JST	14,170	2018-2020
Dynamic surveys to determine changes in population distribution as a result of policy effects	MLIT	7,128	2019
Establishment of Integrated Disaster Data Acquisition and Utilization Environment（CREST)	JST	7,020	2014-2019
Construction of an integrated spatio-temporal information analysis platform and linkage with autonomous vehicles	National Institute of Advanced Industrial Science and Technology (AIST)	5,091	2018-2020

FY2020 (Unit: JPY 1,000)

Research Title	Organization	Amount	Term
Technological research and development of base layout and transportation management for multi-scale transportation coordination	NILIM	34,406	2020
Construction of a model for extracting vulnerable disaster victims using machine learning with anonymized cell phone data and satellite image analysis.	JST	29,999	2020
Establishment of a location authentication service using the Quasi-Zenith Satellite System	NEC Corporation	14,300	2020-2023
Simulation of transmission risk and economic impact of a novel coronavirus pandemic	Mitsubishi Research Institute, Inc.	8,008	2020
Integrated analysis of multimodal data for emergency response and disaster management	JST	7,425	2020-2021

FY2021 (Unit: JPY 1,000)

Research Title	Organization	Amount	Term
Establishment of location-based services using the Quasi-Zenith Satellite System	NEC Corporation	35,750	2020-2023
Technological research and development of base layout and transportation management for multi-scale transportation coordination	NILIM	22,099	2021
International Cooperative Research Program on Science and Technology (aXis) Construction of a model to extract vulnerable persons from disasters by using machine learning to analyze anonymized cell phone data and satellite images	JST	16,787	2021
Research and development of information and communication technologies that contribute to countermeasures against viruses and other infectious diseases (Issue C) ICT for creating an after-coronary society	National Institute of Information and Communications Technology	7,985	2021-2022
International Science and Technology Cooperative Research Promotion Program (SICORP) Integrated Analysis of Multimodal Data for Novel Coronaviruses, Pandemics, and Integrated Disaster Management	JST	6,500	2021

FY2022 (Unit: JPY 1,000)

Research Title	Organization	Amount	Term
Establish a signal authentication function to prevent spoofing of signals broadcast by the Quasi-Zenith Satellite System.	NEC Corporation	33,086	2020-2022
Integrated analysis of multimodal data for novel coronaviruses, pandemics, and integrated disaster management	JST	20,688	2022
Commissioned research on social implementation of regional data infrastructure	Toyota Mobility Fund	8,847	2022
Research and development of information and communication technologies that contribute to countermeasures against viruses and other infectious diseases Issue C: ICT for creating an after-coronary society	National Institute of Information and Communications Technology	7,145	2021-2022
Construction of a platform for integrated analysis of spatio-temporal information and linkage with autonomous vehicles" (NEDO re-commissioning) among realization of a smart society through application of artificial intelligence technology/field of spatial mobility/construction of three-dimensional maps, etc. for safe and secure mobility.	National Institute of Advanced Industrial Science and Technology (AIST)	3,785	2018-2022

FY2023 (Unit: JPY 1,000)

Research Title	Organization	Amount	Term
Research and development and demonstration survey work for the realization of an urban digital twin	MLIT	47,770	2023
Establish a signal authentication function to prevent spoofing of signals broadcast by the Quasi-Zenith Satellite System.	NEC Corporation	31,625	2020-2024
Development of metadata generation and management methods for infrastructure data	NEDO	29,000	2023
Integrated analysis of multimodal data for novel coronaviruses, pandemics, and integrated disaster management	JST	25,875	2023
Research Data Ecosystem Development Project to Promote the Use of AI, etc.	MEXT	23,443	2023

April to September 2024 (Unit: JPY 1,000)

Research Title	Organization	Amount	Term
Research and development and demonstration survey work for the realization of an urban digital twin	MLIT	46,000	2024
Development of metadata generation and management methods for infrastructure data	National Institute for Civil Engineering Research	26,548	2024
Construction of a digital twin for social mobility experiments incorporating a variety of geospatial information and nationwide pseudo people flow data	NEDO	21,116	2024
Research and development of platform construction for evaluation and verification through industry-government-academia-industry collaboration	National Research Institute for Earth Science and Disaster Prevention	17,760	2024
Establish a signal authentication function to prevent spoofing of signals broadcast by the Quasi-Zenith Satellite System.	NEC Corporation	17,250	2020-2024

Scholarship Donations

The main research topics for each fiscal year are listed, up to five items.

FY 2017 (Unit: JPY 1,000)

Donors	Amount	Term	Note
Bill & Melinda Gates Foundation	11,223	2017	
NISHIO RENT ALL CO., LTD.	10,500	2016-2017	Division of Space System and Geospatial Information Engineering
Remote Sensing Technology Center of Japan	10,500	2016-2017	Division of Space System and Geospatial Information Engineering
Kokusai Kogyo Co., Ltd.	7,000	2016-2017	Division of Space System and Geospatial Information Engineering
ZENRIN CO., LTD.	7,000	2016-2017	Division of Space System and Geospatial Information Engineering

FY 2018 (Unit: JPY 1,000)

Donors	Amount	Term	Note
Tateisi Science and Technology Foundation	30,000	2018	
The Sumitomo Foundation	3,927	2018-2019	
NISHIO RENT ALL CO., LTD.	3,500	2016-2020	Division of Space System and Geospatial Information Engineering
Remote Sensing Technology Center of Japan	3,500	2016-2020	Division of Space System and Geospatial Information Engineering
Kokusai Kogyo Co., Ltd.	3,500	2016-2020	Division of Space System and Geospatial Information Engineering

FY 2019 (Unit: JPY 1,000)

Donors	Amount	Term	Note
LIFULL Co., Ltd.	15,000	2019-2021	Division of Real Estate Information Science
Sumitomo Mitsui Trust Research Institute Co., Ltd.	15,000	2019-2021	Division of Real Estate Information Science
NISHIO RENT ALL CO., LTD.	3,500	2016-2020	Division of Space System and Geospatial Information Engineering
Asia Air Survey Co., Ltd.	3,500	2016-2020	Division of Space System and Geospatial Information Engineering
Kokusai Kogyo Co., Ltd.	3,500	2016-2020	Division of Space System and Geospatial Information Engineering

FY 2020

(Unit: JPY 1,000)

Donors	Amount	Term	Note
LIFULL Co., Ltd.	15,000	2018-2020	Division of Real Estate Information Science
Sumitomo Mitsui Trust Research Institute Co., Ltd.	15,000	2018-2020	Division of Real Estate Information Science
PASCO CORPORATION	3,500	2020	Division of Space System and Geospatial Information Engineering
Kokusai Kogyo Co., Ltd.	3,500	2020	Division of Space System and Geospatial Information Engineering
Asia Air Survey Co., Ltd.	3,500	2020	Division of Space System and Geospatial Information Engineering

FY 2021

(Unit: JPY 1,000)

Donors	Amount	Term	Note
LIFULL Co., Ltd.	15,000	2019-2021	Division of Real Estate Information Science
Sumitomo Mitsui Trust Research Institute Co., Ltd.	15,000	2019-2021	Division of Real Estate Information Science
KAJIMA CORPORATION	1,000	2021	
Japan Society of Civil Engineers	4,000	2021	

FY 2022

(Unit: JPY 1,000)

Donors	Amount	Term	Note
KOZO KEIKAKU ENGINEERING Inc.	3,400	2022	Division of Global Spatial Data Commons Initiative
NTT InfraNet Corp.	3,400	2022	Division of Global Spatial Data Commons Initiative
PACIFIC CONSULTANTS CO., LTD.	3,400	2022	Division of Global Spatial Data Commons Initiative
PASCO CORPORATION	3,400	2022	Division of Global Spatial Data Commons Initiative
Asia Air Survey Co., Ltd.	3,400	2022	Division of Global Spatial Data Commons Initiative

FY 2023

(Unit: JPY 1,000)

Donors	Amount	Term	Note
KOZO KEIKAKU ENGINEERING Inc.	3,400	2023	Division of Global Spatial Data Commons Initiative
NTT InfraNet Corp.	3,400	2023	Division of Global Spatial Data Commons Initiative
PACIFIC CONSULTANTS CO., LTD.	3,400	2023	Division of Global Spatial Data Commons Initiative
PASCO CORPORATION	3,400	2023	Division of Global Spatial Data Commons Initiative
Asia Air Survey Co., Ltd.	3,400	2023	Division of Global Spatial Data Commons Initiative

April to September 2024

(Unit: JPY 1,000)

Donors	Amount	Term	Note
PACIFIC CONSULTANTS CO., LTD.	7,650	2024	Division of Global Spatial Data Commons Initiative / Division of Civic Tech Design Initiative
Association for Promotion of infranstructure Geospatial Information Distribution	4,250	2024	Division of Civic Tech Design Initiative
TIS Inc.	4,250	2024	Division of Civic Tech Design Initiative
PwC Consulting LLC	4,250	2024	Division of Civic Tech Design Initiative
PASCO CORPORATION	3,400	2024	Division of Global Spatial Data Commons Initiative

Chapter 4. Research Activities

We summarize major research projects and research themes from April 2017 to the present, as well as research achievements for each of the research division of the Center. We also list contributions to academic organizations related to research, government, and society, educational activities, and awards received, summarized by individual. Furthermore, we list the achievements as a Joint Usage/Research Center and those of the CSIS faculty members.

Among the authors of the research achievements, the members affiliated with CSIS are underlined, and for former members, only the achievements when they belonged to CSIS are underlined. For the achievements of the Division of Spatial Socio-Economic Research, members who were affiliated with CSIS at the time of the publication of the first discussion paper are underlined due to the nature of that division.

Division of Spatial Information Analysis

Takashi Oguchi (1998.6-), Ikuho Yamada (2019.9-), Takahiro Yoshida (2022.9-), Kotaro Iizuka (2017.8-2022.7, 2022.8- Division of Spatial Information Engineering)
Yukio Sadahiro (2012.10-2019.3), Yuichi Hayakawa (2009.4-2018.8), Kentaro Honma (2018.9-2019.3), Xuan Song (2019.4-2024.3)

(1) Geomorphology

The distribution, characteristics, formation process, and controlling factors of landforms found in Japan, Taiwan, and Tajikistan were examined. Geospatial information such as digital elevation models (DEMs) and image information obtained by remote sensing were utilized. We also wrote review papers on geomorphological methods and history.

1. Ma, Q. and Oguchi, T. (2024) Rock glacier inventory of the southwestern Pamirs supported by InSAR kinematics. *Remote Sensing*, **16**(7), 1185.
2. Oguchi, T., Hayakawa, Y.S. and Wasklewicz, T. (2022) Remote data in fluvial geomorphology: Characteristics and applications. In Shroder, J.F. ed. *Treatise on Geomorphology (2nd Ed.)*, Vol. 6.2, Amsterdam: Elsevier, 1116−1142.
3. Oguchi, T. (2020) Geomorphological debates in Japan related to surface processes, tectonics, climate, research principles, and international geomorphology. *Geomorphology*, **366**, 106805.
4. Sîrbu, F., Drăguț, L., Oguchi, T., Hayakawa, Y.S. and Micu, M. (2019) Scaling land-surface variables for landslide detection. *Progress in Earth and Planetary Science*, **6**, 1−13.
5. Chen, C.W., Oguchi, T., Hayakawa, Y.S., Saito, H. and Chen, H. (2017) Relationship between landslide size and rainfall conditions in Taiwan. *Landslides*, **14**, 1235−1240.

(2) Forest dynamics analysis using remote sensing

Utilizing satellite remote sensing in combination with high-definition data acquired from drones, which have advanced rapidly in recent years, we analyzed the three-dimensional structure of trees to enhance the accuracy of stand information required for forest management and resource conservation. Additionally, as part of an international collaborative study, we analyzed tree growth in plantation areas within peatlands in Indonesia, aiming to provide fundamental data for environmental conservation.

1. Iizuka, K., Kosugi, Y., Noguchi, S. and Iwagami, S. (2022) Toward a comprehensive model for estimating diameter at breast height of Japanese Cypress (*Chamaecyparis obtusa*) using crown size

derived from unmanned aerial systems. *Computers and Electronics in Agriculture*, **192**, 106579.
2. Iizuka, K., Hayakawa, Y.S., Ogura, T., Nakata, Y., Kosugi, Y. and Yonehara, T. (2020) Integration of multi-sensor data to estimate plot-level stem volume using machine learning algorithms − case study of evergreen conifer planted forests in Japan. *Remote Sensing*, **12**(10), 1649.
3. Iizuka, K., Kato, T., Silsigia, S., Soufiningrum, A.Y. and Kozan, O. (2019) Estimating and examining the sensitivity of different vegetation indices to fractions of vegetation cover at different scaling grids for early stage acacia plantation forests using a fixed-wing UAS. *Remote Sensing*, **11**(15), 1816.
4. Iizuka, K., Watanabe, K., Kato, T., Putri, N.A., Silsigia, S., Kameoka, T. and Kozan, O. (2018) Visualizing the spatiotemporal trends of thermal characteristics in a peatland plantation forest in Indonesia: Pilot test using unmanned aerial systems (UASs). *Remote Sensing*, **10**, 1345.
5. Manzoor, S.A., Griffiths, G., Iizuka, K. and Lukac, M. (2018) Land cover and climate change may limit invasiveness of *Rhododendron ponticum* in Wales. *Frontiers in Plant Science*, **9**, 664.

(3) Research on the interrelationship between nature and humans

The interrelationships between nature and humans were studied based on the interdisciplinary characteristics of geography, which deals with both natural and human factors. For example, we examined the influence of the natural environment on settlement choices and land use (including both modern and ancient), the socioeconomic use of natural resources, and the effects of human activities on the natural landscape.

1. Takahashi, Y., Yoshida, T., Shigeto, S., Kubota, H., Johnson, B. and Yamagata, Y. (2024) Spatial exploration of rural capitals contributing to quality of life and urban-to-rural migration decisions: A case study of Hokuto City, Japan. *Sustainability Science*, **19**, 489−506.
2. Wang, B., Oguchi, T. and Liang, X. (2023) Evaluating future habitat quality responding to land use change under different city compaction scenarios in Southern China. *Cities*, **140**, 104410.
3. Oguchi, T. (2020) Lithosphere − The solid realm which supports human life. In Himiyama, Y., Satake, K. and Oki, T. eds. *Human Geoscience*, Singapore: Springer, 27−38.
4. Iizuka, K., Itoh, M., Shiodera, S., Matsubara, T., Dohar, M. and Watanabe, K. (2018) Advantages of unmanned aerial vehicle (UAV) photogrammetry for landscape analysis compared with satellite data: a case study of postmining sites in Indonesia. *Cogent Geoscience*, **4**, 1498180.
5. Oguchi, T., Hayakawa, Y.S. and Oguchi, C.T. (2017) Quaternary fluvial environments and palaeohydrology in Syria. In Enzel, Y. and Bar-Yosef, O. eds. *Quaternary of the Levant*, Cambridge: Cambridge University Press, 417−422.

(4) Research on education and outreach for the dissemination of geographic information science and disaster prevention

Educational materials for understanding geographic information systems and hazard maps, as well as a system for experiencing geospatial through VR, were developed, practiced, and publicized to high school students, university students, and citizens. Based on questionnaires and other surveys conducted then, we examined appropriate methods for education and outreach.

1. Yamauchi, H., Oguchi, T., Iizuka, K., Hayakawa, Y.S. and Seto, T. (2024) Evaluation of GIScience exercise using online educational materials for Japanese university students. *The Professional Geographer*, **76**(4), 1−14.
2. Song, J., Yamauchi, H., Oguchi, T., Ogura, T., Nakamura, Y. and Wang, J. (2023) Effects of web

geographic information system (GIS) technology and curriculum approaches on education for disaster risk reduction. *Natural Hazards and Earth System Sciences*, **23**, 3617−3634.

3. Oguchi, T. (2023) Contribution of geography and geospatial technology to cope with hazards and risks: Implications of GIS development in Japan. In Bański, J., Meadows, M., eds. *Research Directions, Challenges and Achievements of Modern Geography*, Singapore: Springer, 141−155.
4. Song, J., Yamauchi, H., Oguchi, T. and Ogura, T. (2022). Application of web hazard maps to high school education for disaster risk reduction. *International Journal of Disaster Risk Reduction,* **72**, 102866.
5. Yamauchi, H., Tsuruoka, K., Ogura, T., Tamura, H., Hayakawa, Y.S., Iizuka, K., and Oguchi, T. (2022) Development and Evaluation of an Application for Exploring Historical Sites Using Three-Dimensional Geospatial Data and Virtual Reality Technology: A Contribution to Geography Education. *E-journal GEO* **17**(1), 169-179. (In Japanese)

(5) Development of analysis methods for spatial and spatio-temporal data

We develop new spatial analysis methods as part of the theoretical research on spatial analysis. In recent years, we have worked specifically on incorporating temporal components into spatial analysis and refining spatial autocorrelation analysis.

1. Sadahiro, Y. and Yamada, I. (2024) Point cluster analysis using weighted random labeling. *Journal of Geographical Systems* (published online on 09/10/2024).
2. Yoshida, T., Murakami, D. and Seya, H. (2024) Spatial prediction of apartment rent using regression-based and machine learning-based approaches with a large dataset. *The Journal of Real Estate Finance and Economics*, **69**(1), 1–28.
3. Nishi, H. and Yamada, I. (2023) Counter-intuitive effect of null hypothesis on Moran's I tests under heterogenous populations. In Beecham, R., Long, J.A., Smith, D., Zhao, Q., and Wise, S. eds. *Proceedings of the 12th International Conference on Geographic Information Science* (GIScience 2023), 0519.
4. Murakami, D., Tsutsumida, N., Yoshida, T., Nakaya, T., Lu, B. and Harris, P. (2023) A linearization for stable and faster geographically weighted Poisson regression. *International Journal of Geographical Information Science*, **37**(8), 1818–1839.
5. Sadahiro, Y. (2018) Analysis of the appearance and disappearance of point objects over time. *International Journal of Geographical Information Science*, **33**(2), 215–239.

(6) Empirical research on local environment and health

Using spatial data and spatial analysis methods, we conducted empirical research to clarify the relationship between the local environment and residents' health, as well as health disparities between regions. Themes such as accessibility to healthcare, physical activity such as the number of steps taken, and individuals' views on regulatory measures related to COVID-19 were addressed through interdisciplinary collaborative research.

1. Huang, J., Kwan, M-P., Kan, Z., Kieu, M., Lee, J., Schwanen, T. and Yamada, I. (2024) Inter-relationships among individual views of COVID-19 control measures across multi-cultural contexts. *Social Science & Medicine*, **358**, 117247.
2. Eom, S., Kim, H., Hasegawa, D. and Yamada, I. (2024) Pedestrian movement with large-scale GPS records and transit-oriented development attributes. *Sustainable Cities and Society*, **102**, 105223.
3. Iba, A., Tomio, J., Sugiyama, T., Abe, K., Yamada, I. and Kobayashi Y. (2024) Association between

spatial access and hospitalization for ambulatory care sensitive conditions: A retrospective cohort study using claims data. *SSM - Population Health*, **25**, 101565.

4. Yamada, Y. (2023) Spatial accessibility to outpatient treatment in the context of everyday life: Analysis focusing on transportation modes of walking and driving. *Journal of the City Planning Institute of Japan*, **58**(3), 1132-1139. (In Japanese)
5. Morioka, W., Kwan, M.-P., Hino, K. and Yamada, I. (2023) How accessibility to neighborhood grocery stores is related to older people's walking behavior: A study of Yokohama, Japan. *Journal of Transport & Health*, **32**, 101668.

(7) Research on spatial behavior using spatio-temporal big data and deep learning

By applying Deep Learning methods to a variety of Spatio-temporal big data such as GPS trajectory data, we conducted empirical research on human spatial behavior, mobility, and individuals' views on policies related to these issues.

1. Yao,Y., Zhang,H., Chen, J., Li, W., Shibasaki, R. and Song, X. (2023) Mobility Tableau: Human Mobility Similarity Measurement for City Dynamics. *IEEE Transactions on Intelligent Transportation Systems*, **24**(7), 7108–7121.
2. Chen, Z., Li, P., Jin, Y., Jin, Y., Chen, J., Li, W., Song, X., Shibasaki, R., Chen, M., Yan, D. and Zhang, H. (2022) Using mobile phone big data to identify inequity of artificial light at night exposure: A case study in Tokyo. *Cities*, **128**, 103803.
3. Li, W., Zhang, H., Chen, J. Li, P., Yao, Y., Shi, X., Shibasaki, M., Kobayashi, H.H., Song, X. and Shibasaki, R. (2022) Metagraph-based Life Pattern Clustering with Big Human Mobility Data. *IEEE Transactions on Big Data*, **9**(1), 227–240.
4. Zhang, H., Song, X., Xia, T., Yuan, M., Fan, Z., Shibasaki, R. and Liang, Y. (2018) Battery electric vehicles in Japan: Human mobile behavior based adoption potential analysis and policy target response. *Applied Energy*, **220**, 527–535.
5. Song, X., Shibasaki, R., Yuan, N., Xie, X., Li, T. and Adachi, R. (2017) DeepMob: Learning Deep Knowledge of Human Emergency Behavior and Mobility from Big and Heterogeneous Data. *ACM Transactions on Information Systems*, **35**(4), 41.

(8) Climate change and cities

Applying spatial analysis methods, we studied climate change mitigation and adaptation at the building and/or district scales in cities. As for mitigation, we estimated effects of introducing both solar panels and electric vehicles and made spatially detailed land use and land cover maps based on the local climate zones classification. As for adaptation, we investigated relationships between urban forms and heat environments under a current situation and estimated future heat stress distributions while considering changes of both urban forms and climate conditions compatible with the shared socioeconomic pathways.

1. Yamasaki, J., Wakazuki, Y., Iizuka, S., Yoshida, T., Nitanai, R., Manabe, R. and Murayama, A. (2024) Microclimate simulation for future urban district under SSP/RCP: Reflecting changes in building stocks and temperature rises. *Urban Climate*, **57**, 102068.
2. Iizuka, K., Akiyama, Y., Takase, M., Fukuba, T. and Yachida, O. (2024) Microscale temperature-humidity index (THI) distribution estimated at the city scale: A case study in Maebashi City, Gunma Prefecture, Japan. *Remote Sensing*, **16**, 3164.
3. Jittayasotorn, T., Sadidah, M., Yoshida, T. and Kobashi, T. (2023) On the adoption of rooftop

photovoltaics integrated with electric vehicles toward sustainable Bangkok City, Thailand. *Energies*, **16**(7), 3011.

4. Chen, C., Bagan, H. and Yoshida, T. (2023) Multi-scale mapping of local climate zones in Tokyo using airborne LiDAR data, GIS vectors, and Sentinel-2 imagery. *GIScience & Remote Sensing*, **60**, 2209970.
5. Chen, C., Bagan, H., Yoshida, T., Borjigin, H. and Gao, J. (2022) Quantitative analysis of the building-level relationship between building form and land surface temperature using airborne LiDAR and thermal infrared data. *Urban Climate*, **45**, 101248.

Division of Spatial Information Engineering

Kaoru Sezaki (2001.4-), Yoshihide Sekimoto (2020.12-2023.3 Division of Joint Usage and Research, 2023.4-), Dinesh Manandhar (2016.7-), Kotaro Iizuka (2017.8-2022.7 Division of Spatial Information Analysis, 2022.8-)
Ryosuke Shibasaki (1998.6-2023.3)

(1) Development of technology to detect and predict vehicle traffic and human behavior using mobile sensor data

To realize a safe and efficient traffic environment, we are developing technologies for detecting and predicting vehicle traffic and related human behaviors using mobile and wearable sensing data and traffic big data. For detecting individual driving behavior, we proposed a method that uses inertial sensors mounted on mobile/wearable devices and deep learning to detect preliminary driving maneuvers and predict driving maneuvers such as turning right, turning left, or changing lanes of bicycles with high accuracy even several seconds in advance. We also developed a silent-sounding interaction system using wireless earphones, which is a fundamental technology by which system can recognize words with high accuracy by simply spelling them silently, even in situations where the use of voice interfaces should be avoid, such as in public transportation. As for detecting and predicting driving behavior at the city scale level, we proposed a method of estimating the purpose of travel using traffic big data and deep learning, and a simulation-based method for evaluating the carbon dioxide emissions from the use of shared micromobility. These research results have been published in top international conferences in the field of computer science such as IEEE PreCom, IEEE WoWMoM, IEEE ICDCS, ACM SIGSPATIAL, and ACM CHI, as well as high impact factor journals such as Elsevier's Sustainable Cities and Society.

1. Han, Z., Dong, X., Xu, L., Zhu, Z., Wang, E., Nishiyama, Y. and Sezaki, K. (2024) RideGuard: Micro-Mobility Steering Maneuver Prediction with Smartphones. *2024 IEEE 44th International Conference on Distributed Computing Systems (ICDCS*), 1039-1049.
2. Dong, X., Chen, Y., Nishiyama, Y., Sezaki, K., Wang, Y., Christofferson, K. and Mariakakis, A. (2024) ReHEarSSE: Recognizing Hidden-in-the-Ear Silently Spelled Expressions. *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems.*
3. Han, Z., Xu, L., Dong, X., Nishiyama, Y. and Sezaki, K. (2023) HeadMon: Head Dynamics Enabled Riding Maneuver Prediction*. 2023 IEEE International Conference* on Pervasive Computing and Communications (PerCom), *22-31. Conference on Pervasive Computing and Communications (PerCom),* 22-31.
4. Han, Z., Dong, X., Nishiyama, Y. and Sezaki, K. (2023) HeadSense: Visual Search Monitoring and Distracted Behavior Detection for Bicycle Riders*. 2023 IEEE 24th International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM),* 281-289.
5. Peng, H., Nishiyama, Y. and Sezaki, K. (2022) Assessing environmental benefits from shared micromobility systems using machine learning algorithms and Monte Carlo simulation. *Sustainable Cities and Society*, **87**, 104207.
6. Lyu, S., Han, T., Nishiyama, Y., Sezaki, K. and Kusakabe, T. (2022) A Plug-in Memory Network for Trip Purpose Classification. *Proceedings of the 30th International Conference on Advances in Geographic Information Systems*. Article 34, 1-12.

(2) Information and communication network technology for collecting spatial information

Various technologies related to the construction and control of wireless sensor networks and wired

communication networks have been studied. These technologies enable us to collect and to distribute spatial information acquired by IoT devices, in-body sensors, smartphones, and other devices. Specifically, we studied the followings: highly efficient federated learning, highly efficient wireless cooperative communication, architecture of access network that flexibly respond to demand fluctuations, and dynamic offloading for vehicular edge computing.

1. Hosonuma, E., Yamazaki, T., Miyoshi, T., Taya, A., Nishiyama, Y. and Sezaki, K. (2025) Image Generative Semantic Communication with Multi-Modal Similarity Estimation for Resource-Limited Networks to appear in *IEICE Transactions on Communications*, vol. E108-B, no. 3, 1-14.
2. Taya, A., Nishiyama, Y. and Sezaki, K. (2023) Convergence Visualizer of Decentralized Federated Distillation with Reduced Communication Costs. *Globecom 2023*, 4442-4448.
3. Ono, S., Yamazaki, T., Miyoshi, T., Taya, A., Nishiyama, Y. and Sezaki, K. (2023) AMoND: Area-Controlled Mobile Ad-hoc Networking with Digital Twin. *IEEE Access*, **11**, 85224-85236.
4. Nguyen, H.D., Aoki,S., Nishiyama, Y. and Sezaki, K. (2021) A Run-time Dynamic Computation Offloading Strategy in Vehicular Edge Computing. *VTC2021-Fall*.
5. Zhang, R., Nakai, R., Sezaki, K. and Sugiura, S. (2020) Generalized Buffer-State-Based Relay Selection in Cooperative Cognitive Radio Networks. *IEEE Access*, **8**, 11644-11657.
6. Nakayama, Y., Maruta, K., Tsutsumi, T. and Sezaki, K. (2018) Optically Backhauled Moving Network for Local Trains: Architecture and Scheduling. *IEEE Access*, **6**, 31023-31036.

(3) Research on estimation and prediction of people's movement and activities using location data

When analyzing spatial big data on people and vehicle movements obtained from GPS and other sources combining with map information and various spatial statistical data, data sparsity of spatial and temporal data becomes a serious issue. Especially when the target urban area is wide, the sparsity makes direct analysis difficult. To overcome it, we conducted research to analyze the distribution of people and activities even in such a situation by introducing machine learning, etc., and developed a method to estimate the current situation and predict the future with high accuracy. Based on the developed method, we also made quantitative analysis of social activities, such as quantitatively showing the effect of mitigating automobile emissions by introducing ride-sharing and the impact of economic losses under COVID-19 lockdown.

1. Zhang, H., Li, P., Zhang, Z., Li, W., Chen, J., Song, X., Shibasaki, R. and Yan, J. (2021) Epidemic versus economic performances of the COVID-19 lockdown: A big data driven analysis. *Cities*, **120**, 103502.
2. Jiang, R., Cai, Z., Wang, Z., Yang, C., Fan, Z., Chen, Q., Tsubouchi, K. and Song, X., Shibasaki, R. (2021) DeepCrowd: A deep model for large-scale citywide crowd density and flow prediction. *IEEE Trans. On Knowledge and Data Engineering*, **35** (1), 276-290.
3. Zhang, H., Chen, J., Li, W., Song, X. and Shibasaki, R. (2020) Mobile phone GPS data in urban ride-sharing: An assessment method for emission reduction potential. *Journal of Applied Energy*, **269**, 115038.
4. Yu, Q., Zhang, H., Li, W., Song, X., Yang, D. and Shibasaki, R. (2020) Mobile phone GPS data in urban customized bus: Dynamic line design and emission reduction potentials analysis. *Journal of Cleaner Production*, **272**, 122471.
5. Jiang, R., Song, X., Huang, D., Song, X., Xia, T., Cai, Z., Wang, Z., Kim, K. and Shibasaki, R. (2019) Deepurbanevent: A system for predicting citywide crowd dynamics at big events. *KDD'19*, 2114-2122.

(4) Development of people flow data as a data base and its use for behavior change simulation

Although we have been taking the lead in analyzing people flows in urban areas for many years using GPS and CDR data from mobile terminals and other devices, it has been difficult to share data with many researchers from the standpoint of protecting personal information, and it has been difficult to accumulate knowledge through simulations and other means. Therefore, we have attempted to share people flow data, held data challenge workshops at international conferences, and developed pseudo people flow data and behavior change simulations using such data.

1. Yabe, T., Tsubouchi, K., Shimizu, T., Sekimoto, Y., Sezaki. K., Moro, E. and Pentland, A. (2024) YJMob100K: City-scale and longitudinal dataset of anonymized human mobility trajectories. *Scientific Data*, **11**, 397.
2. Kashiyama, T., Pang, Y., Shibuya, Y., Yabe, T. and Sekimoto, Y. (2024) Nationwide synthetic human mobility dataset construction from limited travel surveys and open data. *Computer-Aided Civil and Infrastructure Engineering*. **39**, 3337–3353.
3. Ma, J., Shibuya, Y., Pang, Y., Omata, H. and Sekimoto, Y. (2024). A cost-and-effect simulation model for compact city approaches: A case study in Japan. *Cities*, **152**, 105212.
4. Garcia-Gabilondo, S., Shibuya, Y. and Sekimoto, Y. (2024) Enhancing geospatial retail analysis by integrating synthetic human mobility simulations. *Computers, Environment and Urban Systems*, **108**, 102058.
5. Kajiwara, K., Ma, J., Seto, T., Sekimoto, Y., Ogawa, Y. and Omata, H. (2022) Development of current estimated household data and agent-based simulation of the future population distribution of households in Japan. *Computers, Environment and Urban Systems*, **98**, 101873.
6. Yabe, T., Tsubouchi, K., Fujiwara, N., Wada, T., Sekimoto, Y. and Ukkusuri, S.V. (2020) Non-Compulsory Measures Sufficiently Reduced Human Mobility in Tokyo during the COVID-19 Epidemic. *Scientific Reports*, **10**, 18053.
7. Hasegawa, Y., Sekimoto, Y., Seto, T. Fukushima, Y. and Maeda, M. (2018) Urban Planning Communication Tool for Citizen with National Open Data. *Computers, Environment and Urban Systems*, **77**, 101255.

(5) Affordable and rapid monitoring of urban infrastructure and creation of an international community

We have been conducting research on the detection, classification, and reproduction of roads, buildings, and other urban infrastructure on a digital twin using smartphones and other devices to detect and determine shape and damage quickly and inexpensively (the building field is separately listed under the Division of Joint Usage and Research). In particular, for road damage data, we released the world's first large-scale labeled dataset of approximately 9,000 images in 2018, and held the "Road Damage Detection & Classification Challenge" at the international conference IEEE Bigdata (Seattle), 59 teams from 14 countries participated, and the challenge was held again in 2022 and 2024. In addition, the related paper was awarded as Top 10% downloaded paper award 2018-2019 (Ref. 5) and Top cited article award 2020-2021 (Ref. 4). The member of the research group that carried out this research established UrbanX Technologies, Inc. with the support of the IPC at the University of Tokyo in April 2020, and were selected for the Toyo Keizai “100 Amazing Ventures (2023 edition)”.

1. Saha, P.K., Arya, D. and Sekimoto, Y. (2024) Federated learning-based global road damage detection. *Computer-Aided Civil and Infrastructure Engineering*, **146**, 1-16.
2. Arya, D., Maeda, H., Ghosh, S.K., Toshniwal, D. and Sekimoto, Y. (2024) RDD2022: A multi-national image dataset for automatic road damage detection. *Geoscience Data Journal*, **11** (4), 846-862.

3. Arya, D., Maeda, H., Ghosh, S.K., Toshniwal, D., Mraz, A., Kashiyama, T. and Sekimoto, Y. (2021) Deep learning-based road damage detection and classification for multiple countries. *Automation in Construction*, **132**, 103935.
4. Maeda, H., Sekimoto, Y., Seto, T., Kashiyama, T. and Omata, H. (2020) Generative adversarial network for road damage detection. *Computer-Aided Civil and Infrastructure Engineering*, **36** (1), 47-60.
5. Maeda, H., Sekimoto, Y., Seto, T., Kashiyama, T. and Omata, H. (2018) Road Damage Detection and Classification Using Deep Neural Networks with Smartphone Images. *Computer-Aided Civil and Infrastructure Engineering*, **33** (12), 1127-1141.

(6) Development of QZSS signal authentication system for GNSS signals

The current design of civilian GNSS (GPS/USA, GLONASS/Russia, GALILEO/Europe, BeiDou/China, QZSS/Japan, NavIC/India) signals do not have capabilities to protect from Spoofing attacks. For example, even if I am in Tokyo, my location from the GPS receiver can be changed to Shinjuku by using false GPS signals. These days, many countries in the conflict zones are facing spoofing attacks and airlines are facing severe flight delays. We have developed signal authentication systems that can detect spoofing attacks. The complete system design and prototype developments were done at CSIS/UTokyo. This system is now implemented in the Japanese QZSS (Quasi-Zenith Satellite System). It can provide signal authentication services to QZSS, GPS and Galileo signals. The service is called QZSS SAS and is available from 1st April 2024. The systems and applications used in the safety and security-related fields such as autonomous driving, unmanned systems, robotics, timing etc. will benefit from this service. We published papers in ION (Institute of Navigation) conferences which is the biggest for the GNSS and filed patents.

1. Manandhar, D. (2023) Internet-Based GNSS Signal Authentication. *The Institute of Navigation (ION GNSS+ 2023)*, 1454-1459.
2. Manandhar, D., Shibasaki, R. (*2023*) GNSS Signal Authentication using QZSS Signal and Evaluation of Key Performance Indicators. *Proceedings of the 2023 International Technical Meeting*.
3. Manandhar, D. (2021) SBAS Signal Authentication PoC (Proof-of-Concept) Tests, Paper presented during the 8th JWG meeting of the Navigation System Panel of ICAO, 8 - 19 Nov 2021
4. Manandhar, D., Shibasaki, R. (2020) GPS and QZSS L1C/A signal authentication using SBAS L5S signals. (Poster Presentation), 2020/10/01, Poster: https://www.enri.go.jp/jp/event/enri_seminar/doc/2020/2020_p2.pdf
5. Manandhar, D., Shibasaki, R. (2018) GNSS Signal Authentication by QZSS for Anti-Spoofing. *IEICE Technical Report*, **118** (193), SANE2018-36, 19-23. https ://www.ieice.org/ken/paper/20180824W15n/
6. Manandhar, D., Shibasaki, R. (2018) Authenticating GALILEO Open Signal using QZSS Signal. *Proceedings of the 31st International Technical Meeting of The Satellite Division of the Institute of Navigation (ION GNSS+ 2018)*, 3995-4003.
7. Manandhar, D., Shibasaki, R. (2017) GPS and QZSS Signal Authentication by using QZSS L1S Signal. 61st the Space Sciences and Technology Conference (Quasi-Zenith Satellite System Session), 3A07, Session OS21,. JAAS., Oct 2017.
8. Manandhar, D., Shibasaki, R. (2017) Signal Authentication for Anti-Spoofing based on QZSS L1S, *Proceedings of ION Pacific PNT*.

(7) Development of low-cost GNSS receiver system

A Low-Cost GNSS receiver system that is capable of the following has been developed at CSIS.

- RTK (centimeter level) and MADOCA-PPP (about 20-centimeter level) for high-accuracy

- QZSS SAS (Signal Authentication Services) for GNSS
- QZSS EWM (Early Warning Message)
- Space Weather (under feasibility study now)

The receiver system is developed by system integration using commercially available GNSS chipsets and developing necessary software for MADOCA-PPP and QZSS SAS. High-accuracy GNSS receivers cost several thousands of dollars. Commercial MADOCA-PPP receivers cost more than $5,000.

The cost of the GNSS receiver developed at CSIS is just a few hundred dollars. This receiver system is used to promote QZSS MADOCA-PPP technology abroad under the support of CAO (Cabinet Office). The receiver system is distributed to overseas universities and organizations under the CSIS/UTokyo's MTA (Material Transfer Agreement) contract for joint research and pilot projects. So far, we have distributed more than 50 sets of devices to more than 20 institutes and organizations abroad. It also helped us to develop capacity development in foreign countries by conducting trainings, workshops and seminars. CSIS has conducted regular training in collaboration with UNOOSA/ICG for the last six years. Until now, we have trained more than 1,000 persons abroad. Due to its excellent performance, we are now exploring its usage for Space Weather applications related to the ionosphere such as TEC (Total Electron Content) and ROTI (Rate Of change of TEC Index). A working group under my Chairmanship has been established in IAG (International Association of Geodesy) to explore the use of Low-Cost GNSS Receiver System for Space Weather. The list of trainings, workshops and seminars are listed in https://home.csis.u-tokyo.ac.jp/~dinesh/

Division of Spatial Socio-Economic Research

Takaaki Takahashi (2004.9-), Daisuke Kurisu (2023.4-), Yuki Otsu (2021.4-)
Yuzo Maruyama (2001.3-2017.10), Mariko Nakagawa (2016.4-2021.3), Shonosuke Sugasawa (2018.4-2023.3)

(1) Study of the spatial location patterns of the elderly and young generations

Older and younger generations have different incentives in the decision of the places to live and work. In this project, we first examined theoretically how that difference affects location choices within a city (Ref. 1). Next, we studied location choices over regions, based on a two-region model of spatial economics. The analysis revealed that the elderly have a strong tendency to agglomerate in one region, while the younger population tend to disperse into two regions. This implies that the aging of a society promotes geographic concentration of economic activities. The novel point of this study is that it incorporated the core-periphery model of spatial economics into the overlapping generations dynamic model of macroeconomics. The results were published in an international journal (Ref. 2).

1. Takahashi, T. (2018) Infrastructure investment and urban spatial structure in the age of declining birthrate and aging population: a study based on the theory of intra-urban residential location. “In Science of Infrastructure”, edited by Noriyuki Yanagawa, Chuokeizai-sha, 151-172. (In Japanese)
2. Takahashi, T. (2022) On the economic geography of an aging society. *Regional Science and Urban Economics*, **95**, 103798.

(2) Research on the impact of increased tourism on the local economy

The increase in international tourism has various effects on the welfare of residents in the host region. It stimulates demand for goods and services and raises the prices of factors of production, especially wages. This has a positive effect on residents. However, there are at least two unfavorable effects in addition to obvious external diseconomies such as congestion, pollution, and noise. One is the decrease in the variety of the goods and services consumed by local residents. It arises because a greater amount of factors of production is diverted to the production of the goods and services consumed by tourists. The other negative effect is the rise in the prices of the goods and services that local residents consume. Through rigorous theoretical analysis, we identified the mechanisms by which these two effects occur, and examined under what conditions these negative effects outweigh the positive effects of increased tourism. The results were published in the following international journal.

1. Takahashi, T. (2024) The conflict between residents and tourists: On the variety-shifting effect of tourism growth. *Japanese Economic Review*, **75**, 121.

(3) Research on ethnicity acceptance in cities and regions

In these days of increasing international migration, it is important to study what happens when people with different cultural backgrounds, in terms of language and ethnicity, for example, live and work in the same region. First, we studied the acceptance of minorities by majorities in urban areas focusing on social self-perception and public goods spending (Ref. 1). Second, we examined migration behaviors based on the theory of spatial economics, paying attention to the difficulties in transferring workers' skills to the destination of migration where the cultural backgrounds differ from those in its origin (Ref. 2). Third, we conducted an empirical analysis to answer the question of whether linguistic barriers hinder economic development (Ref. 3). Finally, by examining the consumption patterns, we studied cross-cultural acceptance

when diverse ethnicities co-exist in urban areas (Ref. 4).

1. Nakagawa, M., Sato, Y., and Yamamoto, K. (2019) Segregation and public spending under social identification. *RIETI Discussion Paper,* 19-E-096.
2. Nakagawa, M. (2020) Skill transferability and migration: *A* theoretical analysis of skilled migration under frictional skill transfer. *International Economic Journal*, **34**, 202-237.
3. Nakagawa, M. and Sugasawa, S. (2022) Linguistic distance and economic development: A cross-country analysis. *Review of Development Economics*, **26**, 793 -834. (Original version: *CSIS Discussion Paper*, 169, 2019.)
4. Nakagawa, M., Sato, Y., Tabuchi, T., and Yamamoto, K. (2022) Do People Accept Different Cultures? *Journal of Urban Economics*, **130**, 103455. (Original version: *RIETI Discussion Paper* 20-E-090, 2020.)

(4) Research on the impacts of sanctuary policies on crime

In recent years, immigration has become a growing concern in the U.S. and many other countries, especially with regard to its impacts on public safety. This enhances the need to clarify how changes in policies concerning immigration affect public safety. We studied the effects of tolerant policies for illegal immigrants (sanctuary policies) on the occurrence of crime within a city and on the flow of illegal immigrants into and out of a city. Furthermore, we examined if those effects vary within a city. The results showed that the sanctuary policies reduce rather than increase crime, that they are not associated with an increase in illegal immigration, and that the immigrant-abundant neighborhoods in a city are affected more sharply. These findings were published in the following international journal and discussion paper.

1. Otsu, Y. (2021) Sanctuary cities and crime. *Journal of Economic Behavior and Organization*, **192**, 600-615.
2. Otsu, Y. (2024) The local effect of sanctuary policies on crime: Evidence from New York. *CSIS Discussion Paper*, 183.

(5) Research on public policy and crime

Public policies are expected to reduce the number of crimes within a community through changes in the opportunity cost of crime for individuals. To implement better policies, it is important to understand the effects of those policies and how they work. This project studied two classes of such policies, namely, universal health care policies and the policies to promote visitation of prisoners. First, we found that the universal health care policies reduce the occurrence of crime by improving health conditions. Second, we revealed from the analysis of visitation data that a shorter distance from the prison where each prisoner is placed to his/her visitors' home is associated with a lower recidivism rate of that prisoner. The results were published in the following two international journals.

1. Otsu, Y. and Yuen, C. Y. K. (2022) Health, Crime, and the Labor Market: Theory and Policy Analysis. *Journal of Economic Dynamics and Control*, **144**, 104529.
2. Otsu, Y. (2024) Does Visitation in Prison Reduce Recidivism? *Journal of Policy Analysis and Management*, **43**, 126-156.

(6) Research on statistical models with spatial clustering structures

One of the important tools in the analysis of the data with locational information is the statistical analysis

method with explicit consideration of spatial heterogeneity. We developed an algorithm that simultaneously estimates a statistical model and identifies spatial heterogeneity through spatial clustering. The algorithm is shown to be sufficiently fast for large data sets. We further derived its theoretical properties. The results were published in the following two international journals. The Journal of the American Statistical Association is one of the top journals in statistics.

1. Sugasawa, S. and Murakami, D. (2021) Spatially clustered regression. *Spatial Statistics,* **44**, 100525.
2. Sugasawa, S. (2021) Grouped heterogeneous mixture modeling for clustered data. *Journal of the American Statistical Association,* **116**, 999-1010.

(7) Development of data analysis techniques that are robust against outliers

Real-world data often include outliers for various reasons. To analyze such data robustly, we need distinct techniques. In this project, we developed new techniques using a general statistical theory of divergence and a Bayesian statistical approach of reduced prior distribution. We proposed the algorithm to perform the estimation, and then examined theoretically its properties concerning robustness. The results were published in the following three international journals. Biometrika is one of the top journals in statistics.

1. Hamura, H., Irie, K. and Sugasawa, S. (2022) On global-local shrinkage priors for count data. *Bayesian Analysis,* **17**, 545-564.
2. Yonekura, S. and Sugasawa, S. (2023) Adaptation of the tuning parameter in general Bayesian inference with robust divergence. *Statistics and Computing,* **33**, article number: 39.
3. Sugasawa, S. (2020) Robust empirical Bayes small area estimation with density power divergence. *Biometrika,* **107**, 467-480.

(8) Development of statistical methods for spatio-temporal data analysis

With the development of new technologies represented by remote sensing, more and more large-scale data with time and space (spatio-temporal data) are becoming available. This increasingly raises the need for new statistical tools to analyze them. In this project, we worked on three topics. First, we developed a nonparametric regression model for spatio-temporal data and examined its theoretical properties (Ref. 1, 3, 4). Second, we constructed a method of uncertainty quantification in spatio-temporal data analysis and examined its theoretical properties (Ref. 2). Third, we introduced a novel framework for causal inference involving random objects, which are data valued in a metric space, and developed methods to estimate causal effects with theoretical guarantees (Ref. 5). The results were published or are under revision in the following international journals. The Journal of the American Statistical Association is one of the top journals in mathematical statistics, and the publication of the paper in this journal deserves special mention.

1. Kurisu, D. (2022) Nonparametric regression for locally stationary random fields under stochastic sampling design. *Bernoulli* **28**, 1250-1275.
2. Kurisu, D., Kato, K. and Shao, X. (2024) Gaussian approximation and spatially dependent wild bootstrap for high-dimensional spatial data. *the American Statistical Association (Theory and Methods)*, 2218578.
3. Kurisu, D. and Matsuda, Y. (2024) Local polynomial trend regression for spatial data on R^d. *Bernoulli* **30**, 2770-2794.
4. Kurisu, D. and Matsuda, Y. (2024) Series ridge regression for spatial data on R^d. arXiv:2402.02773. major revision requested from *Bernoulli.*

5. Kurisu, D., Zhou, Y., Otsu, T and Mueller, H.-G. (2024) Geodesic causal inference. arXiv.2406.19604. submitted to *Econometrica*.

Division of Joint Usage and Research

Yuuki Nishiyama (2022.4-), Yoshiki Ogawa (2020.11-), Renhe Jiang (2023.4-), Yanbo Pang (2021.4-), Yuriko Yazawa (2022.1-), Yoshihide Sekimoto (2020.12-2023.3, 2023.4- Division of Spatial Information Engineering)
Hiroki Kobayashi (2013.9-2020.3), Naoya Fujiwara (2014.4-2017.5), Takahiko Kusakabe (2016.4-2022.3), Hisatoshi Ai (2016.4-2022.3), Yuki Akiyama (2016.4-2020.3), Yuya Shibuya (2022.1-2024.3)

(1) Development of Traffic Network Observation and Analysis Methods Using Various Data Sources

By utilizing various spatial information on the flow of people and vehicles, we developed a method for understanding and detecting the state of traffic networks by using traffic big data. By using a large amount of location information collected by digital tachographs installed in commercial vehicles, we proposed a method for estimating and understanding traffic conditions that have been difficult to achieve using probe data alone. In addition, we worked on using Wi-Fi devices to improve the observation of human flow at traffic nodes and mixed traffic flow in developing countries and improving the efficiency of survey methods by using mobile phones.

1. Seo, T., Bayen, A., Kusakabe, T. and Asakura, Y. (2017) Traffic state estimation on highways: a comprehensive survey. *Annual reviews in control*, **43**, 128-151 .
2. Asakura, Y., Kusakabe, T., Nguyen, L. and Ushiki, T. (2017) Incident detection methods using probe vehicles with on-board GPS equipment. *Transportation Research Part C: emerging technologies*, **81**, 330-341.
3. Seo, T., Kawasaki, Y., Kusakabe, T. and Asakura, Y. (2019) Fundamental diagram estimation by using trajectories of probe vehicles. *Transportation Research Part B: Methodological*, **122**, 40-56.
4. Seo, T., Kusakabe, T., Gotoh, H. and Asakura, Y. (2019) Interactive online machine learning approach for activity-travel survey. *Transportation Research Part B: Methodological*, **123**, 362-373.
5. Kusakabe, T., Yaginuma, H. and Fukuda, D. (2018) Estimation of bus passengers' waiting time at a coach terminal with Wi-Fi MAC addresses. *Transportation Research Procedia*, **32**, 62-68.
6. Thaithatkul, P., Seo, T., Kusakabe, T. and Asakura, Y. (2019) Evolution of a dynamic ridesharing system based on the rational behavior of users. *International Journal of Sustainable Transportation*, **13** (8), 614-626.

(2) Next-Generation Deep Learning Technology for Spatiotemporal Data Modeling

Spatiotemporal data modeling has been gaining attention in the fields of artificial intelligence and data science as one of the most fundamental technologies for realizing smart cities (Society 5.0). Taking human/traffic data as an example, by dividing an entire city into many small grids or regions, the human/traffic flow of the entire city in continuous time can be uniformly represented by a 3D tensor ($T \times N \times C$). Here, T is the total number of time steps, N is the size of the spatial domain (for example, mesh grids or graph nodes), and C represents the information channels. Such 3D tensor data exhibits complex spatial and temporal dependencies: temporally, future predictions depend on both recent observations and past periodic patterns; spatially, the value of any mesh-grid or graph-node is influenced not only by nearby locations but also by distant ones. In addition to human and traffic flow, it is also possible to model other spatiotemporal data in the same way, including taxi demand, ambulance demand, traffic accidents, power consumption, and air quality. In response to these needs, we have developed highly versatile deep learning technologies that can effectively and efficiently model spatiotemporal data. We have published many related findings as the first or corresponding author at top conferences and journals in the field of artificial

intelligence, such as KDD, WWW, CIKM, AAAI, IJCAI, and ICML.

1. Tan, S., Li, D., Jiang,R., Zhang, Y. and Okumura, M. (2024) Community-Invariant Graph Contrastive Learning. *Proc. of the 41st International Conference on Machine Learning (ICML*), PMLR **235**, 47579-47606.
2. Wang, Z., Jiang, R., Xue, H., Salim, F.D., Song, X., Shibasaki, R., Hu, W. and Wang, S. (2024) Learning Spatio-Temporal Dynamics on Mobility Networks for Adaptation to Open-World Events. *Artificial Intelligence (AI)*, **335**, 104120.
3. Deng, J., Jiang, R., Zhang, J. and Song, X. (2024) Multi-Modality Spatio-Temporal Forecasting via Self-Supervised Learning. *Proc. of the 33rd International Joint Conference on Artificial Intelligence (IJCAI*), 2018-2026.
4. Liu, H., Dong, Z., Jiang, R., Deng, J., Deng, J., Chen, Q. and Song, X. (2023) Spatio-Temporal Adaptive Embedding Makes Vanilla Transformer SOTA for Traffic Forecasting. *Proc. of 32nd ACM International Conference on Information and Knowledge Management (CIKM*), 4125 - 4129.
5. Deng, J., Deng, J., Jiang, R. and Song, X. (2023) Learning Gaussian Mixture Representations for Tensor Time Series Forecasting. *Proc. of the 32nd International Joint Conference on Artificial Intelligence (IJCAI*), 2077-2085.
6. Jiang, R., Wang, Z., Tao, Y., Yang, C., Song, X., Shibasaki, R., Chen, S. and Shyu, M. (2023) Learning Social Meta-knowledge for Nowcasting Human Mobility in Disaster. *Proc. of the ACM Web Conference (WWW)*, 2655 - 2665.
7. Jiang, R., Wang, Z., Yong, J., Jeph, P., Chen, Q., Kobayashi, Y., Song, X., Fukushima, X. and Suzumura, T. (2023) Spatio-Temporal Meta-Graph Learning for Traffic Forecasting. *Proc. of Thirty-Seventh AAAI Conference on Artificial Intelligence (AAAI*), Article No. 907, 8078 - 8086.

(3) Construction and Evaluation of Urban Data from Satellite and Street View Images Using Deep Learning

Toward the realization of an urban digital twin, we are developing a method for the maintenance of urban data such as buildings on a national scale using High Performance Computing in combination with deep learning, based on satellite and street view images. Regarding extracting building contour data using deep learning, we have developed a new technique for generating high LOD 3D city models that can reflect roof shapes and facade designs. Furthermore, to realize one of the SDGs goals, "Make cities and human settlements inclusive, safe, resilient and sustainable," we have developed a deep learning model based on crowdsourced 22 items of subjective impression evaluation data, such as "attractive" and "desirable to live in," using Street View images, that can make detailed evaluation of cities. This model mapped subjective impressions on a map at 2.5-meter increments, so that we could evaluate cities at a larger spatial scale and with greater precision than previously possible.

1. Ogawa, Y., Oki, T., Zhao, C., Sekimoto, Y. and Shimizu, C. (2024) Evaluating the subjective perceptions of streetscapes using street-view images. *Landscape and Urban Planning*, **247**, 105073.
2. Ogawa, Y., Nakamura, R., Sato, G., Maeda, H. and Sekimoto, Y. (2024) End-to-End Framework for the Automatic Matching of Omnidirectional Street Images and Building Data and the Creation of 3D Building Models. *Remote Sensing*, **16**(11),1858.
3. Zhao, C., Ogawa, Y., Chen, S., Yang, Z. and Sekimoto, Y. (2023) Label Freedom: Stable Diffusion for Remote Sensing Image Semantic Segmentation Data Generation. *2023 IEEE International Conference on Big Data (BigData)*, 1022-1030.
4. Zhao, C., Ogawa, Y., Chen, S., Oki, T. and Sekimoto, Y. (2023) Quantitative land price analysis via

computer vision from street view images. *Applications of Artificial Intelligence*, **123**, Part A, 106294.
5. Ogawa, Y., Zhao, C., Oki, T., Chen S. and Sekimoto, Y. (2023) Deep Learning Approach for Classifying the Built Year and Structure of Individual Buildings by Automatically Linking Street View Images and GIS Building Data. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, **16**, 1740-1755.
6. Chen, S., Ogawa, Y., Zhao, C. and Sekimoto Y. (2023) Large-scale individual building extraction from open-source satellite imagery via super-resolution-based instance segmentation approach. *ISPRS Journal of Photogrammetry and Remote Sensing*, **195**, 129-152.

(4) Development of Human Behavior/Status Detection and Analysis Infrastructure using Passive Mobile Sensing

We are developing a platform and methodology for passively detecting and analyzing people's behavior and conditions using hardware and software sensors installed in mobile devices such as smartphones. Smartphones on the market are equipped with a wide variety of sensors, which can be collected, analyzed, and combined to realize a wide range of applications. The AWARE framework is an open-source sensing framework for continuously collecting data from sensors installed in commercial mobile devices, and is an international sensing infrastructure that has been jointly developed and operated with domestic and international research institutions such as Finland, the United States, and Australia. The AWARE framework is currently being used in more than 300 research projects in Japan and abroad. In addition, by utilizing the mobile sensing platform developed, we are also conducting research on the development of detection algorithms for human mental and physical health, a survey of university students' lifestyle patterns in the Corona Disaster, and an automatic campus location recording and sharing platform (MOCHA: Mobile Check-in Application) in the COVID-19 disaster. Through development and operation, we have conducted cross-disciplinary joint research with domestic and international researchers, and the results have been published in many domestic and international academic societies and journals. Among them, the research on UV index estimation method using GNSS signal strength has been highly evaluated, winning the IPSJ Yamashita SIG Research Award from the Information Processing Society of Japan (IPSJ) for two consecutive years.

1. Xu, L., Nishiyama, Y., Tsubouchi, K. and Sezaki, K. (2024) Deep Learning-Based Compressed Sensing for Mobile Device-Derived Sensor Data. *Proceedings of the 33rd ACM International Conference on Information and Knowledge Management*, 5023 - 5030.
2. Atsumi, S., Ishioka, R., Tsubouchi, K., Nishiyama, Y. and Sezaki, K. (2024) UV index estimation using point cloud neural network for signal information of each GNSS satellite. *IPSJ SIG Technical Report*, **2024-UBI-81** (32), 1-8. (IPSJ Yamashita SIG Research Award) (In Japanese)
3. Ishioka, R., Tsubouchi, K., Nishiyama, Y. and Sezaki, K. (2022) UV Index Estimation Using GNSS Sensor of Smart Phone. *IPSJ SIG Technical Report*, **2022-UBI-76** (20), 1-7. (IPSJ Yamashita SIG Research Award) (In Japanese)
4. Nishiyama, Y. and Sezak, K. (2023) Smartwatch-Based Sensing Framework for Continuous Data Collection: Design and Implementation. *Adjunct Proceedings of the 2023 ACM International Joint Conference on Pervasive and Ubiquitous Computing*, 620-625.
5. Nishiyama, Y., Murakami, H., Suzuki, R., Oko, K., Sukeda, I., Sezaki, K. and Kawahara, Y. (2022) MOCHA: Mobile Check-in Application for University Campuses Beyond COVID-19. *Proceedings of The Twenty-third International Symposium on Theory, Algorithmic Foundations, and Protocol Design for Mobile Networks and Mobile Computing*, 253 - 258.

6. Han, Z., Nguyen, H.Z., Aoki, S., Nishiyama, Y. and Sezaki, K. (2021) MiMoSense: An Open Crowdsensing Platform for Micro-Mobility. *2021 IEEE International Conference on Intelligent Transportation (ITSC*), 3130-3135.
7. Nishiyama, Y., Ferreira, D., Eigen, Y., Sasaki, W., Okoshi, T., Nakazawa, J., Dey, A.K. and Sezaki, K. (2020) iOS Crowd-Sensing Won't Hurt a Bit!: AWARE Framework and Sustainable Study Guideline for iOS Platform. In Streitz, N. and Konomi, S. eds. *Distributed, Ambient and Pervasive Interactions. HCII 2020. Lecture Notes in Computer Science*, 12203. Springer, Cham. 223-243.

(5) Non-verbal Interaction Across Human-Animal Barriers Using Animal-Worn Sensor Networks

As one of the social implementations of spatial information, we are developing animal-worn sensor networks. In particular, we have recently conducted demonstration tests in the difficult-to-return zone (undecontaminated area) around the Fukushima Daiichi Nuclear Power Plant. We have worked on information collection from animal-worn sensors, power saving of animal-worn sensor network systems (JST PRESTO), and data analysis on the obtained natural environment data with AI, respectively. There is a joint research project with the University of Toulon, France. Prof. Kobayashi has received the International Art Award from the British government and the Design Award from the German Federation.

1. Kobayashi, H., H., Nakagawa, K., Makiyama, K., Sasaki, Y., Kudo, H., Niraula, B. and Sezaki, K. (2018) Animal-to-animal Data Sharing Mechanism for Wildlife Monitoring in Fukushima Exclusion Zone. *Multimodal Technol. Interact*, **2** (3), 40.
2. Kobayashi, H., H. and Shimotoku, D. (2019) Comparison of User Listening Attitude for Birdsongs Recorded in Fukushima Restricted Area to Prepare Training Data for AI. in Streitz, N. and Konomi, S. eds. *Distributed, Ambient and Pervasive Interactions. HCII 2019. Lecture Notes in Computer Science*, 11587. Springer, Cham. 381-389.
3. Kobayashi, H., H. and Shimotoku, D. (2020) Tele Echo Tube for Historic House Tojo-Tei in Matsudo International Science Art Festival 2018.In Streitz, N. and Konomi, S. eds. *Distributed, Ambient and Pervasive Interactions. HCII 2020. Lecture Notes in Computer Science*, 12203. Springer, Cham. 520-532.
4. Nakagawa, K., Makita, A., Nagasawa, M., Kikusui, T., Sezaki, K. and Kobayashi, H. (2018) Opportunistic Data Exchange Algorithm for Animal Wearable Device Through Active Behavior Against External Stimuli. in: Streitz, N., Konomi, S. eds *Distributed, Ambient and Pervasive Interactions: Understanding Humans., DAPI 2018., Lecture Notes in Computer Science*, 10921. Springer, Cham, 253-263.
5. Nakagawa, K. and Kobayashi, H., H. (2020) Optimal Arrangement of Wearable Devices Based on Lifespan of Animals as Device Transporter Materials for Long-term Monitoring of Wildlife Animal Sensor Network. *Sensors and Materials*, **32**(1), 13-25.

(6) Initiatives Related to Civic Tech, Including Citizen-Participatory Data and Digital Applications

Although initiatives on citizen-participatory data and digital utilization in the region, as typified by civic tech and open data, are being undertaken in various fields and various countries, the formation of inter-disciplinary networks among researchers and the sharing of knowledge that fuse initiatives in various fields are not yet sufficient. Therefore, to expand international networks among researchers, promote interdisciplinary fusion, and broaden the sharing of knowledge among researchers and practitioners of citizen-participatory data/digital applications, we organized a workshop on civic participation data and digital use represented by civic tech at CHI, the top international conference in the field of human-computer

interaction (HCI) in 2023. The workshop included networking with researchers and civic tech-related practitioners from more than a dozen of countries, including Europe, North America, Asia, and Africa. This activity was widely recognized and was published in ACM Interactions, the flagship journal in the field of HCI and user experience (UX). Furthermore, it has been decided that the workshop will continue to be held annually as a forum for promoting interdisciplinary collaboration.

1. Shibuya, Y., Hamm, A. and Cerratto Pargman, T. (2022) Mapping HCI research methods for studying social media interaction: A systematic literature review. *Computers in Human Behavior*, **129**, 107131.
2. Shibuya, Y., Lai, C., Hamm, A., Takagi, S. and Sekimoto, Y. (2022) Do open data impact citizens' behavior? Assessing face mask panic buying behaviors during the Covid-19 pandemic. Scientific Reports, **12**, 17607.
3. Raetzsch, C., Hamm, A. and Shibuya, Y. (2023) Mainstreaming civic tech and citizen sensing: a research agenda on co-creation methods, data interfaces, and impact pathways. *Frontiers in Environmental Science*, **11**, 1228487.
4. Sun, C., Shibuya, Y. and Sekimoto, Y. (2023) Social segregation levels vary depending on activity space types: Comparison of segregation in residential, workplace, routine and non-routine activities in the Tokyo metropolitan area. *Cities*, **146**, 104745.
5. Shibuya, Y., Jones, N. and Sekimoto, Y. (2024) Assessing internal displacement patterns in Ukraine during the beginning of the Russian invasion in 2022. *Scientific Reports*, **14**, 11123.
6. Hamm, A., Shibuya, Y., Pargman, T.C., Bendor, R., Raetzsch, C., Hendawy, M., Rehak, R., Klerks, G., Schouten, B. and Hansen, N.B. (2024) What Does 'Failure' Mean in Civic Tech? We Need Continued Conversations About Discontinuation. *Interactions*, **31** (2), 34-38.
7. Garcia-Gabilondo, S., Shibuya, Y. and Sekimoto, Y., (2024) Enhancing geospatial retail analysis by integrating synthetic human mobility simulations. *Computers, Environment and Urban Systems*, **108**, 102058.

Division of Spatial Formation for Innovation Hubs and its Evaluation (Social Cooperation Research Department)

This division was established in the CSIS in October 2024 as part of the MEC-UTokyo Lab, a joint industry-university project between Mitsubishi Estate and the University of Tokyo (establishment period: October 1, 2024 - end of March 2028). This division investigates the formation of innovation hubs from a spatial perspective. It analyzes the location dynamics of startups and the effectiveness of innovation promotion measures implemented in incubation facilities both quantitatively and qualitatively so as to obtain insights into regional and spatial developments that attract new startups and support their growth. The research themes of this division can be broadly divided into the following two categories

(1) Analysis of startup location dynamics

We quantitatively and qualitatively analyze the location dynamics of startups on two spatial scales: a macro-scale analysis for the 23 wards of Tokyo and a micro-scale analysis for the "Honmaru area," which encompasses an oval zone from Hongo to Marunouchi. We attempt to identify regional environmental factors that promote the growth of startups by comprehensively analyzing macro spatial characteristics representing the richness of urban functions, such as corporate concentration and accessibility to domestic and international transportation, and micro regional characteristics related to co-creation space, inter-company communication, and employee wellbeing, in relation to the location of startups and their dynamics.

(2) Analysis of the effectiveness of innovation promotion measures at incubation facilities

To form a new startup ecosystem in the Honmaru area, we qualitatively and quantitatively evaluate the impact of measures such as reskilling programs and community activities implemented at an incubation facility on the ecosystem. Specifically, we examine the effects of the incubation facility's measures on the growth of companies residing in the facility through the monitoring of their values and the interaction analysis visualizing their face-to-face communications.

Collaborative Research Organization for the Digital Spatial Society (DSS)

The Collaborative Research Organization for the Digital Spatial Society (DSS) was established in April 2020 with a 10-year mission to expand the foundation of the digital spatial society. As of April 2024, DSS comprises 18 departments within the University of Tokyo.

In recent years, the availability of dynamic, real-time spatio-temporal big data—such as mobile data, IoT sensor data, satellite imagery, traffic probe data, and disaster data—has grown rapidly. This shift has created a pressing need for new analytical methods that build upon the existing foundation of spatio-temporal data analysis. To address this challenge, it is essential to integrate diverse types of spatio-temporal big data and construct a digital social space. This digital social space would serve as a data infrastructure encompassing human and corporate activities, transportation, logistics, commercial flow, urban expansion, environmental changes, and the transformation of socioeconomic systems.

At the University of Tokyo, related research has traditionally been conducted within specialized academic fields such as databases, artificial intelligence (AI), image recognition, traffic engineering, satellite applications, disaster engineering, natural geography, urban engineering, and economics. DSS unites faculty members from these diverse disciplines to establish a new academic field focused on real-time spatio-temporal data analysis and its applications.

Moreover, DSS has been instrumental in translating research outcomes into data-driven industries. Through various industry-academia collaboration schemes—such as the Social Cooperation Research Department, Corporate Sponsored Research Programs, and trusted data use agreements—DSS contributes its research findings to industry and society. These efforts also support the resolution of societal challenges, particularly those aligned with Sustainable Development Goals (SDGs) 3 (Good Health and Well-Being), 11 (Sustainable Cities and Communities), and 13 (Climate Action).

Since its inception in 2020, DSS has consistently advanced its mission through:

- Cross-disciplinary academic research
- Social application of research outcomes
- Educational initiatives leveraging spatio-temporal big data research

These efforts are made possible through close collaboration among participating departments, with CSIS serving as the central coordinating body.

(1) Cross-disciplinary academic research in collaboration with the Research Organization for DSS

Addressing challenges faced by elderly individuals living in "difficult" residential environments (Graduate School of Medicine)

Our health status is significantly influenced by the type of residential environment in which we live. For instance, neighborhood walkability and access to shopping facilities are known to affect the risk of obesity and non-communicable diseases. This impact may be even more pronounced among the elderly, who often face reduced physical ability and difficulty driving.

In Japan, a substantial number of elderly individuals reside in depopulated areas with limited access to shopping facilities, and many live on steep slopes that are inaccessible by car. The presence of elderly individuals with reduced physical abilities in such "difficult" residential environments represents a unique issue of environmental justice in Japan.

The primary objective of this study is to examine the relationship between residential environments (including neighborhood walkability, shopping accessibility, slope, and roadway access) and the aging population (age distribution of residents) across Japan. The study also aims to identify regional differences in these relationships. While significant research has been conducted on walkability and shopping environments, relatively little attention has been paid to the combined factors of roadway access and slope

in residential environments.

The second objective is to test the hypothesis that living on a steep slope without roadway access influences physical activity levels in a distinct way: it may increase physical activity and slow the decline in physical ability up to a certain age, but beyond a certain threshold age, it could lead to a steep decline in physical activity and physical ability.

The concept of environmental justice, commonly used in analyses of the locations of nuclear power plants and waste disposal sites, is being applied here in a novel context: the relationship between residential environments and the residence of elderly populations. This aspect of the study involves collaborative theoretical research with humanities faculty members within the DSS.

Survey on Security Acceptance for Secure E-mail Operations (Graduate School of Information Science and Technology)

It has been approximately 50 years since the invention of e-mail, a staple communication tool. While chat applications such as Slack have gained significant popularity in recent years, e-mail remains indispensable in business due to its open protocol, which enables communication with anyone as long as their e-mail address is known. This openness ensures that e-mail will not be entirely replaced by chat applications.

However, this same openness is exploited by attackers who use e-mail for phishing and targeted attacks. Many of the threats listed in the "10 Major Security Threats 2023" leverage e-mail as a primary attack vector. To mitigate such risks, the Internet Engineering Task Force (IETF) has standardized various elements to improve e-mail security.

Despite these advancements, the majority of large corporations and government agencies in Japan emphasize encryption but often fail to confirm whether their e-mail operations support core technologies such as DNSSEC. Consequently, the fundamental pillars of e-mail security—confidentiality, integrity, and authenticity—remain inadequately addressed.

Developing advanced e-mail security elements is a critical research area, but the decision to implement these technologies ultimately lies with humans. Even the most advanced technologies will not achieve widespread adoption if their importance is not recognized. Furthermore, e-mail security requires high levels of protection for both senders and receivers. Isolated efforts by a few organizations to secure their environments will not resolve the issue fundamentally. Society as a whole must elevate its e-mail security standards.

To address these challenges, this study conducts an awareness survey on the social acceptability of security technologies and user attitudes toward them. This survey will be implemented in collaboration with several research companies. Through this investigation, we aim to assess whether e-mail can become a reliable and secure communication tool and identify necessary measures to enhance e-mail security within the university.

Analyzing the attractiveness of tourism resources using online reviews (Information Science and Engineering)

The objective of this research is to gain insights into the attractiveness of tourist destinations and analyze movement trends by leveraging images and textual information obtained from digital media such as social networking services (SNS) and online reviews. By employing advanced machine learning techniques, the research aims to predict the popularity of tourism-related entities, such as hotels and transportation, and analyze trends in their popularity.

Through this research, we seek to create new value for the tourism industry by visualizing the appeal of tourism resources and identifying areas for improvement. Data on tourism resources will be collected from

SNS and online review platforms, and multimodal deep learning techniques, including graph neural networks, will be developed. Additionally, advanced language processing techniques, such as Large Language Models (LLMs), will be employed to analyze people's opinions and preferences. These efforts are expected to establish fundamental technologies for interpreting individuals' interests and behavioral tendencies from text and image data.

The project will also involve collaboration with local governments and companies focused on local development and urban planning. By sharing the artificial intelligence technologies developed through this research, we aim to foster collaboration with researchers both within and outside the DSS. Furthermore, the project seeks to accelerate the practical application of research outcomes and drive technological innovation through joint research initiatives within the DSS.

Sediment production and transport processes in mountain forests using very long-term observation data and spatial information technology (Graduate School of Agricultural and Life Sciences)

This study aims to elucidate the sediment runoff processes on forested slopes in mountainous regions, with a focus on promoting Nature-based Solutions (NbS) for land management under climate change. Forests, as green infrastructure, play a vital role in water-soil conservation. Sediment dynamics in mountain watersheds are influenced by current precipitation patterns and forest cover. Moreover, sediment discharge to rivers today is often shaped by historical human disturbances over a century ago, such as the creation of "bald hills."

To address these complexities, this study adopts a very long-term spatiotemporal approach to investigate sediment production and transport processes. Managing sediment dynamics across entire watersheds—from mountains and forests to rivers, plains, and coasts—is critical to addressing issues such as excessive sediment deposition in dams and coastal erosion caused by insufficient sediment supply. However, knowledge of sediment discharge from upstream forested watersheds remains limited.

By accumulating long-term data and understanding sediment transport patterns, this study aims to enhance predictive models and contribute to disaster prevention and sustainable land management. The University Forest provides a valuable resource for this research, with existing GIS vegetation data, meteorological, hydrological, and sediment datasets serving as ground truthers. These datasets are publicly accessible, fostering collaboration in spatial information analysis and long-term observation using remote sensing and GIS across disciplines such as geography, engineering, and informatics.

Additionally, network infrastructure in parts of the University Forest enables real-time monitoring and testing of innovative methods. The project also supports collaboration in addressing social issues, such as research-policy-consensus building, focusing on land conservation and sediment dynamics management. This integrated approach is expected to advance solutions for sustainable land use management and environmental conservation.

Building Resolution CO_2 Data maintenance and model improvement for the development of transport calculation models (Atmosphere and Ocean Research Institute)

In preparation for the Global Stocktake, an international initiative to reduce carbon dioxide (CO2) emissions, it is critical to develop methods for evaluating CO2 reductions and assessing the effectiveness of mitigation measures. Specifically, there is a pressing need for integrated analysis systems that combine observational data and numerical models to estimate emissions from large-scale sources, such as power plants and urban areas.

Current analysis systems typically operate at spatial resolutions of several kilometers, making them unsuitable for analyzing point emission sources like power plants. While advancements in satellite-borne

sensors have enabled the observation of CO2 concentration distributions at a spatial resolution of approximately 50 meters, numerical models capable of analyzing such high-resolution data at the building scale (spatial resolution: 10 meters) remain largely undeveloped.

To address this gap, this study aims to develop a "building-resolution CO2 transport calculation model" using SCALE-RM, an ultra-high-resolution meteorological model with a Large Eddy Simulation (LES) mode that explicitly calculates diffusion processes. The first phase of this project involves using SCALE-LES to compute meteorological fields that incorporate 3D building information.

The realization of this model represents a significant step toward the development of a CO2 transport model at building resolution. Once completed, the model will enable the analysis of satellite data at a spatial resolution of 50 meters, allowing for precise evaluation of CO2 emissions from large point-scale sources, such as power plants. Additionally, it will facilitate the verification of the effectiveness of implemented reduction measures, contributing to the global effort to combat climate change.

High-resolution spatio-temporal heat stress exposure assessment of metropolitan areas based on population movement (Graduate School of Medical)

The frequency of extreme temperatures is increasing due to global warming, and the risk of heat-related illnesses, including heat stroke, has become a significant public health concern. This is particularly critical in densely populated urban areas. Nationwide, the number of emergency medical calls for heat stroke rose from 71,029 in 2022 to 91,467 in 2023 (May–September), highlighting the urgent need for effective heat stroke prevention measures.

This study aims to comprehensively assess heat stress exposure at high spatio-temporal resolution (1 hour, 500 meters), incorporating daytime population movements in metropolitan areas. By providing detailed insights into heat stress patterns, the research seeks to enable interdisciplinary collaboration between medical and public health experts and researchers in spatial information science, paving the way for innovative solutions to this growing public health issue.

(2) Returning research results to society

Building data development in the digital space society

In collaboration with the Digital Smart City Initiative Social Cooperation Research Department, established in November 2019 at the University of Tokyo’s Institute of Industrial Science, various studies are being conducted to design, build, and socially demonstrate digital smart cities. With advancements in technologies such as "digital twins," real-time data from urban infrastructure, equipment, and environmental sensors can be integrated into virtual spaces. These technologies enable large-scale simulations and future predictions, particularly for disaster prevention.

This study focuses on designing standardized specifications for urban models with building data at different scales, which can be input into various simulation models. Additionally, we are developing and releasing "Urban CPS for Strong Resilience," a tool that visualizes simulation results of building responses to earthquake ground motion on easy-to-understand maps, facilitating disaster prevention and societal consensus building.

Development of digital city services

Technological advances in open data, big data, and AI have enabled local governments and organizations to distribute city-level data. However, it is still challenging to assess how accurately a city is represented as a digital twin, requiring significant effort to create a comprehensive picture. To address this, Digital City Service is developing technologies that provide local governments with a real-time digital twin environment,

integrating datasets and 3D urban visualizations to enhance usability and decision-making.

Research on sustainable approaches to efficiency, labor saving, and sophistication for comfortable urban development

The rise of remote work has heightened awareness of urban living and working conditions. Urban maintenance and management require active citizen participation alongside government efforts. To this end, we have developed services such as:

A "citizens' cooperative contribution service" allowing citizens to report road and park defects via smartphones.

A "road damage detection service" using AI to detect potholes and cracks from smartphones mounted in vehicles.

These services aim to foster collaboration between governments and citizens, promoting mutual understanding and active participation in urban management.

Developing the Real Estate ID Matching System

We are developing the Real Estate ID Matching System, an initiative to link real estate IDs with PLATEAU. In the real estate sector, inconsistencies in address and lot number notations often make it challenging to identify identical properties, placing a significant burden on businesses when collecting and reconciling real estate-related information.

To address this issue, we are creating an environment for the development, dissemination, and utilization of "real estate IDs." This system links 3D city model data with building information, such as residential maps and 3D point cloud data, assigning unique real estate IDs to buildings in 3D urban models.

This initiative not only reduces the workload for real estate developers but also aims to expand the utility of real estate IDs across various societal domains, including lifestyle infrastructure, urban development, and logistics. By streamlining property identification and data management, this system contributes to market revitalization and supports more efficient urban planning and infrastructure development.

Urban Data Challenge

The Collaborative Research Organization for the Digital Spatial Society and the Japan Society of Civil Engineers (JSCE), among others, sponsor the annual Urban Data Challenge, a contest of works involving data-oriented community building and public participation for the purpose of solving regional issues (Chapter 8). For example, in 2023, “the Urban Data Challenge 2023 with JSCE Infrastructure Data Challenge 2023” was held. 131 works were submitted in 2023, a large number of entries. At the final judging session, after the presentations of the works that passed the preliminary screening, the audience cast their deciding votes to determine each award, and approximately 100 people participated on the day of the event.

(3) Educational activities using research results

Academic Frontier Lecture Series "Frontiers of Research and Social Implementation in Digital Spatial Society”

Advancements in IoT devices, satellite data, and other spatio-temporal data sources are enabling new ways to understand spaces such as cities, forests, and oceans. This lecture series features faculty members from various departments, each delivering sessions designed to expose students to cutting-edge, cross-disciplinary research on spatio-temporal big data. The course aims to help students develop a broad perspective and analytical skills for addressing societal issues from multiple data-driven approaches. Offered in 2023 and 2024, the program targeted first- and second-year Liberal Arts students.

Urban Digital Twin Application Project

Launched by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in FY2020, Project PLATEAU reproduces real-world urban spaces through "3D urban models" to drive innovation and practical solutions. This course introduces students to urban digital twin technologies, combining theoretical input in the first half of the lecture with hands-on application development in the second half. Students participate individually or in groups to create solutions using PLATEAU's 3D city models, with the ultimate goal of entering their projects in the MLIT-sponsored PLATEAU AWARD development contest.

Summer Schools for Developing Young Human Resources

This summer school equips students with essential data analysis and visualization skills across various fields, including the handling of time-series data (e.g., people flow) and urban data (e.g., 3D building data). It emphasizes practical methods for analyzing and presenting results effectively. Additionally, the program fosters community building through exchange meetings among participants and faculty members from DSS.

Division of Global Spatial Data Commons Initiative (Corporate Sponsored Research Program)

The Global Spatial Data Commons Initiative is a Corporate Sponsored Research Program established in December 2022 within the DSS. In collaboration with local and national governments across Japan, this division promotes the digital twinning of entire cities, create an environment where various technological solutions can be generated by the private sector, and enable regions-particularly local governments- to autonomously manage the social deployment and operation of the digital twin. In addition, the initiative aims to create a global-scale spatial data commons.

The core activity of this division is to innovate the annual budget of 10 trillion yen in urban development through a wide range of support, including human resource development. To this end, the division actively promotes in training for private companies and local governments to enhance data handling capabilities. Furthermore, it aims to leverage universities and the Urban Data Challenge (UDC) network to incorporate motivated members of local government on a nationwide scale into a cooperative framework to speed up the digital transformation of the region.

The following three research issues are being addressed by this division:

(1) Research Project A: Development of Field-Based Registry Geocoding Technology
(2) Research Project B: Development of Stage-Specific Digital Twin Technology
(3) Research Project C: Regional Development and Human Resource Development

The main results to date are shown below.

(1) Research Project A: Development of Field-Based Registry Geocoding Technology

Buildings and land (A-1)

This project aims to integrate data on buildings and land, including common real estate IDs, to realize a building matching service in about 100 cities. So far, a matching system utilizing maps maintained by the registry office (Article 14 maps) has been completed, and user verification tests in 50 cities have been completed, showing that in areas where Article 14 maps are maintained, matching between buildings and land is realized with a high accuracy of 95-100%. The Ministry of Land, Infrastructure, Transport and Tourism is experimenting with linking real estate IDs with address descriptions, in the future we plan to develop the ID assignment service on a voluntary basis, keeping in mind the possibility of changes due to this.

Roads and infrastructure structures (A-2)

Matching technology based on road link IDs was developed, achieving an 89% matching rate for 1,300 road facilities in Shizuoka Prefecture. Prototyping and ID assignment for national trunk roads using OpenStreetMap (OSM) are ongoing. Future efforts will focus on expanding the actual use of the matching technology on roads larger than prefectural roads.

People flow, transportation and tourism (A-3)

A WebAPI for pseudo people flow data has been developed, creating an environment that can be used as part of digital city services. Pseudo People Flow data version 2.0, incorporating improved household estimation and transportation mode data, was released in June. Process has also been made on a GTFS data repository for centralized management of GTFS data nationwide, with over 40% of operators now contributing data.

Local economy and trade (A-4)

A framework for regional economic estimation using pseudo people flow data and business transaction

data has been developed. A social experiment conducted in the Sangen-jaya shopping district included sales forecasting and clarified the impact of data accuracy on estimation outcomes. Furthermore, the digital twin project for the entire shopping district is evaluating the effect of incorporating store information on a digital twin of the district.

Topography and hazards (A-5)

A real-time data provision system for disasters is being developed, and a social experiment is planned for the use of mobile spatial statistics and driver recordings image data in Kumamoto Prefecture. A system to provide data within 24 to 48 hours after a major disaster is being developed, and contracts with about 10 companies are in progress.

(2) Research Project B: Development of Stage-Specific Digital Twin Technology

Construction of an automatic superimposition method of national and local data for entry-level municipalities (B-1)

This project aims to construct a digital twin environment that can visualize about 100 different data sets for each municipality by integrating various data from the national, prefectural, city, and private sectors registered in the G-Spatial Information Center. As of April 2023, nationalization of digital city services were announced, and an Urban Application Collaborative Implementation Study Group was established in June with the participation of 14 municipalities. Furthermore, implementation as a public GIS has been largely completed in Susono City, and other applications for local governments are being implemented in plug-in form. Through these efforts, the technology of superimposing national and local data is reaching the practical stage.

Construction of BID and behavior change measurement platform (B-2)

The dashboard function of the Digital City Service is being enhanced to create a platform related to behavior change measurement and BID (Business Improvement District). In 2023, SoftBank data was released for business-like deployment. In addition, a system combining pseudo people flow data with social experiments such as smart cities and MaaS is being tested. As part of SIP Phase 3 (Smart Mobility), the Mobility Digital Twin Study Group utilizing nationwide pseudo people flow data was held, and demonstrated its first prototype successfully,, and implementation of five use cases is ongoing.

(3) Research Project C: Regional Development and Human Resource Development

Formation of a consortium of local governments and related parties (C-1)

The Digital City Council Coalition (tentative name) was launched to unite local governments and stakeholders for regional digital transformation. In April 2023, the Digital Nanto/Susono Council was substantially started, and a joint promotion meeting was held in Nanto in June of the same year. In addition, this division has exchanged views with the leaders of several municipalities, including Takehara City in Hiroshima Prefecture and Kobe City, and collaboration is progressing. Currently, five municipalities are participating in the consortium, which is further accelerating regional development through collaboration with the Urban Application Collaborative Implementation Study Group.

Regular hands-on implementation and systemic development of key personnel (C-2)

To support regional digital transformation, an onboarding package has been developed to facilitate stakeholder participation. An onboarding package is being developed to facilitate participation of stakeholders from the University of Tokyo, AIGID, and others. In addition, a program called "Regional

Digital Circles" was kicked off in late June 2023 to support council operations in each region, and hands-on sessions are being held twice a month. This initiative has deepened the region's understanding of digital technology and is making steady progress in the development of key personnel.

1. Kashiyama, T., Pang, Y., Shibuya, Y., Yabe, T. and Sekimoto, Y. (2024) Nationwide synthetic human mobility dataset construction from limited travel surveys and open data. *Computer-Aided Civil and Infrastructure Engineering*. Available online 10 June 2024.
2. Garcia-Gabilondo, S., Shibuya, Y., and Sekimoto, Y. (2024). Enhancing geospatial retail analysis by integrating synthetic human mobility simulations. *Computers, Environment and Urban Systems*, 108, 102058.
3. Ma, J., Shibuya, Y., Pang, Y., Omata, H., and Sekimoto, Y. (2024). A cost-and-effect simulation model for compact city approaches: A case study in Japan. *Cities*, 152, 105212.

Division of Civic Tech Design Initiative (Corporate Sponsored Research Program)

The Civic Tech Design Initiative (CTDI) is a five-year Corporate Sponsored Research Program established in July 2024. The goal of CTDI is to promote Civic Tech approach, which emphasizes dialog among diverse actors and promotes democratic participation with data and digital technologies to address challenges and common concerns in communities. CTDI plans to develop learning and practical opportunities in various communities where each citizen can be proactively and consistently involved in the solution development process, from problem setting to data generation, data utilization, and design technology development. In particular, we will build a foundation to foster and support activities that provide opportunities for dialogue, co-creation, and diverse experiences that cannot be gained by a single organization or individual, and that raise the digital power of the region from the bottom up, to be shared among industry, government, and academia.

CTDI addresses the following three research items

Research Item A: Academic Systematization of Civic Tech Design Studies

Research Item B: Case Creation and Human Resource Development

Research Item C: Regional Development Support

The major accomplishments of CTDI in this fiscal year are shown below.

Develop educational materials that focus on "participation" in the datafied society

In order to promote "participation" in communities in the datafied society, e-learning materials using the civic tech approach have been developed and released jointly with the Asian Development Bank Institute. The materials are designed for policymakers and others to learn about Civic Tech approach's academic and practical backgrounds, various cases, current situations, and challenges. In addition to CSIS faculty members, CSIS FY2024 Visiting Scholars Prof. Christoph Raetzsch (Aarhus University, Denmark) and Andrea Hamm (Weizenbaum Institute for the Networked Society, Germany) join the material development covering a wide range of topics globally. The materials are available on the Asian Development Bank Institute E-Learning Platform, where more than 100,000 people from around the world have registered online (Sekimoto et al. 2024).

In addition to the E-learning material above, CTDI is working on comprehensive teaching materials for a variety of audiences, including citizens, students, and businesses, and preparing lecture series for the next fiscal year.

1. Sekimoto, Y., Inatsugu, H., Hamm, A., Raetzsch, C. and Shibuya, Y. (2024) Data Innovation for Development: Civic Participation for Social Good and Well- Being. https://elearning-adbi.org/courses/data-innovation-for-development-civic-participation-for-social-good-and-well-being/ (E-learning material)

Contributions to academic organizations, government, society, etc., educational activities, and awards received related to research

The following is a list of major activities of our faculty members (those affiliated with CSIS as of October 1, 2024) that contribute to academic organizations, government, and society, as well as their educational activities outside the university and the awards they have received. They engage in a wide range of activities, including activities at academic societies, editing academic journals, serving on committees at central and local government ministries and agencies, and educational activities at universities other than the University of Tokyo, including those of younger faculty members.

Yoshihide Sekimoto

- Association for Promotion of Infrastructure Geospatial Information Distribution (AIGID): Representative Director
- Geographic Information Systems Society of Japan: External Relations Committee Member
- The Japanese Society of Photogrammetry: Councilor
- JSCE: Research Division, Subcommittee on Infrastructure and Service Co-Creation Research in Civil Engineering Informatics / Subcommittee Chair, Committee on Civil Engineering Informatics
- JSCE: Executive Secretary, Committee on Civil Informatics, Research Division
- Nippon Foundation: Member of the Study Group on Relevant Data for the Promotion of Unmanned Vessels
- JSPS: Expert Member, Committee on Grants-in-Aid for Scientific Research
- Low Carbon Investment Promotion Organization: External evaluation committee member for the FY2022 supplementary budget "Ministry of Land, Infrastructure, Transport and Tourism Small and Medium Enterprise Innovation Promotion Project
- Ministry of Land, Infrastructure, Transport and Tourism: Member of "Study Group on Urban Policies in Response to Rapid Development of Digitalization and the New Normal", Chairperson of "Study Group on Urban Development Measures for a Data-driven Society", Member of "Study Group on New Urban Transportation Research System", Member of Regional Road Economic Strategy Study Group
- National Institute for Land and Infrastructure Management: Member of Advisory Council for Commissioned Research, Member of Research Evaluation Committee Subcommittee (Section 1), Member of Technical Proposal Evaluation Review Committee
- Japan Science and Technology Agency: Emergent Research Support Program Pre-evaluation External Expert
- New Energy and Industrial Technology Development Organization (NEDO): Technical Committee Member
- Fire and Disaster Management Agency: Advisor, Fire and Disaster Management Study Group in light of changes surrounding firefighting
- Minister's Secretariat, Ministry of Internal Affairs and Communications: Advisor for Local Informatization
- Ministry of Internal Affairs and Communications: Member of R&D Steering Committee
- Cabinet Office: Member, Data Linkage Study Group, Secretariat of Science, Technology and Innovation, Member, Study Group of Experts on the Utilization of Real Estate Information, etc., Expert Judge, Ichi Biz Award 2023
- Science Council of Japan: Member, Subcommittee on Regional Knowledge, Regional Information Subcommittee, Committee on Regional Studies
- Ministry of Land, Infrastructure, Transport and Tourism: Member, Study Group on Handling of Personal

Information in Utilization of Geospatial Information; Chairperson, Study Group for Upgrading Urban Planning Information in the Digital Society, Ministry of Land, Infrastructure, Transport and Tourism

- ADBI-Purdue University-University of Tokyo Virtual Workshop on Resilience of Cities to External Shocks: Analysis, Modeling, and Economic Impacts Execution Chairperson
- Workshop on Global Road Damage Detection data challenge 2020, IEEE Bigdata Executive Committee Chair
- Urban Data Challenge 2020, 2021, 2022, 2023 Executive Committee Chair
- [Award] Wiley, Top cited article award 2020-2021: for the article "Generative adversarial network for road damage detection" published in Wiley's "Computer-Aided Civil and Infrastructure Engineering" (Impact factor: 8.552).
- [Award] PLOS ONE, Top 10% most cited paper award 2019: for the article "Cross-comparative analysis of evacuation behavior after earthquakes using mobile phone data"
- [Award] Wiley, Top 10% downloaded paper award 2018-2019: for the paper "Road Damage Detection and Classification Using Deep Neural Networks with Smartphone Images" published in Wiley's "Computer-Aided Civil and Infrastructure Engineering" (Impact factor: 6.208).
- [Award] 2019 Geographic Information System Association of Japan Award (Academic Paper Division): for the presentation of a scholarly paper on geographic information systems to date.
- [Award] 2019 Geographic Information System Association of Japan Award (Software and Data Division): for the "My City Report" team's work on the release of the "Road Damage Dataset"
- Visiting Professor, The Open University of Japan "Geospatial Information in Daily Life

Ikuho Yamada

- Science Council of Japan: Associate Member
- Statistics Bureau, Ministry of Internal Affairs and Communications: Member of the Study Group on the 2023 Housing and Land Survey
- City Planning Institute of Japan: Member of the International Affairs Committee
- Geographic Information Systems Association: Director, Secretary General
- The Association of Japanese Geographers: Member of the Public Relations Committee, Editorial Board Member of *Geographical Review of Japan Series B*
- Japan Geoscience Union: Member of the JpGU Meeting Organizing Committee, Member of the Finance Committee, Member of the Global Strategy Committee, Delegate
- International Regional Science Review (SAGE): Editorial Board Member
- Urban & Regional Planning Review (The City Planning Institute of Japan): Editorial Board Member
- Visiting Professor, The Open University of Japan, "Utilization of Geospatial Information in Daily Life," "Fundamentals and Utilization of Geospatial Information," etc.
- Part-time Lecturer, Tokyo Medical and Dental University, "Special Lectures on Mobile Health"
- Part-time Lecturer, Center for Research and Development of Statistical Information, "Statistics Seminar 2023"

Kaoru Sezaki

- IEEE Communication Society eHealth Committee Member
- IEEE Wireless Communications "5G and Beyond Technology-Enalbed Remote Health" Special Issue Editor (2021)
- Globecom 2017/ Globecom 2018/ Globecom 2019/ Globecom 2020/ Globecom 2021: Technical

Program Committee Member

- ICC 2017/ICC 2018/ICC 2019/ICC 2020/ICC 2021: Technical Program Committee Member
- DPSWS2022: Program Committee Member
- HuMob Challenge 2023 (workshop of Sigspatial 2023): Organizing Committee Member
- Journal of Semantic Computing (Elsevier): Editorial Board Member
- The Journal of the Institute of Image Electronics Engineers of Japan: Editorial Board Member
- Ministry of Internal Affairs and Communications: Member of "Research and Development Evaluation Committee on Technologies for Bridging the Digital Divide"
- ISOTC211: National Committee Member
- Asian Development Bank: Expert
- Hong Kong Research Grants Council: External Evaluation Committee Member
- Association of Precise Survey and Applied Technology: Chairman of the Qualification Committee
- Council for Research Institutes and Centers of Japanese National Universities: Science and Technology Division Chairman
- [Award] 2017 Career Achievement Award, IEEE COMSOC e-Health Technical Committee
- [Award] 2018 MBL Research Group Best Paper Award, Information Processing Society of Japan
- [Award] 2019 English Session Awards, IEICE Technical Committee on Networked Systems Research
- [Award] 2022 Best Paper Award, 76th IPSJ Ubiquitous Computing Systems Conference, Information Processing Society of Japan

Takashi Oguchi

- International Association of Geomorphologists: Vice-President, Steering Committee Member for Asia-Pacific
- International Geographical Union: Chair, Commission on Hazard and Risk
- Science Council of Japan: Member, Affiliate Member
- Japan Geoscience Union: Vice President, President of the Human Geoscience Section
- The Association of Japanese Geographers: President, Board Chairperson
- Japan Geomorphological Union: President, Vice President
- Geographic Information Systems Society of Japan: President, Vice President
- GSI Bid Monitoring Committee: Chairman
- Geomorphology (Elsevier): Co-Editor-in-Chief
- Geomorphology (Elsevier): Emeritus Editor
- Remote Sensing (MDPI): Associate Editor
- Catena (Elsevier): Editorial Board Member
- Earth (MDPI): Editorial Board Member
- Geoderma Regional (Elsevier): Editorial Board Member
- Progress in Earth and Planetary Science (Springer): Editorial Board Member
- Scientific Reports (Nature Portfolio): Editorial Board Member
- [Award] Full Member, Sigma Xi, The Scientific Research Honor Society, USA
- [Award] Geographic Information System Association of Japan Award (Education Division) as a representative of GIS-OER WG
- [Award] GSI Geo Activity Contest Geography Education Award as a representative of GIS-OER WG
- [Award] International Fellowship Award of Excellence, Taiwan Group on Earth Observations
- [Award] JSPS Special Researcher Award, JSPS Special Researcher Review Committee (in charge of

written work)

- Part-time lecturer, Faculty of Urban Environment, Tokyo Metropolitan University, “Geoinformatics”
- Part-time lecturer, Graduate School of Urban Environmental Sciences, Tokyo Metropolitan University, “Advanced Spatial Information Science I”
- Part-time lecturer, Graduate School of Science, Tohoku University, “Special Subjects in Geography III”, “Special Lectures on Natural Geography II”, “Special Lectures on Environmental Geography I”

Takaaki Takahashi

- The Society of Applied Regional Science: Annual Conference Organizing Committee Member, Paper Award Review Committee Chair, Director, Vice President, President
- Part-time lecturer, Faculty of Political Science and Economics, Waseda University “Urban Economics A” and “Urban Economics B”

Daisuke Kurisu

- [Award] The 38th the Japan Statistical Society Ogawa Award

Dinesh Manandhar

- International Association of Geodesy (IAG), Commission4, Working Group 4.1.4, Low-Cost GNSS receiver systems: Chair
- ICAO/NSP (International Civil Aviation Organization / Navigation System Panel), Joint Working Group and SBAS Authentication ad-hoc committee: Member
- Invited Lectures on GNSS
  - University of Indonesia, Jakarta
  - Tribhuvan University, Paschimanchal Campus, Pokhara, Nepal

Yuki Nishiyama

- Information Processing Society of Japan: Ubiquitous Computing Research Group, Secretary
- The Society of Instrument and Control Engineers (SICE): Measurement Division at the Smart Sensing Systems Subcommittee, Secretary
- Transactions of Information Processing Society of Japan: Ubiquitous Computing Systems (XII) Special Issue Secretary, (XI) Special Issue Editor
- Measurement Field, Transactions of the Society of Instrument and Control Engineers (SICE): Associate Editor
- IEEE International Conference on E-health Networking, Application & Services (HealthCom 2024): Technical Program Committee
- 26th ACM International Conference on Multimodal Interaction (ICMI 2024): Program Committee
- 14th International Conference on the Internet of Things (IoT 2024): Technical Program Committee
- The Society of Instrument and Control Engineers (SICE) Annual Conference 2024, 2023, 2022: Associate Editors
- The 22nd ACM International Conference on Mobile Systems, Applications, and Services (ACM MobiSys2024): Local Chair
- The 6th & 4th International Conference on Activity and Behavior Computing (ABC2024, 2022): Program Committee
- 25th IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks

(WoWMoM): Technical Program Committee
- The 13th International Conference on the Internet of Things (IoT2023): Publicity Chair & Technical Program Committee
- [Award] Best Paper Award, The 81st IPSJ Ubiquitous Computing Systems (UBI) Conference (Co-author)
- [Award] Outstanding Reviewer Awards, 25th ACM International Conference on Multimodal Interaction (ICMI2023)
- [Award] Best Paper Award, IPSJ 76th Ubiquitous Computing Systems (UBI) Conference (Co-author)
- [Award] Best Presentation Award, The 84th National Convention of Information Processing Society of Japan (Session: Sensors on Health Status) (Co-author)
- [Award] Best Presentation Award, The 84th National Convention of IPSJ (Session: Public Transportation) (Co-author)

Yoshiki Ogawa

- HPCI Interdisciplinary Collaborative Research WG: Member
- JHPCN Proposal Review Committee
- Research subcommittee on methodology for design and development of civil information systems
- The Steering Committee of the Micro-Geodata Research Group: Member
- [Award] New Energy and Industrial Technology Development Organization (NEDO)/Ministry of Economy, Trade and Industry “NEDO Supply Chain Data Challenge 3rd Prize in System Development Category” 2022 (joint name)
- Part-time lecturer, Graduate School of Life and Environmental Sciences, University of Tsukuba, "Special Lecture on Spatial Information Science II”

Yuki Otsu

- Part-time lecturer, Faculty of Economics, Musashino University, “Urban Economics”

Renhe Jiang

- AAAI 2023, 2024: Program Committee Members
- IJCAI 2023, 2024: Program Committee Members
- KDD 2023, 2024: Program Committee Member
- WWW (TheWebConf) 2024: Program Committee
- ACM MM 2024: Program Committee Member
- NeurIPS 2024: Program Committee Member
- CIKM 2023, 2024: Program Committee Members
- ECML PKDD 2023, 2024: Program Committee Members
- SDM 2024: Program Committee Member
- PAKDD 2023, 2024: Program Committee Members
- IEEE BigData 2023, 2024: Program Committee Member
- Remote Sensing, ACM TSAS, Springer GeoInformatica, IEEE TBD, Springer WWWJ: Guest Editorial Board Member
- Springer GeoInformatica: Executive Editor

Takahiro Yoshida

- Japan Society of Civil Engineers: Member, Academic Subcommittee, Committee of Infrastructure Planning and Management
- National Institute for Environmental Studies: Visiting Researcher, Earth System Division
- National Institute for Environmental Studies: Visiting Researcher, Social System Division
- Keio University: Part-time lecturer “Sustainable Urban Systems 1 (shared responsibility),” “Sustainable Urban Systems 2 (shared responsibility),” and “Studios for Urban Systems Design (shared responsibility)”
- Sagamihara City: Member, Committee of Land Use Planning for Sagamihara Station North Exit Area
- General Incorporated Association Zero Emi Yamanashi: Advisor

Yanbo Pang

- 2022 IEEE Big Data Cup “Trip Destination Prediction Challenge 2022”: Steering Committee Member
- Bachelor of Program in Global Issues (BPGI), University of Tsukuba “Methodology for Global Issues (Environment)”

Kotaro Iizuka

- Japan Geoscience Union Information System Committee: Member
- Fukuoka Prefectural Kyoto High School: Research Guidance
- CSIS Symposium 2018 “Frontiers of Field Science Using Drones” in G-spatial EXPO
- Omuta City, Fukuoka Prefecture, Torrential Rain Disaster Situation Assessment and Information Provision Activities Using Drones
- International Journal “Sensors” Special Issue “Multi-Sensor Techniques for Topographic Mapping”: Editor
- Keio University “Workshop on Sensing Technologies”
- Tokyo Metropolitan University “Exercise on Geographic Information Science for Tourism” (shared responsibility)
- University of Tsukuba “General Introduction to Global Issues” (shared responsibility), “Special Lecture on Spatial Information Science” (shared responsibility)
- Lecturer, JICA Innovative Asia 2021 International Workshop, Hokkaido University
- Tokyo City University “Advanced Social Infrastructure Information Management”

Yuriko Yazawa

- The Association of Japanese Geographers: Member, Special Committee on Meetings (at AJG): Member (2nd term)
- The Japanese Institute of Landscape Architecture: Member, / Committee for Landscape Planning Research Promotion (at JILA Committee for Research Promotion) / Organizer (2nd term)
- The Kanto Branch of the Japanese Institute of Landscape Architecture: Management member (in charge of the administrative office) (2nd term)
- Specified Nonprofit Corporation Arakawa Gakkai (The Society of Arakawa River): Director
- Part-time lecturer, University of the Ryukyus, “Geospatial Information Studies”
- Part-time lecturer, Takachiho University, “Physical Geography”

Research Achievements

Trends in the Number of Research Achievements

The following shows the number of papers and other achievements as a Joint Usage/Research Center. Although the total number of publications has been around 200 in most years, the number in FY2023 was 276, the highest number in the past eight years (Fig. 4-1). This is presumably due to an increase in the number of research reports, as a result of actively requesting joint researchers who use spatial data and services to report their research results (Fig. 4-2). The number of papers and other publications that include CSIS faculty members as authors among the total number has been on a slight downward trend in recent years (Fig. 4-3).

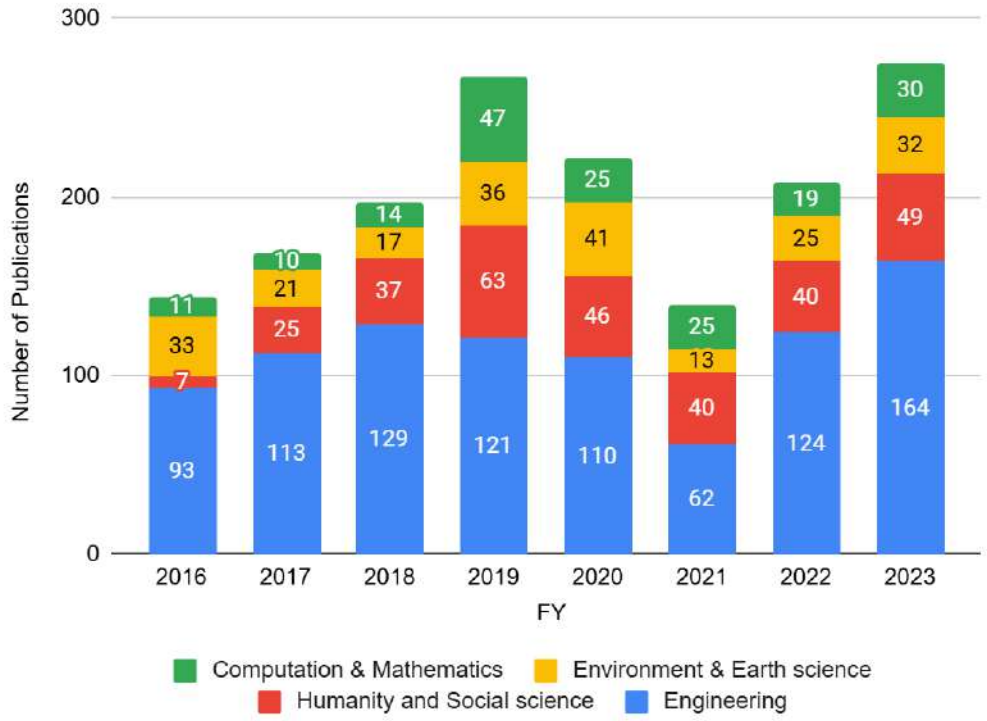


Fig. 4-1 Number of Publications
(Total Number as a Joint Usage/Research Center)

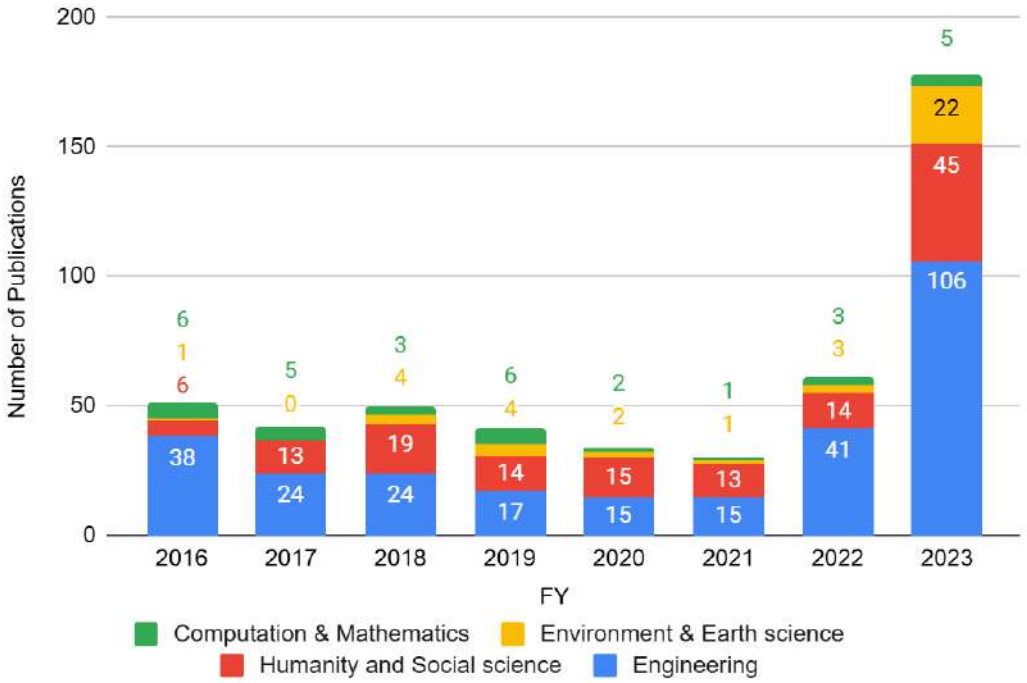


Fig. 4-2 Number of Publications
(CSIS faculty members are not included as authors)

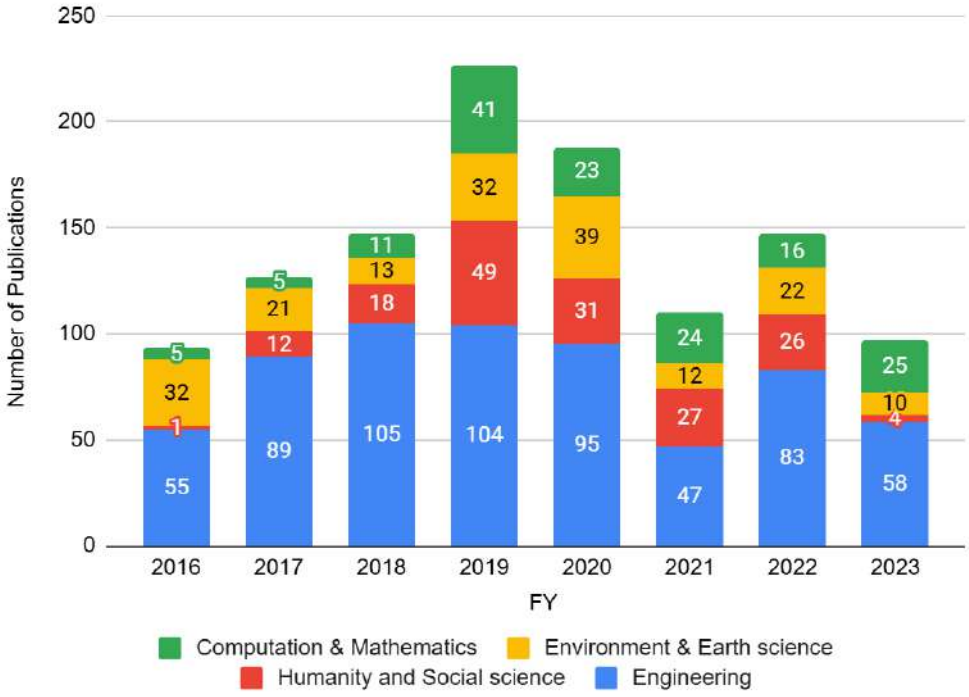


Fig. 4-3 Number of Publications
(CSIS faculty members are included as authors)

Top 10% Most Cited Papers

Of the core members' achievements during the study period, 86 were in the Top 10% most cited papers, as follows. The survey was conducted using SciVal, a research strength analysis tool by Elsevier, and the Field-Weighted Citation Impact (FWCI) was used as the metric for identifying Top 10% most cited papers.

Title	Authors	Source title	Year
Traffic state estimation on highway: A comprehensive survey	Seo, T., Bayen, A.M., Kusakabe, T., Asakura, Y.	Annual Reviews in Control, 43, 128-151	2017
Robust cylinder fitting in three-dimensional point cloud data	Nurunnabi, A., Sadahiro, Y., Lindenbergh, R.	International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archives, 42(1) 63-70	2017
ABSORB: Autonomous base station with optical reflex backhaul to adapt to fluctuating demand	Nakayama, Y., Tsutsumi, T., Maruta, K., Sezaki, K.	Proceedings - IEEE INFOCOM	2017
Assessment for soil loss by using a scheme of alterative sub-models based on the RUSLE in a Karst Basin of Southwest China	CHEN, H., Oguchi, T., WU, P.	Journal of Integrative Agriculture,16(2) 377-388	2017
Combination of smart card data with person trip survey data	Kusakabe, T., Asakura, Y.	Public Transport Planning with Smart Card Data,73-92	2017
Relationship between landslide size and rainfall conditions in Taiwan	Chen, C.-W., Oguchi, T., Hayakawa, Y.S., Saito, H., Chen, H.	Landslides,14(3) 1235-1240	2017
Automatic building segmentation of aerial imagery usingmulti-constraint fully convolutional networks	Wu, G., Shao, X., Guo, Z., Chen, Q., Yuan, W., Shi, X., Xu, Y., Shibasaki, R.	Remote Sensing,10(3)	2018

Title	Authors	Source title	Year
Semantic segmentation for urban planning maps based on U-Net	Guo, Z., Shengoku, H., Wu, G., Chen, Q., Yuan, W., Shi, X., Shao, X., Xu, Y., Shibasaki, R.	International Geoscience and Remote Sensing Symposium (IGARSS), 2018-6187-6190	2018
Estimating Tree Height and Diameter at Breast Height (DBH) from Digital surface models and orthophotos obtained with an unmanned aerial system for a Japanese Cypress (Chamaecyparis obtusa) Forest	Iizuka, K., Yonehara, T., Itoh, M., Kosugi, Y.	Remote Sensing,10(1)	2018
Battery electric vehicles in Japan: Human mobile behavior based adoption potential analysis and policy target response	Zhang, H., Song, X., Xia, T., Yuan, M., Fan, Z., Shibasaki, R., Liang, Y.	Applied Energy, Inc. 220, 527-535	2018
A CNN-based method of vehicle detection from aerial images using hard example mining	Koga, Y., Miyazaki, H., Shibasaki, R.	Remote Sensing,10(1)	2018
DeepUrbanMomentum: An online deep-learning system for short-term urban mobility prediction	Jiang, R., Song, X., Fan, Z., Xia, T., Chen, Q., Miyazawa, S., Shibasaki, R.	32nd AAAI Conference on Artificial Intelligence, AAAI 2018, 784-791	2018
MAAs in bike-sharing: Smart phone GPS data based layout optimization and emission reduction potential analysis	Zhang, H., Song, X., Xia, T., Zheng, J., Haung, D., Shibasaki, R., Yan, Y., Liang, Y.	Energy Procedia, Inc. 152, 649-654	2018
Application of a hybrid artificial neural network-particle swarm optimization (ANN-PSO) model in behavior prediction of channel shear connectors embedded in normal and high-strength concrete	Shariati, M., Mafipour, M.S., Mehrabi, P., Bahadori, A., Zandi, Y., Salih, M.N.A., Nguyen, H., Dou, J., Song, X., Poi-Ngian, S.	Applied Sciences (Switzerland) ,9(24)	2019
Measuring spatio-temporal accessibility to emergency medical services through big GPS data	Xia, T., Song, X., Zhang, H., Song, X., Kanasugi, H., Shibasaki, R.	Health and Place, Inc. 56, 53-62	2019

Title	Authors	Source title	Year
Deepurbanevent: A system for predicting citywide crowd dynamics at big events	Jiang, R., Song, X., Wang, Z., Huang, D., Song, X., Kim, K.-S., Xia, T., Cai, Z., Shibasaki, R.	Proceedings of the ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, 2114-2122	2019
GPS data in urban online ride-hailing: A comparative analysis on fuel consumption and emissions	Sui, Y., Zhang, H., Song, X., Shao, F., Yu, X., Shibasaki, R., Sun, R., Yuan, M., Wang, C., Li, S., Li, Y.	Journal of Cleaner Production, 227, 495-505	2019
Robust cylinder fitting in laser scanning point cloud data	Nurunnabi, A., Sadahiro, Y., Lindenbergh, R., Belton, D.	Measurement: Journal of the International Measurement Confederation, 138, 632-651	2019
Improved bathymetric mapping of coastal and lake environments using sentinel-2 and landsat-8 images	Yunus, A.P., Dou, J., Song, X., Avtar, R.	Sensors (Switzerland), 19(12)	2019
A voyage with minimal fuel consumption for cruise ships	Zheng, J., Zhang, H., Yin, L., Liang, Y., Wang, B., Li, Z., Song, X., Zhang, Y.	Journal of Cleaner Production, 215, 144-153	2019
A Variational Autoencoder Based Generative Model of Urban Human Mobility	Huang, D., Song, X., Fan, Z., Jiang, R., Shibasaki, R., Zhang, Y., Wang, H., Kato, Y.	Proceedings - 2nd International Conference on Multimedia Information Processing and Retrieval, MIPR 2019, 425-430	2019
Assessing landslide characteristics in a changing climate in northern Taiwan	Chen, C.-W., Tung, Y.-S., Liou, J.-J., Li, H.-C., Cheng, C.-T., Chen, Y.-M., Oguchi, T.	Catena,175, 263-277	2019
Pedestrian trajectory prediction in extremely crowded scenarios	Shi, X., Shao, X., Guo, Z., Wu, G., Zhang, H., Shibasaki, R.	Sensors (Switzerland), 19(5)	2019

Title	Authors	Source title	Year
Mobile phone GPS data in urban bicycle-sharing: Layout optimization and emissions reduction analysis	Zhang, H., Song, X., Long, Y., Xia, T., Fang, K., Zheng, J., Huang, D., Shibasaki, R., Liang, Y.	Applied Energy, 242, 138-147	2019
Time series prediction for output of multi-region solar power plants	Zheng, J., Zhang, H., Dai, Y., Wang, B., Zheng, T., Liao, Q., Liang, Y., Zhang, F., Song, X.	Applied Energy, 257, 114001	2020
A network-of-networks percolation analysis of cascading failures in spatially co-located road-sewer infrastructure networks	Dong, S., Wang, H., Mostafizi, A., Song, X.	Physica A: Statistical Mechanics and its Applications, 538, 122971	2020
A method for vehicle detection in high-resolution satellite images that uses a region-based object detector and unsupervised domain adaptation	Koga, Y., Miyazaki, H., Shibasaki, R.	Remote Sensing, 12(3), 575	2020
A new hybrid firefly-pso optimized random subspace tree intelligence for torrential rainfall-induced flash flood susceptible mapping	Nhu, V.-H., Ngo, P.-T., Pham, T.D., Dou, J., Song, X., Hoang, N.-D., Tran, D.A., Cao, D.P., Aydilek, I.B., Amiri, M., Costache, R., Hoa, P.V., Bui, D.T.	Remote Sensing, 12(17), 2688	2020
IOS Crowd-Sensing Won't Hurt a Bit: AWARE Framework and Sustainable Study Guideline for iOS Platform	Nishiyama, Y., Ferreira, D., Eigen, Y., Sasaki, W., Okoshi, T., Nakazawa, J., Dey, A.K., Sezaki, K.	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 12203, 223-243	2020
Mining urban sustainable performance: Spatio-temporal emission potential changes of urban transit buses in the post-COVID-19 future	Sui, Y., Zhang, H., Shang, W., Sun, R., Wang, C., Ji, J., Song, X., Shao, F.	Applied Energy, 280, 115966	2020
Constructing a digital city on a web-3D platform: Simultaneous and consistent generation of metadata and tile data from a multi-source raw dataset	Seto, T., Sekimoto, Y., Asahi, K., Endo, T.	Proceedings of the 3rd ACM SIGSPATIAL International Workshop on Advances in Resilient and Intelligent Cities, ARIC 2020, 1-9	2020

Title	Authors	Source title	Year
Multimodal interaction-aware trajectory prediction in crowded space	Shi, X., Shao, X., Fan, Z., Jiang, R., Zhang, H., Guo, Z., Wu, G., Yuan, W., Shibasaki, R.	AAAI 2020 - 34th AAAI Conference on Artificial Intelligence, 11982-11989	2020
Delineating urban park catchment areas using mobile phone data: A case study of Tokyo	Guan, C., Song, J., Keith, M., Akiyama, Y., Shibasaki, R., Sato, T.	Computers, Environment and Urban Systems, 81, 101474	2020
ST-Norm: Spatial and Temporal Normalization for Multi-variate Time Series Forecasting	Deng, J., Chen, X., Jiang, R., Song, X., Tsang, I.W.	Proceedings of the ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, 269-278	2021
Generative adversarial network for road damage detection	Maeda, H., Kashiyama, T., Sekimoto, Y., Seto, T., Omata, H.	Computer-Aided Civil and Infrastructure Engineering, 36(1) 47-60	2021
DL-Traff: Survey and Benchmark of Deep Learning Models for Urban Traffic Prediction	Jiang, R., Yin, D., Wang, Z., Wang, Y., Deng, J., Liu, H., Cai, Z., Deng, J., Song, X., Shibasaki, R.	International Conference on Information and Knowledge Management, Proceedings, 4515-4525	2021
RDD2020: An annotated image dataset for automatic road damage detection using deep learning	Arya, D., Maeda, H., Ghosh, S.K., Toshniwal, D., Sekimoto, Y.	Data in Brief, 36, 107133	2021
Deep learning-based road damage detection and classification for multiple countries	Arya, D., Maeda, H., Ghosh, S.K., Toshniwal, D., Mraz, A., Kashiyama, T., Sekimoto, Y.	Automation in Construction, 132, 103935	2021
Forecasting ambulance demand with profiled human mobility via heterogeneous multi-graph neural networks	Wang, Z., Xia, T., Jiang, R., Liu, X., Kim, K.-S., Song, X., Shibasaki, R.	Proceedings - International Conference on Data Engineering, 2021-1751-1762	2021
Seasonal variations of park visitor volume and park service area in Tokyo: A mixed-method approach combining big data and field observations	Guan, C., Song, J., Keith, M., Zhang, B., Akiyama, Y., Da, L., Shibasaki, R., Sato, T.	Urban Forestry and Urban Greening, 58, 126973	2021
Countrywide Origin-Destination Matrix Prediction and Its Application for COVID-19	Jiang, R., Wang, Z., Cai, Z., Yang, C., Fan, Z., Xia, T., Matsubara, G., Mizuseki, H., Song, X., Shibasaki, R.	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 12978, 319-334	2021

Title	Authors	Source title	Year
Understanding rooftop PV panel semantic segmentation of satellite and aerial images for better using machine learning	Li, P., Zhang, H., Guo, Z., Lyu, S., Chen, J., Li, W., Song, X., Shibasaki, R., Yan, J.	Advances in Applied Energy, 4, 100057	2021
Citywide reconstruction of cross-sectional traffic flow from moving camera videos	Kumar, A., Kashiyama, T., Maeda, H., Sekimoto, Y.	Proceedings - 2021 IEEE International Conference on Big Data, Big Data 2021, 1670-1678	2021
1.6 Million transactions replicate distributed PV market slowdown by COVID-19 lockdown	Zhang, H., Yan, J., Yu, Q., Obersteiner, M., Li, W., Chen, J., Zhang, Q., Jiang, M., Wallin, F., Song, X., Wu, J., Wang, X., Shibasaki, R.	Applied Energy, 283, 116341	2021
Crowdsensing-based Road Damage Detection Challenge (CRDDC'2022)	Arya, D., Maeda, H., Ghosh, S.K., Toshniwal, D., Omata, H., Kashiyama, T., Sekimoto, Y.	Proceedings - 2022 IEEE International Conference on Big Data, Big Data 2022, 6378-6386	2022
Event-Aware Multimodal Mobility Nowcasting	Wang, Z., Jiang, R., Xue, H., Salim, F.D., Song, X., Shibasaki, R.	Proceedings of the 36th AAAI Conference on Artificial Intelligence, AAAI 2022, 36, 4228-4236	2022
Online trajectory prediction for metropolitan scale mobility digital twin	Fan, Z., Yang, X., Yuan, W., Jiang, R., Chen, Q., Song, X., Shibasaki, R.	GIS: Proceedings of the ACM International Symposium on Advances in Geographic Information Systems, Article No. 103,. 1 - 12	2022

Title	Authors	Source title	Year
Epidemic versus economic performances of the COVID-19 lockdown: A big data driven analysis	Zhang, H., Li, P., Zhang, Z., Li, W., Chen, J., Song, X., Shibasaki, R., Yan, J.	Cities, 120, 103502	2022
Realtime Safety Analysis System using Deep Learning for Fire Related Activities in Construction Sites	Dwivedi, U.K., Wiwatcharakoses, C., Sekimoto, Y.	International Conference on Electrical, Computer, Communications and Mechatronics Engineering, ICECCME 2022	2022
Citywide reconstruction of traffic flow using the vehicle-mounted moving camera in the CARLA driving simulator	Kumar, A., Kashiyama, T., Maeda, H., Omata, H., Sekimoto, Y.	IEEE Conference on Intelligent Transportation Systems, Proceedings, ITSC, 2022-2292-2299	2022
DoubleCheck: Detecting Single-Hand Cycling with Inertial Measurement Unit of Smartphone	Dong, X., Han, Z., Nishiyama, Y., Sezaki, K.	2022 IEEE International Conference on Pervasive Computing and Communications Workshops and other Affiliated Events, PerCom Workshops 2022, 50-53	2022
Fluvial palaeohydrology in the 21st century and beyond	Baker, V.R., Benito, G., Brown, A.G., Carling, P.A., Enzel, Y., Greenbaum, N., Herget, J., Kale, V.S., Latrubesse, E.M., Macklin, M.G., Nanson, G.C. Oguchi, T., Thorndycraft, V.R., Ben Dor, Y., Zituni, R.	Earth Surface Processes and Landforms, 47(1), 58-81	2022
Remote Data in Fluvial Geomorphology: Characteristics and Applications	Oguchi, T., Hayakawa, Y.S., Wasklewicz, T.	Treatise on Geomorphology,. 1116-1142	2022
Heterogeneous Hypergraph Neural Network for Friend Recommendation with Human Mobility	Li, Y., Fan, Z., Zhang, J., Shi, D., Xu, T., Yin, D., Deng, J., Song, X.	International Conference on Information and Knowledge Management, Proceedings, 4209-4213	2022
Road Rutting Detection using Deep Learning on Images	Saha, P.K., Arya, D., Kumar, A., Maeda, H., Sekimoto, Y.	Proceedings - 2022 IEEE International Conference on Big Data, Big Data 2022, 1362-1368	2022

Title	Authors	Source title	Year
Challenges and future directions of secure federated learning: a survey	Zhang, K., Song, X., Zhang, C., Yu, S.	Frontiers of Computer Science, 16, 165817	2022
Application of web hazard maps to high school education for disaster risk reduction	Song, J., Yamauchi, H., Oguchi, T., Ogura, T.	International Journal of Disaster Risk Reduction, 72, 102866	2022
Big Data and Emergency Management: Concepts, Methodologies, and Applications	Song, X., Zhang, H., Akerkar, R., Huang, H., Guo, S., Zhong, L., Ji, Y., Opdahl, A.L., Purohit, H., Skupin, A., Pottathil, A., Culotta, A.	IEEE Transactions on Big Data, 8(2), 397-419	2022
Large-Scale Building Footprint Extraction from Open-Sourced Satellite Imagery via Instance Segmentation Approach	Chen, S., Ogawa, Y., Zhao, C., Sekimoto, Y.	International Geoscience and Remote Sensing Symposium (IGARSS), 2022-6284-6287	2022
Large-scale individual building extraction from open-source satellite imagery via super-resolution-based instance segmentation approach	Chen, S., Ogawa, Y., Zhao, C., Sekimoto, Y.	ISPRS Journal of Photogrammetry and Remote Sensing, 195, 129-152	2023
Spatio-Temporal Adaptive Embedding Makes Vanilla Transformer SOTA for Traffic Forecasting	Liu, H., Dong, Z., Jiang, R., Deng, J., Deng, J., Chen, Q., Song, X.	International Conference on Information and Knowledge Management, Proceedings, 4125-4129	2023
Spatio-Temporal Meta-Graph Learning for Traffic Forecasting	Jiang, R., Wang, Z., Yong, J., Jeph, P., Chen, Q., Kobayashi, Y., Song, X., Fukushima, S., Suzumura, T.	Proceedings of the 37th AAAI Conference on Artificial Intelligence, AAAI 2023, Article No. 907, 8078-8086	2023
Learning Social Meta-knowledge for Nowcasting Human Mobility in Disaster	Jiang, R., Wang, Z., Tao, Y., Yang, C., Song, X., Shibasaki, R., Chen, S.-C., Shyu, M.-L.	ACM Web Conference 2023 - Proceedings of the World Wide Web Conference, WWW 2023, 2655-2665	2023
DeepCrowd: A Deep Model for Large-Scale Citywide Crowd Density and Flow Prediction	Jiang, R., Cai, Z., Wang, Z., Yang, C., Fan, Z., Chen, Q., Tsubouchi, K., Song, X., Shibasaki, R.	IEEE Transactions on Knowledge and Data Engineering, 35(1), 276-290	2023

Title	Authors	Source title	Year
MepoGNN: Metapopulation Epidemic Forecasting with Graph Neural Networks	Cao, Q., Jiang, R., Yang, C., Fan, Z., Song, X., Shibasaki, R.	Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 13718, 453-468	2023
MTMGNN: Multi-time multi-graph neural network for metro passenger flow prediction	Yin, D., Jiang, R., Deng, J., Li, Y., Xie, Y., Wang, Z., Zhou, Y., Song, X., Shang, J.-S.	GeoInformatica, 27(1), 77-105	2023
Using mobile phone big data to identify inequity of aging groups in transit-oriented development station usage: A case of Tokyo	Chen, Z., Li, P., Jin, Y., Bharule, S., Jia, N., Li, W., Song, X., Shibasaki, R., Zhang, H.	Transport Policy, 132, 65-75	2023
HeadMon: Head Dynamics Enabled Riding Maneuver Prediction	Han, Z., Xu, L., Dong, X., Nishiyama, Y., Sezaki, K.	2023 IEEE International Conference on Pervasive Computing and Communications, PerCom 2023, 22-31	2023
Adaptive Policy Learning for Offline-to-Online Reinforcement Learning	Zheng, H., Luo, X., Wei, P., Song, X., Li, D., Jiang, J.	Proceedings of the 37th AAAI Conference on Artificial Intelligence, AAAI 2023, Article No.:1276, 11372-11380	2023
Label Freedom: Stable Diffusion for Remote Sensing Image Semantic Segmentation Data Generation	Zhao, C., Ogawa, Y., Chen, S., Yang, Z., Sekimoto, Y.	Proceedings - 2023 IEEE International Conference on Big Data, BigData 2023, 1022-1030	2023
Revisiting Mobility Modeling with Graph: A Graph Transformer Model for Next Point-of-Interest Recommendation	Xu, X., Suzumura, T., Yong, J., Hanai, M., Yang, C., Kanezashi, H., Jiang, R., Fukushima, S.	GIS: Proceedings of the ACM International Symposium on Advances in Geographic Information Systems Article No. 94,. 1 - 10	2023
Evaluating future habitat quality responding to land use change under different city compaction scenarios in Southern China	Wang, B., Oguchi, T., Liang, X.	Cities, 140, 104410	2023
EpiMob: Interactive Visual Analytics of Citywide Human Mobility Restrictions for Epidemic Control	Yang, C., Zhang, Z., Fan, Z., Jiang, R., Chen, Q., Song, X., Shibasaki, R.	IEEE Transactions on Visualization and Computer Graphics, 29(8), 3586-3601	2023

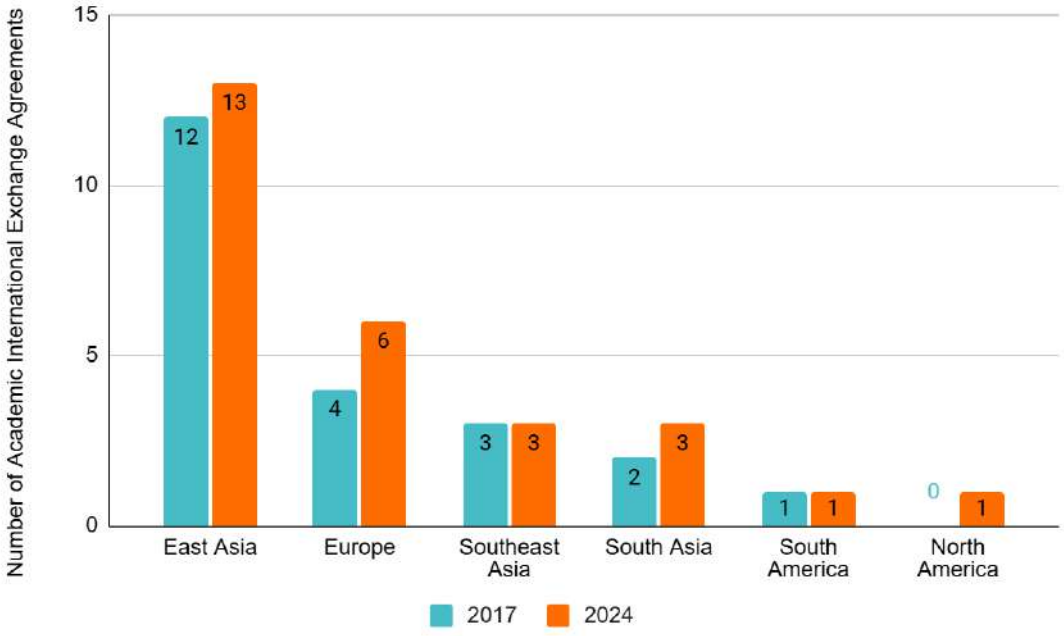
Title	Authors	Source title	Year
Easy Begun Is Half Done: Spatial-Temporal Graph Modeling with ST-Curriculum Dropout	Wang, H., Chen, J., Pan, T., Fan, Z., Song, X., Jiang, R., Zhang, L., Xie, Y., Wang, Z., Zhang, B.	Proceedings of the 37th AAAI Conference on Artificial Intelligence, AAAI 2023, Article No. 521,. 4668-4675	2023
Deep Learning Approach for Classifying the Built Year and Structure of Individual Buildings by Automatically Linking Street View Images and GIS Building Data	Ogawa, Y., Zhao, C., Oki, T., Chen, S., Sekimoto, Y.	IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing16, 1740-1755	2023
Automatic Evaluation of Street-Level Walkability Based on Computer Vision Techniques and Urban Big Data: A Case Study of Kowloon West, Hong Kong	Huang, L., Oki, T., Muto, S., Kim, H., Ogawa, Y., Sekimoto, Y.	Urban Book Series, 231-259	2023
Metagraph-Based Life Pattern Clustering with Big Human Mobility Data	Li, W., Zhang, H., Chen, J., Li, P., Yao, Y., Shi, X., Shibasaki, M., Kobayashi, H.H., Song, X., Shibasaki, R.	IEEE Transactions on Big Data, 9(1), 227-240	2023
Domain Adversarial Graph Convolutional Network Based on RSSI and Crowdsensing for Indoor Localization	Zhang, M., Fan, Z., Shibasaki, R., Song, X.	IEEE Internet of Things Journal, 10(15), 13662-13672	2023
Disentangling Structured Components: Towards Adaptive, Interpretable and Scalable Time Series Forecasting	Deng, J., Chen, X., Jiang, R., Du Yin, Yang, Y., Song, X., Tsang, I.W.	IEEE Transactions on Knowledge and Data Engineering, 36(8), 3783-3800	2024
Spatial Prediction of Apartment Rent using Regression-Based and Machine Learning-Based Approaches with a Large Dataset	Yoshida, T., Murakami, D., Seya, H.	Journal of Real Estate Finance and Economics, 69(1), 1-28	2024
Evaluating the subjective perceptions of streetscapes using street-view images	Ogawa, Y., Oki, T., Zhao, C., Sekimoto, Y., Shimizu, C.	Landscape and Urban Planning, 247, 105073	2024
From global challenges to local solutions: A review of cross-country collaborations and winning strategies in road damage detection	Arya, D., Maeda, H., Sekimoto, Y.	Advanced Engineering Informatics, 60, 102388	2024

Title	Authors	Source title	Year
Integration of carbon dioxide sensor with GNSS receiver for dynamic air quality monitoring applications	Yola, L., Nanditho, G.A., Kobayashi, K., Manandhar, D.	Sensors International, 5, 100279	2024
Social segregation levels vary depending on activity space types: Comparison of segregation in residential, workplace, routine and non-routine activities in Tokyo metropolitan area activities in Tokyo metropolitan area	Sun, C., Shibuya, Y., Sekimoto, Y.	Cities, 146, 104745	2024
RDD2022: A multi-national image dataset for automatic road damage detection	Arya, D., Maeda, H., Ghosh, S.K., Toshniwal, D., Sekimoto, Y.	Geoscience Data Journal, 11(4), 846-862	2024
Rock Glacier Inventory of the Southwestern Pamirs Supported by InSAR Kinematics	Ma, Q., Oguchi, T.	Remote Sensing, 16(7), 1185	2024

Chapter 5. International Exchange

CSIS is actively involved in international exchange. As shown in the table below, as of October 1, 2024, the Center has concluded academic international exchange agreements with 27 organizations. Compared to the time of the previous self-assessment (2017), the overall number of agreements has increased. While most of the agreements are with organizations in Asia, the number of agreements with organizations in Europe is increasing, and an agreement with the School of Engineering at New York University was also signed in 2024.

In addition, the Center accepts one to two distinguished foreign researchers each year as Project Professors, Project Associate Professors, or Project Lecturers through the Visiting Foreign Faculty Program. When foreign researchers visit the Center, seminars are held to foster exchanges with them.



Comparison of Academic International Exchange Agreements by Region (2017 and 2024)

International Academic Exchange Agreements

Agreement date	Partner country	Institution name	Field
2005.1	Ireland	National Centre for Geocomputation	Geography
2005. 3	United Kingdom	CASA: Centre for Advanced Spatial Analysis, University College London	Geography
2005. 3	United Kingdom	CEH: Centre for Ecology and Hydrology	Geography
2005. 3	Italy	International Research School of Planetary Sciences, G. d'Annunzio University	Geography
2005. 3	India	Department of Geography, University of Pune	Geography
2005. 3	China	College of Architecture and Urban Planning, Tongji University	Geography
2005. 4	Korea	Institute for Korean Regional Studies, The Seoul National University	Urban Planning
2005. 5	Korea	Department of Civil and Environmental Engineering, Yonsei University	Civil Engineering Planning
2006. 1	Korea	Center of GIS Research, Institute of Urban Science, The University of Seoul	Urban Planning
2006. 9	Taiwan	Department of Geosciences, National Taiwan University	Geography
2007. 1	Taiwan	Department of Geography, National Taiwan University	Geography
2007. 7	China	Chinese Academy of Sciences	Geography
2008. 2	China	Wuhan University	Civil Engineering Planning
2009. 9	China	The Institute of Agricultural Resources & Regional Planning, Chinese Academy of Agricultural Sciences	Agro-Environment and Information Engineering
2009. 12	Bangladesh	Department of civil engineering, Presidency university	Civil Engineering Planning
2009. 12	Korea	College of Environmental and Marine Science and Technology, Pukyong National University	Environmental Dynamics Analysis
2014. 2	Thailand	School of Engineering & Technology, Asian Institute of Technology	Spatial Information Engineering

Agreement date	Partner country	Institution name	Field
2014. 10	China	School of Architecture, Tianjin University	Architectural History and Design
2015. 3	Thailand	Sirindhorn International Institute of Engineering, Thammasat University	Geography
2016. 2	Korea	Korea Research Institute for Human Settlements	Urban Planning
2017. 1	Chile	Universidad Técnica Federico Santa María	Communication and Network Engineering
2018. 3	France	University of Toulon	Intelligent Informatics
2019. 11	China	College of Engineering, Southern University of science and Technology	Intelligent Informatics
2020. 2	Nepal	The National Trust of Nature Conservation	Intelligent Informatics
2022. 11	Portugal	THE UNITED NATIONS UNIVERSITY OPERATING UNIT ON POLICY-DRIVEN ELECTRONIC GOVERNANCE	Urban Informatics
2023. 7	Thailand	Faculty of Engineering, Chiang Mai University	Urban Informatics
2024. 7	United States of America	Tandon School of Engineering. New York University	Urban Informatics

2023 MoU signing ceremony with Chiang Mai University Faculty of Engineering

Chapter 6. Intra-university Collaboration and Human Resource Development in Education and Research

Education of Our Students

CSIS is basically a research organization and does not have its own department or graduate school. However, it also takes part in student education through cooperative courses and other systems. For example, at the graduate school level, CSIS accepts students from a variety of academic departments and programs. These include the Department of Socio-Cultural Environmental Studies, the Department of Natural Environmental Studies, and the Graduate Program in Sustainability Science, the Graduate School of Frontier Sciences; the Department of Contemporary Economics, the Graduate School of Economics; the Department of Earth and Planetary Science, the Graduate School of Science; the Department of Electronics and Information Science, the Graduate School of Information Science and Technology; the Department of Urban Engineering and the Department of Social Infrastructure Science, the Graduate School of Engineering (Fig. 6-1 and 6-2). The following figures summarize the number of Ph.D. students who received their Ph.D. degrees under the supervision of the center faculty from 2017 to 2023 (Fig. 6-3) and the total number of graduate, undergraduate, and research students supervised by the CSIS faculty (by graduate school affiliation: Fig. 6-4; by region of origin of international students: Fig. 6-5). Approximately 60 to 80 students are supervised each year, indicating that CSIS contributes not only to research but also to the educational activities of the university. In addition, since the 2018 academic year, more than 60% of the students are international students (Fig. 6-5), which indicates that CSIS is building up international education.

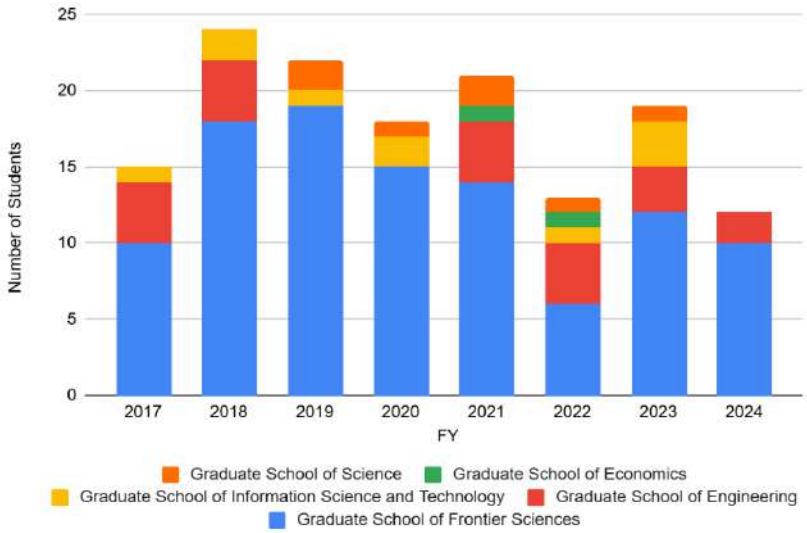


Fig. 6-1 Number of students enrolled in master's programs

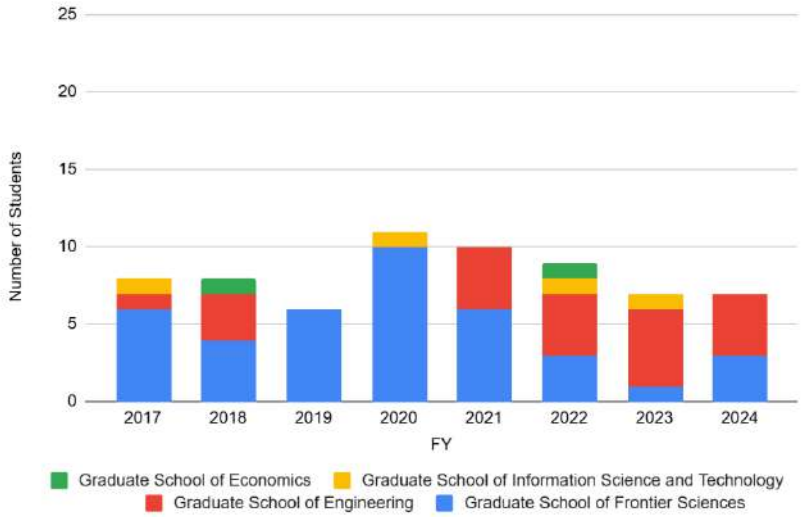


Fig. 6-2 Number of students enrolled in doctoral programs

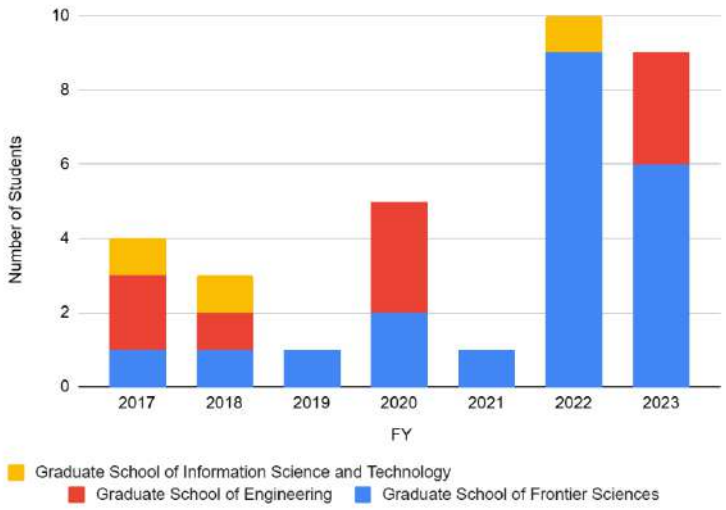


Fig. 6-3 Number of doctoral degree recipients

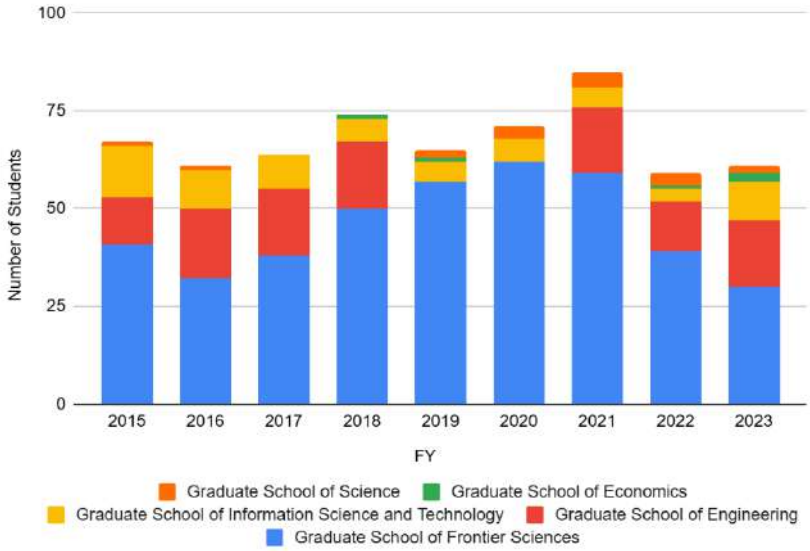


Fig. 6-4 Total Number of Students (Undergraduate, Graduate, and Research Students) (by Graduate School)

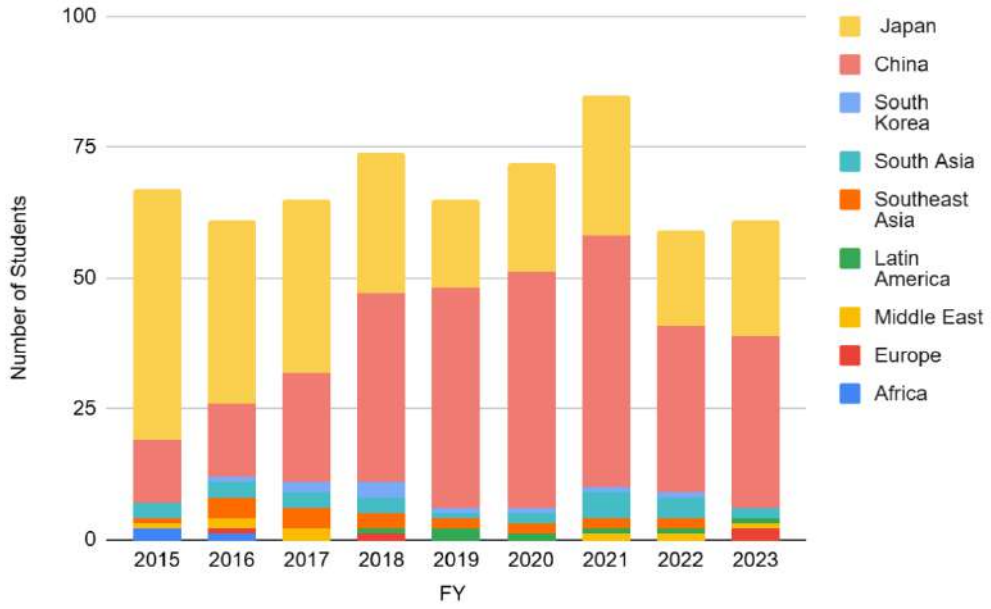


Fig. 6-5 Total Number of Students (Undergraduate, Graduate, and Research Students) (by Country/Region)

Lectures Taught on Campus

In FY2023-2024, the following lectures are being taught on campus.

CSIS Faculty	Course Title	Course Offered by
Yoshihide Sekimoto, Takahiro Yoshida, Daisuke Kurisu, Yuki Otsu	Academic Frontier Lecture Series “Frontiers of Research and Social Implementation in Digital Space Society”	Undergraduate (1st and 2nd years)
Yoshihide Sekimoto	Creativity Engineering Project for Undergraduate / Creativity Engineering Project “Urban Digital Twin Application Project” (*)	Faculty of Engineering / Graduate School of Engineering
Yoshihide Sekimoto, Dinesh Manandhar, Yoshiki Ogawa, Yanbo Pang	Geographic Information Systems	Department of Civil Engineering, Graduate School of Engineering
Yoshihide Sekimoto, Yoshiki Ogawa, Yanbo Pang	Geographic Information Systems Exercises / Seminar on Spatial Information System	Department of Civil Engineering, Graduate School of Engineering / Department of Socio-Cultural Environmental Studies, Graduate School of Frontier Sciences
Yoshihide Sekimoto, Dinesh Manandhar, Yoshiki Ogawa	Development and Utilization of Spatial Database	Department of Socio-Cultural Environmental Studies, Graduate School of Frontier Sciences
Yoshihide Sekimoto	Spatial Information Engineering II	Faculty of Engineering
Ikuho Yamada, Takahiro Yoshida	Spatial Information Analysis	Department of Socio-Cultural Environmental Studies, Graduate School of Frontier Sciences
Ikuko Yamada, Takahiro Yoshida	Seminar on Spatial Information Analysis (*)	Department of Socio-Cultural Environmental Studies, Graduate School of Frontier Sciences
Takashi Oguchi	Lecture: Geomorphology	Department of Earth and Planetary Science, Faculty of Science
Takashi Oguchi	Lecture: Human and Environment System	Faculty of Science
Takashi Oguchi	Physical Geography	Faculty of Science
Takashi Oguchi	Landscape Planning and Design	Department of Natural Environmental Studies, Graduate School of Frontier Sciences
Takashi Oguchi	Geographical Information Science	Graduate School of Science

CSIS Faculty	Course Title	Course Offered by
Takashi Oguchi	Environmental Information Science	Graduate School of Frontier Sciences
Takashi Oguchi, Kotaro Iizuka, Yuriko Yazawa	Field Exercise: Earth and Planetary Environmental Science II	Faculty of Science
Takashi Oguchi, Kotaro Iizuka, Yuriko Yazawa	Lecture and Practice in Remote Sensing and Geographic Information System	Faculty of Science
Kaoru Sezaki, Yuuki Nishiyama, Renhe Jiang	Urban Computing	Graduate School of Frontier Sciences
Kaoru Sezaki	Network Architecture for Digital Communication	Graduate School of Information Science and Technology
Takaaki Takahashi	Urban and Regional Economic Analyses I	Department of Socio-Cultural Environmental Studies, Graduate School of Frontier Sciences
Yuki Otsu	Urban and Regional Economic Analyses II	Graduate School of Frontier Sciences
Takaaki Takahashi, Yuki Otsu	Urban Economic Policy	Graduate School of Economics
Takaaki Takahashi, Yuki Otsu	Urban and Regional Policy	Graduate School of Public Policy
Daisuke Kurisu	High-Dimensional Statistical Analysis	Graduate School of Economics
Daisuke Kurisu	Joint Seminar in Statistics	Graduate School of Economics
Daisuke Kurisu	Applied Statistics Workshop	Graduate School of Economics
Daisuke Kurisu	Statistical Data Analysis	Graduate School of Frontier Sciences
Yuuki Nishiyama	Creativity Engineering Project for Undergraduate, Creativity Engineering Project “Web Programming for Practice” (*)	Faculty of Engineering / Graduate School of Engineering
Yuuki Nishiyama	Specialized Seminar “Introduction to Web Service and Application Design” (*)	Undergraduate (1st and 2nd years)

(*) Translator’s note: The English course title is a provisional translation by the translator.

Destination of Instructional Students

The students taught by faculty members of the center work and take an active role in various fields, as shown below.

Universities as faculty and post-doctoral research fellows, etc.

Kyoto Prefectural University; The University of Tokyo; Tokyo University of Agriculture and Technology; Ritsumeikan University; Shandong University (China); Dalian Maritime University (China); Northeastern University (China); University of New Mexico (USA)

Universities as students

The Doctoral Program, Graduate School of Engineering, The University of Tokyo; Istituto Universitario di Studi Superiori (Italy)

Private sector (start-up)

UrbanX Technologies, Inc.

Private sectors

Accenture Japan Ltd; Amazon Web Services Japan G.K.; Amazon Japan G.K.; Woven by Toyota, Inc.; MRI Research Associates Inc.; MC Digital, Inc.; ASANO TAISEIKISO ENGINEERING Co.,Ltd.; NTT DATA, Inc.; ZMP Inc.; TIER IV, Inc.; TLV CO., LTD.; PASCO CORPORATION; Hitachi, Ltd.; Kyndryl Japan KK; KDDI CORPORATION; Kokusai Kogyo Co., Ltd.; SUMITOMO CORPORATION; SoftBank Corp.; Deloitte Touche Tohmatsu LLC; NIPPON TELEGRAPH AND TELEPHONE CORPORATION; NIPPON TELEGRAPH AND TELEPHONE EAST CORPORATION; Hihatu Co., Ltd.; Fujitsu Limited; McKinsey & Company; Map Marketing Co., Ltd.; Mizuho Research & Technologies, Ltd.; Mitsubishi Electric Corporation; Yahoo Japan Corporation (now LY Corporation); LINE Corporation (now LY Corporation); SK Telecom Co Ltd. (South Korea)

Government offices

Japan Meteorological Agency, Ministry of National Development Planning (Indonesia), Ministry of Railways (India)

Others

Japan Agency for Marine-Earth Science and Technology, Indian Railways (India)

Human Resource Development on Campus

CSIS conducts activities to foster young researchers, including students. First, the following initiatives are being undertaken for all members of the University of Tokyo.

Provide GIS Site Licenses to All Members of the University

The ArcGIS site license is a service for higher education institutions to use products developed and marketed by ESRI (Environmental Systems Research Institute, Inc.) for processing, analyzing, and managing spatial information. It can be used for research as well as educational purposes such as classes and exercises. CSIS has acquired an ArcGIS site license and provides it to faculty, staff, and students on campus. The main products available include ArcGIS Pro, ArcGIS Online, and City Engine. The number of registered licensees was around 500 most years, but has increased to 707 in FY2022 and 723 in FY2023. Looking at the breakdown of renewal accounts (302), the Faculty of Agriculture and Graduate School of Agricultural and Life Sciences had the largest number of registrants (117), followed by the Faculty of Engineering and Graduate School of Engineering (39), Graduate School of Frontier Sciences (22), and Faculty of Liberal Arts and Sciences (18).

Conducting GIS Training Sessions

Until FY 2019, GIS training workshops were regularly held at three campuses of the University of Tokyo (Hongo, Komaba, and Kashiwa) in a hands-on format, divided into beginner and intermediate levels, focusing on the use of ArcGIS. However, due to the impact of the COVID-19 pandemic, the workshops were held online in FY 2020 and were canceled in FY 2021. Starting in FY 2022, the workshops resumed as a three-day intensive program combining both beginner and intermediate levels. The beginner and intermediate training sessions covered foundational and advanced ArcGIS analytical techniques, practical exercises using outdoor survey applications, and hands-on guidance for creating and publishing web maps. Participants included a diverse range of individuals from various disciplines, such as geography, engineering, forestry, agriculture, and informatics, spanning from undergraduate students to faculty members.

Date	Course Type	Venue
2017/4/26	ArcGIS Desktop Beginner Training	Kashiwa
2017/5/21	ArcGIS Online & Collector for ArcGIS Training Session	Kashiwa
2017/6/29	ArcGIS Desktop Beginner Training	Hongo
2017/7/6	ArcGIS Desktop Beginner Training	Komaba II
2017/07/06	ArcGIS Desktop Beginner Training	Komaba
2017/11/06	ArcGIS Desktop Intermediate Workshop	Kashiwa
2017/11/13	ArcGIS Desktop Intermediate Workshop	Kashiwa
2018/04/25	ArcGIS Desktop Beginner Training	Kashiwa
2018/05/09	ArcGIS Online & Collector for ArcGIS Training Session	Kashiwa
2018/06/28	ArcGIS Desktop Beginner Training	Hongo
2018/07/25	ArcGIS Pro Training Session	Kashiwa
2018/11/28	ArcGIS Desktop Intermediate Workshop	Kashiwa

Date	Course Type	Venue
2018/12/12	ArcGIS Desktop Intermediate Workshop	Kashiwa
2019/02/22	ArcGIS Desktop Intermediate Workshop	Hongo
2019/03/13	ArcGIS Desktop Intermediate Workshop	Kashiwa
2019/06/12	ArcGIS Desktop Beginner Training	Kashiwa
2019/07/10	ArcGIS Desktop Intermediate Workshop	Kashiwa
2019/07/03	ArcGIS Desktop Beginner Training	Kashiwa
2019/11/20	ArcGIS Online & Collector for ArcGIS Workshop	Kashiwa
2020/02/12	ArcGIS Desktop Intermediate Workshop	Kashiwa
2020/02/03	ArcGIS Online & Collector for ArcGIS Workshop	Hongo
2020/12/23, 2021/01/16	ArcGIS Pro Intermediate Online Training Course	Online
2023/03/28-30	ArcGIS Pro Beginner-Intermediate Workshop	Hongo
2024/03/27-29	ArcGIS Pro Beginner-Intermediate Workshop	Hongo

Academic Frontier Lecture Series “Frontiers of Research and Social Implementation in Digital Space Society”

Since FY2023, with the cooperation of faculty members belonging to the Collaborative Research Organization for the Digital Spatial Society, we have been holding Academic Frontier Lecture Series for first and second year undergraduate students in the College of Liberal Arts, entitled "Frontiers of Research and Social Implementation in Digital Spatial Society," providing early contact to basic concepts of spatial information science for a wide range of students, regardless of major. The course consists of 15 lectures, with 30 participants in FY2023 and 16 participants in FY2024.

For members of CSIS and their supervised students, the following efforts are being made

Allocation of Research Funds to Young Researchers

Young researchers at the rank of assistant professor or above, who are not appointed specifically for project-based roles, have traditionally been treated as PIs by providing them laboratory space and research funds from the Management Expense Grants, thus supporting their development as independent researchers. In addition to this, a new competitive research funding system within the Center was introduced in FY2022, and additional research funds are allocated to three young faculty members each year. In addition, senior faculty members from related fields are assigned as mentors to provide advice as needed. Particularly outstanding young faculty members are recommended via their mentors for The University of Tokyo Excellent Young Researcher program. Under this program, the researcher is granted the title of "The University of Tokyo Excellent Young Researcher" and receives 3 million yen per year for two years as start-up funding. One researcher participated in the program from FY2020 to FY2022, and in FY2023, one researcher was selected. Additionally, all faculty members, including young researchers, regularly present their research during the Center's regular meetings, and young researchers are given appropriate research advice at these opportunities as well.

Financial Support for Doctoral Program Graduate Students

As part of individual faculty members' efforts, the Center provides financial support by hiring doctoral graduate students as RAs to assist with the Center's operations. Additionally, the Center makes use of RA and TA programs in cooperation with affiliated departments to provide further support.

Conducting Research Presentations by Graduate Students

As mentioned above, the Center does not have a graduate school, but many of its faculty members are cooperating or adjunct professors in various graduate schools of the University, such as the Graduate School of Frontier Sciences, the Graduate School of Information Science and Technology, the Graduate School of Engineering, the Graduate School of Science, and the Graduate School of Economics, with approximately 60 to 80 students under their supervision annually. In addition to supervising graduate students belonging to these schools, the Center's faculty members also provide lectures and practical training at related graduate and undergraduate schools. Every year, the Center holds a research presentation event for these graduate students to promote broad interaction with graduate students and faculty members and to help them understand the diversity of spatial information science.

Support for Student Research Presentations

Research conducted by students under the guidance of the Center's faculty members is submitted as papers or presented at academic conferences. The faculty members in charge endeavor to support the expenses for these activities as much as possible. Some students participate in international joint research, and this kind of support enables them to actively present their research results at international conferences.

Educational Support and Human Resource Development for Spatial Information Science, Both within and beyond the University

Spatial information science is the study of developing general-purpose methodologies and theories that can be applied across a variety of academic disciplines. However, few organizations provide formal education on spatial information science, and it is often limited to departments related to geography and engineering at a few universities. Therefore, even if researchers, practitioners, and students are interested in applying spatial information science, they often do not have sufficient knowledge or experience in processing and managing spatial data, which is one factors hindering the spread of spatial information science. Basic knowledge and skills in statistics are important in many academic fields, and spatial information science can similarly be positioned. Therefore, it is important to educate students and others, as well as "re-educate" researchers and practitioners.

Specialists in spatial information science (geographic information science) are few in number, and while our center has a relatively large number of specialists, other organizations in Japan have few. Therefore, the Center has taken the lead in attempting to develop educational curricula and teaching materials for students, researchers, and practitioners from diverse backgrounds. First, under the leadership of Professor Okabe, the Center's first director, the project "Studies on the development of standard geographical information science curricula and that of the sustainable-collaborative web library systems for serving their contents" (JSPS Grant-in-Aid for Scientific Research (A), FY2005 to FY2007) was implemented to develop a systematic and comprehensive educational curriculum and content. Then, Professor Asami (Director of the Center from FY2010 to 2013) led the "The Research on Geographic Information Science Education and Spatial Thinking" (JSPS Grant-in-Aid for Scientific Research (A), FY2009 to FY2013) and developed textbooks and teaching materials. Subsequently, the Center conducted research on “Development of open educational materials for GIS based on standard core curricula and bodies of knowledge” (JSPS Grant-in-Aid for Scientific Research (A), FY2015 to FY2019), “Implementation and Analysis of the Effectiveness of Natural Geography and Disaster Prevention Education Using Online Practical Training Materials in Geographic Information Science” (JSPS Grant-in-Aid for Scientific Research (B), FY2022 to FY2023). Through these efforts, a standard curriculum and teaching materials for geospatial information science, from undergraduate to graduate level, as well as online learning materials for GIS using free software, have been developed. These results are widely available as publications and web content. In addition, each of the above-mentioned graduate schools and related faculties are using these materials to provide high-quality education related to spatial information science.

In addition, a summer school is held to provide students with the opportunity to learn how to handle and analyze time-series data such as people flows and urban data such as buildings, as well as techniques for effectively visualizing the results of analysis (Chapter 4). It has also become a place for the formation of a spatial information science community through exchanges among participating students and lecturers, with 43 and 48 people from inside and outside the University of Tokyo participating in FY2023 and FY2024, respectively.

Destinations of Former Faculty and Staff

There are many faculty and staff members who have worked at CSIS and then moved to other institutions, contributing to research and education in spatial information science and related corporate activities. The following are the destinations of those who have left CSIS.

New affiliation	Number of people
Attached to the Cabinet Secretariat of the Ministry of Land, Infrastructure, Transport and Tourism	1
AIR MARK Inc.	1
Hankyu Hanshin Holdings, Inc.	1
LocationMind, Inc.	3
PASCO CORPORATION	1
Center for Disaster Management Information Research, Ehime University	1
Institute of Economic Research, Hitotsubashi University	1
Graduate School of Environmental Sciences, Hokkaido University	1
Faculty of Economics, Keio University	1
Faculty of Letters, Komazawa University	1
Center for Southeast Asian Area Studies, Kyoto University	1
College of Bioresource Sciences, Nihon University	1
Osaka School of International Public Policy, Osaka University	1
Faculty of Engineering, Reitaku University	2
Faculty of Humanities and Social Sciences, Showa Women's University	1
Faculty of Architecture and Urban Design, Tokyo City University	1
Information Technology Center, The University of Tokyo	1
Institute of Industrial Science, The University of Tokyo	2
Interfaculty Initiative in Information Studies, The University of Tokyo	2
Graduate School of Arts and Sciences, The University of Tokyo	1
Center for Real Estate Innovation, The University of Tokyo	2
School of Artificial Intelligence, Jilin University (China)	1
Sirindhorn International Institute of Technology, Thammasat University (Thailand)	1

Chapter 7. Status of Activities as Joint Usage/Research Center

As a Joint Usage/Research Center, joint research projects are conducted and supported in partnership with universities nationwide, while also providing various services related to spatial information.

Operation of the Joint Research Assist System (JoRAS)

In order to improve convenience for researchers who use spatial information, a database containing a wide variety ranging from society and culture to natural environment was established as "the Spatial Data Infrastructure for Research" in CSIS. As an interface for using the database, we are operating a system entitled "the Joint Research Assist System (JoRAS)." JoRAS is a very convenient system that is seamless and places a low burden on applicants, which has the following features: (1) applications can be completed only on the web, (2) applications can be received at any time, and (3) our review process is completed in a short period of time, enabling the applicants to start their joint research quickly. JoRAS also enhances convenience for researchers by enabling them to immediately access spatial data and register results on the web after acceptance. Furthermore, if an applicant for a joint research project is unable to immediately identify a suitable collaborator at CSIS due to interdisciplinarity, we will introduce an appropriate collaborator to the applicant. Our system encourages participation in joint research by researchers from all over Japan and around the world. Our frameworks and application procedures of JoRAS are explained in an easy-to-understandable manner on our website (https://joras.csis.u-tokyo.ac.jp/) in both Japanese and English.

In addition, we organize "CSIS DAYS" once a year as a forum for presenting the results of joint research (see Chapter 8). Presentations are invited not only from ongoing joint research projects, but also from a wide range of researchers from universities, research institutes, and private sectors. About 200 researchers participate in CSIS DAYS each year. Researchers using JoRAS are encouraged to actively participate in CSIS DAYS and visitors to CSIS DAYS are encouraged to start new joint research themes. Researchers at CSIS can give advice on how to deepen visitors' research by using the spatial data provided by JoRAS. To motivate participation in joint research, awards are presented to outstanding joint research projects presented at CSIS DAYS.

As a result of our efforts to promote the information above and collect opinions through our web page, social medias, mailing lists, as well as related conferences, the number of joint research projects has increased significantly from 132 to 217 from FY2012 to FY2023 (Fig. 7), although there is a saturation trend. The number of joint researchers during the same period has also increased significantly, from 270 to 431 (Fig. 7).

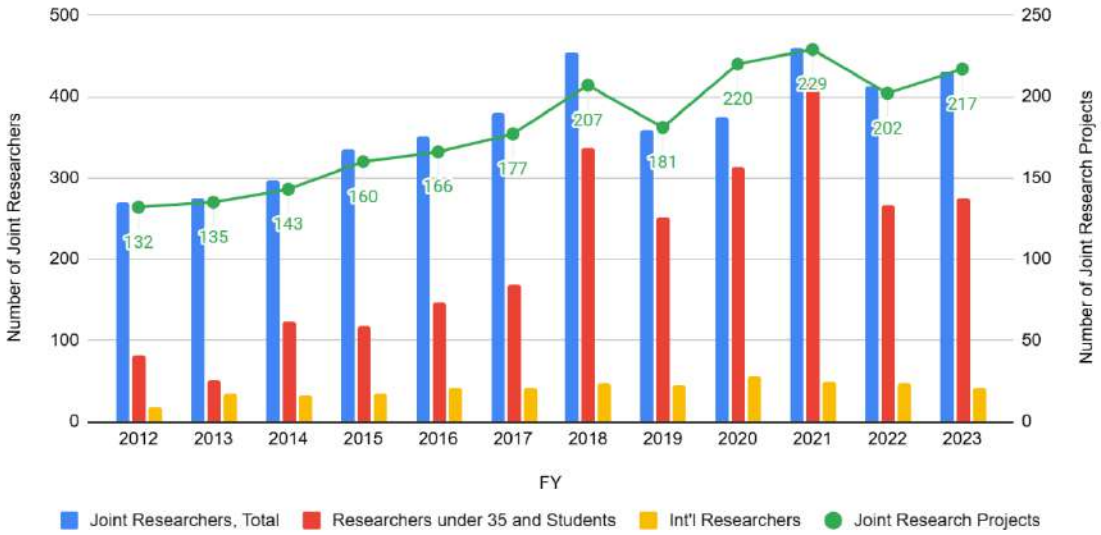


Fig. 7 Number of Joint Research Projects and Researchers

Joint Research Supported by Research Funds

In order to promote diverse research in the field of spatial information science, we have launched a system to support research expenses as an open collaborative research program since FY2022. This system is intended to support a wide range of research themes and contribute to the expansion and deepening of research in spatial information science, including basic theoretical research that does not necessarily use the "Spatial Data Infrastructure for Research" mentioned above.

CSV Address Matching

In this service, address matching is conducted on CSV format data including address and place name fields. Latitude / longitude or public survey coordinate system coordinate values are added, and these are then made into data that could be used in GIS. Spatial data could be easily created from address books, customer databases, and questionnaires, among others.

SANET

Spatial Analysis along Networks (SANET) is a tool for analyzing spatial events that occur on or along networks such as roads, rivers, and pipelines. Examples of analysis subjects include traffic accidents that occur on roads and stores that face roads. CSIS provides the SANET software to users for research and educational purposes only.

Urban Employment Area

A metropolitan area is formed by the connection between a central city and its surrounding areas (mainly suburbs), and it is different from an administrative city area. CSIS has identified the Urban Employment Area (UEA) as a new metropolitan area definition that can be widely used by researchers and policymakers, and is currently developing a statistical database for each metropolitan area, which is available on the CSIS website.

People Flow Project

In recent years, it has become possible to obtain more detailed data through not only conventional statistical surveys but also technological innovations, such as GPS and mobile communication history. Using these data at a business level requires consistent data quality. Efficiently processing, storing, displaying, and providing data is also important. In this project, we conduct research on quality assurance of people flow-related data and common infrastructure to achieve spatiotemporal services.

Reconstruction Support Survey Archive

The Reconstruction Support Survey Archive is an archive of the results of the “Survey on reconstruction support for urban areas affected by the Great East Japan Earthquake and Tsunami” by the City Bureau, Ministry of Land, Infrastructure, Transport and Tourism of Japan, and it is made available on the internet by CSIS with data provided by the bureau.

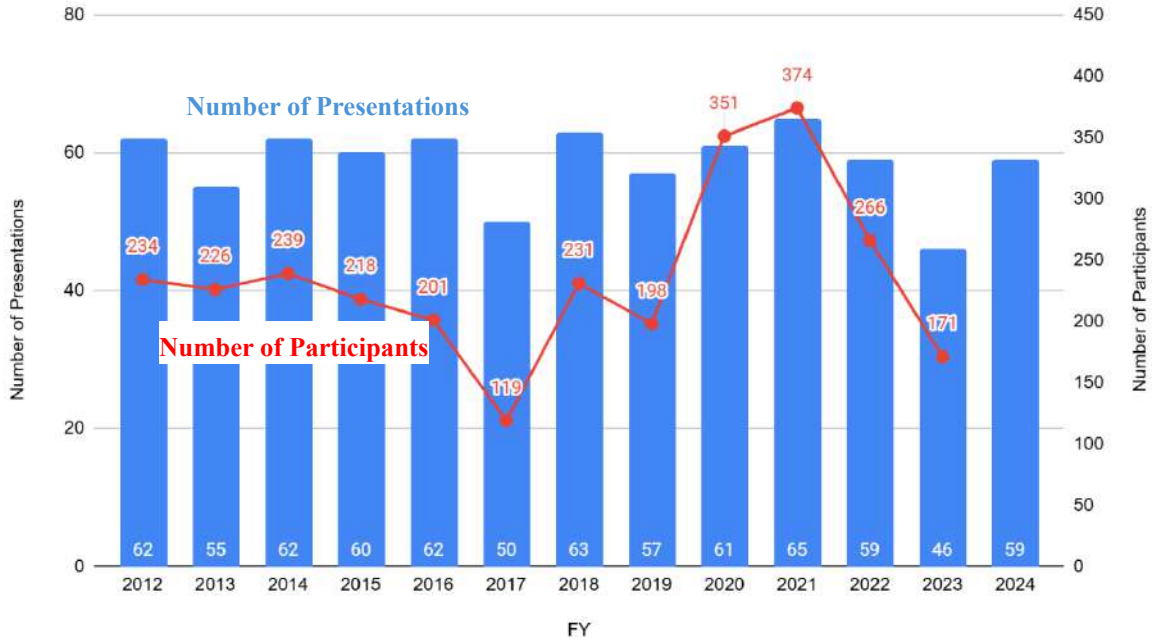
HD-Topography Project

CSIS provides point clouds, DEMs, and image data as well as analysis tools and operation manuals relating to the acquisition, analysis, and various applications of high-definition topography and feature information derived from laser surveying, SfM multi-view stereo photogrammetry, unmanned aerial vehicles (UAVs, commonly known as drones), and other methods.

Chapter 8. Other Research Exchange and Information Dissemination Activities

Organizing CSIS DAYS, Annual Meeting of Inter-University Research Activities

CSIS DAYS is a poster presentation conference held every fall with an open call for presentations. Presenters give a 5-minute oral presentation (research introduction) and display their posters in a 45-minute poster session. Research presentations contain both ones by the general public and others by CSIS's joint-research collaborators through JoRAS (Chapter 7). For the collaborators, CSIS DAYS is used as an opportunity to present the progress or results of their joint research and discuss its further development. Symposia and lectures are also held during the conference. Proceedings containing abstracts of the research presentations are prepared and distributed to participants (since 2022, the proceedings have been available only in PDF format), and special lectures are streamed on YouTube. CSIS DAYS is generally held in person on the Kashiwa Campus. Due to the COVID-19 pandemic, the conference was held entirely online in 2020 and 2021 and partially in person in 2022.The number of presentations is around 60, with around 200 participants each year.



Number of Presentations and Participants in CSIS DAYS

CSIS DAYS 2023
(Left: Poster Presentation Right: Special Lecture)

Urban Economics Workshop

The Urban Economics Workshop is a forum held once a month by members of the Division of Spatial Socio-Economic Research of the CSIS and Graduate School of Economics at the University of Tokyo. Serving as a platform for research presentations in urban and spatial economics, the workshop invites both domestic and international researchers—primarily external scholars—to present their work. The workshop covers various academic areas, specifically urban and regional economics, including transportation, real estate, trade, international migration, labor mobility, and industrial clustering. Presenters share the latest research from both theoretical and empirical perspectives.

	Dates
FY2017	2017/04/14, 2017/05/12, 2017/06/30, 2017/07/21, 2017/09/22, 2017/10/20, 2017/12/15, 2018/01/19, 2018/02/16
FY2018	2018/04/13, 2018/05/25, 2018/07/13, 2018/09/13, 2018/10/19, 2018/11/16, 2018/12/21, 2019/01/18, 2019/02/22
FY2019	2019/04/19, 2019/05/17, 2019/07/26, 2019/09/13, 2019/10/18, 2019/11/08, 2019/12/13, 2020/01/10, 2020/02/14
FY2020	2020/07/10, 2020/10/16, 2020/11/20, 2020/12/18, 2021/01/08, 2021/02/12
FY2021	2021/04/23, 2021/05/21, 2021/06/18, 2021/07/16, 2021/10/22, 2021/11/12, 2021/12/17, 2022/01/21, 2022/02/18
FY2022	2022/04/15, 2022/05/13, 2022/06/17, 2022/07/15, 2022/10/14, 2022/11/11, 2022/12/09, 2023/01/13, 2023/02/24
FY2023	2023/04/21, 2023/05/19, 2023/06/23, 2023/07/14, 2023/10/13, 2023/11/10, 2023/12/15, 2024/01/26
FY2024	2024/04/19, 2024/05/17, 2024/06/14, 2024/07/19, 2024/10/11, and four additional workshops are planned

CSIS Symposium

The CSIS Symposium provides a chance to share and discuss the latest trends in spatial information science. It was launched as the opening ceremony of CSIS, and has been held every year since then. In recent years, we have been setting cross-disciplinary themes.: "Socioeconomic Networks in Spatial Information Science" (FY 2017), "Frontiers of Field Science Using Drones" (FY 2018), "The Future of Mobility and Spatial Information" (FY 2019), "Spatial Information Science related to COVID-19" (FY 2020), "Progress and Future of Building Data in the Digital Spatial Society" (FY2021), "Livable Cities: An Approach from Spatial Information Science Perspective" (FY2022), and "Toward New Education in Spatial Information Science and Geography" (FY2023). At this symposium, we share the latest research issues, through the topical presentations by researchers from a variety of fields as well as discussions involving the participants. From 2022, we began streaming the symposium online, so that not only researchers from inside and outside the university but also students and the public can participate.

CSIS Symposium in FY 2023

Spatial Information Science Forum

The Spatial Information Science Forum is held in March every year as a study and opinion exchange meeting. The forum brings together most faculty members of CSIS, off-campus researchers, and people in practical business related to spatial information science. It serves as an opportunity to introduce efforts related to the center's joint research and to present the content of ongoing studies. Off-campus researchers and people in practical business provide topics for discussion and explain their activities.

In recent years, the forum was held in Kitakyushu City, Fukuoka Prefecture (FY 2017) and Taipei (FY 2018), but could not be held in FY 2019-2022 due to the COVID-19 pandemic. In FY 2023, the event was held in Beppu City, Oita Prefecture and a joint workshop with Ritsumeikan Asia Pacific University was held as part of the forum. The participants introduced their research and engaged in meaningful exchanges of opinions, fostering deeper mutual understanding.

Joint Workshop at the Spatial Information Science Forum in FY 2023
(at Ritsumeikan Asia Pacific University)

Urban Data Challenge

This was first held in 2013 in Tokyo as the “Community-building Contest” alongside annual workshops utilizing data for local governments, the private sector, universities, and civil activity organizations to solve regional issues using infrastructure information.

The project holds numerous events including the “ideathon” and “hackathon” in various regional bases throughout the year, serving as an important hub for linking activities to facilitate citizen participation, regional problem resolution, and to develop applications (Chapter 4).

Date	Event	Participants
2017/7/3	Urban Data Challenge 2017 Kickoff Event	116
2017/11/24	Urban Data Challenge 2017 Interim Symposium	85
2018/2/24	Urban Data Challenge 2017 Final Event	113
2018/7/18	Urban Data Challenge 2018 Kickoff Event	107
2018/10/26	Urban Data Challenge 2018 Interim Symposium	31
2019/3/16	Urban Data Challenge 2018 Final Event	161
2019/7/1	Urban Data Challenge 2019 Kickoff Event (Co-sponsored with the Japan Society of Civil Engineers (JSCE) Infrastructure Data Challenge 2019)	90
2019/11/1	Urban Data Challenge 2019 Plenary Event and Interim Symposium (Co-sponsored with the JSCE Infrastructure Data Challenge 2019)	112
2020/3/14	Urban Data Challenge 2019 with JSCE Infrastructure Data Challenge 2019 Final Event	104
2020/6/30	Urban Data Challenge 2020 Kickoff Event	226
2020/11/14	Urban Data Challenge 2020 Plenary Event and Interim Symposium with the JSCE Infrastructure Data Challenge	117
2021/3/13	Urban Data Challenge with the JSCE Infrastructure Data Challenge 2020 Final Event	131
2021/6/30	Urban Data Challenge / Infrastructure Data Challenge 2021 Kickoff Event	114
2021/11/12	Urban Data Challenge 2021 Plenary Event - Interim Symposium with JSCE Infrastructure Data Challenge 2021	62
2022/3/12	Urban Data Challenge 2021 with Infrastructure Data Challenge 2021 Final Event	175
2022/7/1	Urban Data Challenge 2022 / Infrastructure Data Challenge 2022 Kickoff Symposium	112

Date	Event	Participants
2022/11/25	Urban Data Challenge 2022 with JSCE Infrastructure Data Challenge 2022 Interim Symposium	92
2023/3/11	Urban Data Challenge 2022 with JSCE Infrastructure Data Challenge 2022 Final Event	250
2023/7/14	Urban Data Challenge 2023 Kickoff Symposium	109
2023/11/11	Urban Data Challenge 2023 Interim Symposium	54
2024/3/9	Urban Data Challenge 2023 with Civil Engineering Society Infrastructure Data Challenge 2023 Final Event	289
2024/7/3	Urban Data Challenge 2024 Kick-off Symposium	53

GNSS Training Workshop

Since 2018, CSIS has been organizing international training, workshops, and seminars on Global Navigation Satellite System (GNSS). These programs are conducted in joint collaboration with UNOOSA (United Nations Office for Outer Space Affairs), ICG (International Committee on GNSS), universities in the host countries or government organizations. The training covers lectures on GNSS, its applications, GNSS data processing for high accuracy using low-cost GNSS receiver systems, and fieldwork. After the training, the participants will be able to conduct GNSS field surveys and process GNSS data for high accuracy that are required in various GNSS applications. We also conduct GNSS workshops for policy and decision makers. The workshop covers an overview of GNSS, its applications, issues related to GNSS such as interference, jamming and spoofing, low-cost receiver systems, and receiver selection guidelines. Both training and workshop programs have participants from various countries.

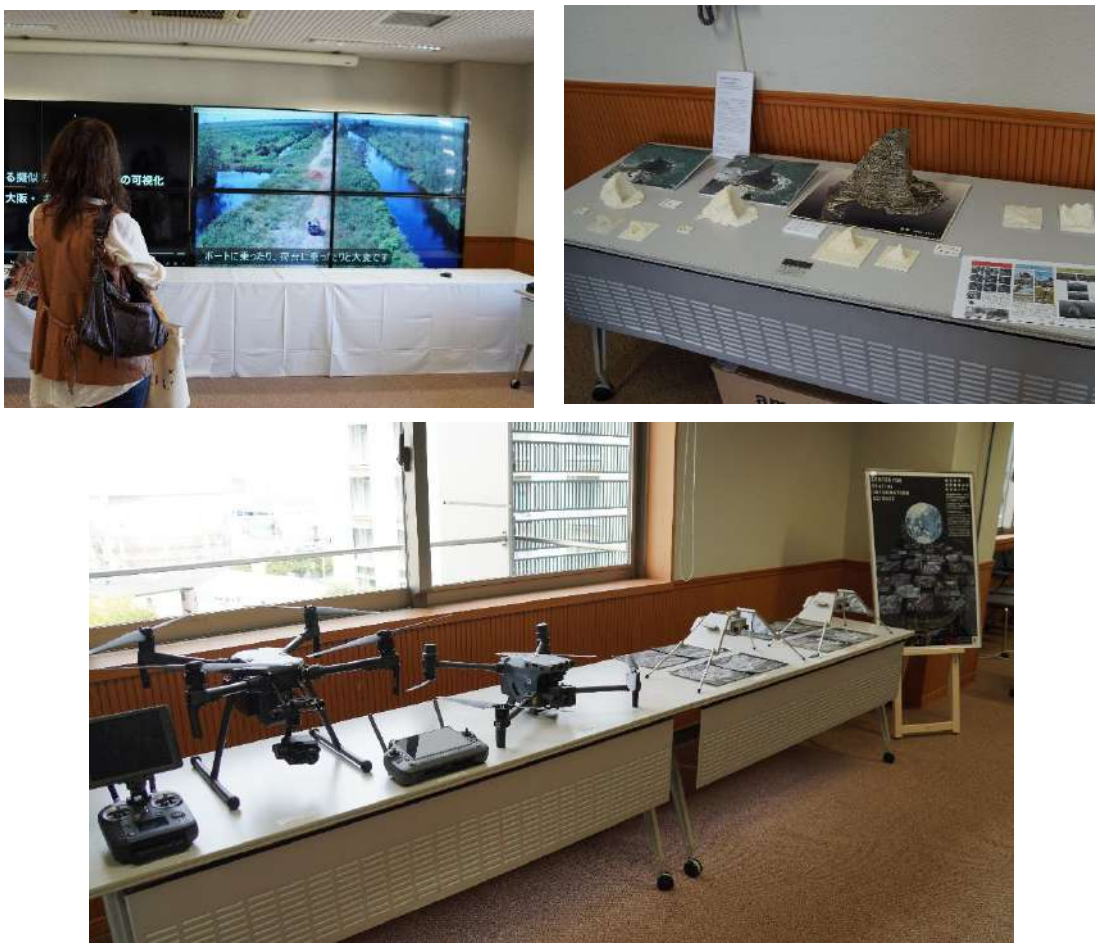
In addition, we also promote QZSS (Quasi-Zenith Satellite System) technology and applications abroad under the support from CAO (Cabinet Office), NSPS (National Space Policy Secretariat), Japan. QZSS provides several new services like CLAS, MADOCA PPP for high-accuracy, EWMS (Early Warning Messaging System) for disaster mitigation and management and QZSS SAS (Signal Authentication Services) for security and safety related systems to protect from spoofing attacks. The QZSS SAS methodologies were developed at CSIS.

Dates	Event	Location	Participants
2018/1/23 - 26	GNSS Training	Asian Institute of Technology (Thailand)	67 (15 countries)
2019/1/14 - 18	GNSS Training	Asian Institute of Technology (Thailand)	94 (15 countries)
2020/1/6 - 10	GNSS Training and Workshop	Asian Institute of Technology (Thailand)	71 (15 countries)
2021/1/19 - 21	GNSS Training	Online	294 (65 countries)
2021/1/28	GNSS for Policy and Decision Makers	Online	184 (54 countries)
2022/1/11 - 14	GNSS Training	Online with Tribhuvan University, Nepal	75 (15 countries)
2022/1/21	GNSS Workshop for Policy and Decision Makers	Online	21 (9 countries)
2022/3/4 - 23	Workshop (5 sessions)	Thailand and Sri Lanka	285
2023/1/3 - 6	GNSS Training	Online with Tribhuvan University, Nepal	352 (57 countries)
2023/1/9	GNSS Workshop for Policy and Decision Makers	Online	30
2023/7/5 - 7	GNSS Training	University of the Philippines (Philippines)	30

Dates	Event	Location	Participants
2023/7/24 - 26	GNSS Training on MADOCA-PPP Data Processing	Jakarta (Indonesia)	15
2023/7/27	GNSS data acquisition with QZSS enabled receiver	Jakarta (Indonesia)	50
2023/11/1 - 2	GNSS Training for the University of Indonesia	Jakarta (Indonesia)	100
2024/2/12 - 16	GNSS Training	Tribhuvan University, Nepal	22 (7 countries)
2024/2/12 - 14	GNSS Workshop for Policy and Decision Makers	Tribhuvan University (Nepal)	18 (5 countries)
2024/5/6 - 10	GNSS Training for UNCRASTE-FL, Morocco	Rabat (Morocco)	18
2024/9/2 - 3	MADOCA-PPP Training for MLMUPC, Cambodia	Cambodia	25

Kashiwa Open Campus

During the annual public open day at the University of Tokyo's Kashiwa Campus, held every October, various outreach activities are conducted to broadly introduce CSIS's research activities to visitors. In FY 2019, a mini-drone piloting experience was offered for the first time, where visitors could enjoy hands-on control of multiple drones. This experience was particularly popular among families and children, with many participating in the activity. From FY2020 to FY2022, the event was held online due to the COVID-19 precautions. A dedicated website was created to introduce the research of various departments, allowing anyone to access the content. Additionally, virtual reality (VR) technology was utilized to provide field experiences related to physical geography in a virtual environment, with interactive areas where participants could engage with one another. In FY2023, in-person events resumed, including mini-drone piloting experiences and exhibits of drone equipment used in natural geography research. The event also featured 3D-printed models of topography and structures obtained from field surveys in various regions, aerial footage, and visualizations of human flow data. These exhibits allowed visitors to observe and interact with societal and natural environments from unique, bird’s-eye perspectives. The number of visitors increased from 372 in FY 2019 to 439 in FY 2023, demonstrating the continued strong interest in this initiative.



Example of an exhibit of CSIS at the Kashiwa Open Campus, the University of Tokyo (4th floor, General Research Bldg.)

Chapter 9. CSIS Future Plans

The Center for Spatial Information Science was originally conceived as a national museum of cartography. It was established in 1998 as the so-called “new cartography” was evolving into new disciplines with higher and broader perspectives: first “geographic information science” and later “spatial information science,” which is the focus of the Center. After that, the goal was to become a research base for spatial information science, not only within the University of Tokyo, but also nationwide. In 2005, the Center was accredited by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) as a national Joint Usage Facility, and today we continue to support researchers nationwide as a designated Joint Usage/Research Center.

Nearly 25 years have now passed since the Center’s establishment, and in that time the scope of spatial information science has greatly expanded and become deeply rooted in daily life. Viewing digital maps on a smartphone has become commonplace, and in the wake of COVID-19, it has even become commonplace to talk about crowd congestion in a city using data on the movement patterns of people. In addition, artificial intelligence (AI) technology makes it possible not only to automatically detect damage to roads while driving, but also to create high-definition images that look like real landscapes using generative AI. Furthermore, autonomous driving technology that measures the surrounding spatial information will soon be deployed on actual roads.

At the same time, however, we are faced with an increasing number of complex social issues such as the aging of society, a declining population, the frequent occurrence of large-scale disasters, and, at the global level, security issues such as social division and regional conflicts. We therefore need to actively consider how spatial information science can contribute to solving these problems from the perspective of autonomy and sustainability.

In this sense, now that the use of spatial information is commonplace for researchers in many fields, it can be said that the first stage of our mission has been accomplished. I believe we are now entering a new stage in which we must further expand our conceptual horizon and seriously discuss how to build and lead a sustainable digital spatial society. As explained in the previous chapters, at the University of Tokyo, the Center played a central role in establishing the Collaborative Research Organization for the Digital Spatial Society (DSS) in 2020, and as of April 2024, nearly 85 faculty members from 18 departments are collaborating within this organization, engaging in activities and discussions from various perspectives. These encompass not only the traditional fields such as cities, social infrastructure, geography, economics, and information and communication, but also medicine, agriculture, forestry, humanities, social sciences, arts and sciences, history, and more. The University of Tokyo has more than 40 such Collaborative Research Organizations, but DSS is the largest among them. While leveraging the activities of DSS, it is becoming increasingly important to strengthen the organizational capacity of our center, which serves as a central department. To address this, two proposals are presented below.

The first is the acquisition of external funding. As explained in the previous chapters, the Center has received a great deal of support from the private sector through the activities of the Corporate Sponsored Research Program and the Social Cooperation Research Department, in comparison with the size of the Center, but strengthening these funding activities will enable us to increase the number of project faculty members and administrative staff. The other is the expansion of tenured positions. It is essential to somehow expand the number of posts with no fixed term to increase the number of excellent young faculty members. Therefore, it is crucial to devise ways to utilize the Management Expense Grants for National University Corporations effectively. Recently, the University of Tokyo has reviewed its personnel system and promoted the employment of young faculty members through an employment system that utilizes external funds other than the Management Expense Grants for National University Corporations, such as the Chapter 8 system

and intradepartmental cross-appointment system. We would like to make good use of such systems and effectively utilize the surplus of Management Expense Grants for National University Corporations. In addition, as part of this effort, we have recently developed internal regulations for the tenure track system, which has not yet been introduced in so many departments within the university, and applied them to some open faculty positions in order to improve incentives for applying and post-hiring activities.

Finally, despite these efforts, the Management Expense Grants for National University Corporations, which is the source of funding, is limited, making it difficult to resolve some issues. Under these difficult circumstances, in order to promote a drastic expansion, it is important to consider a direction for expanding and reorganizing CSIS based on the activities of DSS, while obtaining the cooperation of the departments affiliated with DSS. It is not an easy task, but we will persevere in gaining the understanding of the relevant departments.

Part II: External Evaluation of the Center

Chapter 1: Method of External Evaluation

Member of External Evaluation Committee

The members of the External Evaluation Committee are as follows:

Chair:
Yoshiyasu Ida
(President of the Association of Japanese Geographers; Professor Emeritus, University of Tsukuba)

Domestic Committee Members:
Akiko Aizawa (Deputy Director and Professor, National Institute of Informatics)
Mamoru Taniguchi (Professor, University of Tsukuba)
Tomoki Nakaya (Professor, Tohoku University)
Se-il Mun (Professor, Doshisha University)
Satoshi Yamamoto (Director General, Geospatial Information Authority of Japan, Ministry of Land, Infrastructure, Transport and Tourism)

International Committee Members:
Kristian Behrens (Professor, Université du Québec à Montréal, Canada)
Jiannong Cao (Professor, The Hong Kong Polytechnic University, Hong Kong)
Helen Jarvie (Professor, University of Waterloo, Canada)
Perry P J Yang (Professor, Georgia Institute of Technology, USA)
Huijing Zhao (Professor, Peking University, China)

Method of External Evaluation

Prior to the external evaluation, the first draft of the Self-Assessment Report of the Center for Spatial Information Science, The University of Tokyo (hereinafter referred to as the "Self-Assessment Report") was prepared in Japanese on November 11, 2024. This draft was distributed to six domestic evaluation committee members, who were asked to review it. Based on this, an external evaluation meeting attended by all domestic committee members was held on December 5, 2024, at the Ito International Research Center, The University of Tokyo. During this meeting, an explanation of the Center's activities was provided, focusing on the contents of the Self-Assessment Report, and an evaluation was conducted.

Subsequently, the Self-Assessment Report was translated into English and distributed to five international evaluation committee members for their review. Based on this, an evaluation meeting with full participation of the international evaluation committee members, both in person and online, was held on February 5, 2025, at the Ito International Research Center of The University of Tokyo. As in the December meeting with the domestic committee, the Center's activities were presented and evaluated.

All external evaluation meetings were transcribed in the language in which they were conducted. Based on these transcripts, a summary of the evaluations and the Center's responses was compiled in both Japanese and English. The summaries and the meeting minutes were then reviewed by both domestic and international committee members. After incorporating their feedback and revisions, the final evaluation report was completed.

Chapter 2: Summary of the External Evaluation

Key Points from the External Evaluation Committee

As a result of the evaluation, the following points were noted.

(1) Research Activities

A deeper understanding was gained regarding CSIS's activities over the past six years, the research conducted by each division, and the contributions of DSS. Although CSIS is a relatively small research institute, it became clear that researchers from diverse fields coexist and interdisciplinary research is actively promoted. It was also recognized that individual research activities are of outstanding quality and that their scientific and technological outputs have received high acclaim. Specifically, contributions were made across a wide range of fields such as climate change, disaster management, urban planning, health, crime, and communications. Progress was also observed in the development of systems and applications based on geographic information and spatiotemporal data, as well as in the utilization of higher-resolution spatial data and real-time sensing technologies.

In addition, many researchers have been promoted or moved to other universities, indicating that CSIS fosters excellent human resources.

Recommendations for the future include strengthening foundational methodologies to more effectively integrate different research fields, further promoting interdisciplinary collaborative research, establishing collaborative research frameworks such as DSS, enhancing societal contributions (e.g., incorporating psychological perspectives, applying research to support persons with disabilities, and solving challenges in educational settings), strengthening public relations, and considering strategies for fundraising and organizational development.

(2) Research Support Activities

The Center's distinctive initiatives, such as the generation and sharing of pseudo-people flow data, the CSV address-matching service developed in collaboration with the Geospatial Information Authority of Japan, the promotion of research use of spatial data infrastructure through JoRAS, the provision of SANET, and the development of a statistical database at the urban employment area level, were highly evaluated.

The data provided by CSIS vary in terms of security and privacy levels. For datasets with lower security requirements, it is important to facilitate easier access for a broader range of users. Furthermore, it is recommended to enhance public relations efforts for these services and datasets, to develop mechanisms that make spatial data more accessible for the social sciences and humanities fields, to preserve a culture that values high-quality data free from fake information, to update the urban employment area data, and to consider standardization of data formats. It is also desirable for the Center to develop a vision regarding the extent to which it intends to expand its data holdings.

(3) Educational Activities

CSIS members contribute to improving the quality of education and presenting at top-level academic conferences, fostering the development of many researchers. CSIS possesses a unique combination of expertise and skills, and there may be an opportunity to consider establishing a graduate program to provide students with a broader range of skills.

(4) Collaboration with Society

Efforts related to societal collaboration were presented, including the Social Cooperation Research Department established as part of the MEC-UTokyo Lab, the Corporate Sponsored Research Programs supported by private companies, joint projects with local governments on road damage detection, collaborative research with telecommunications companies on people flow, and involvement in the Ministry of Land, Infrastructure, Transport and Tourism's "PLATEAU" project. The diversification of funding sources through partnerships with corporate sponsors, such as the establishment of the Social Cooperation Research Department and the Corporate Sponsored Research Programs, was highly evaluated.

Recommendations include the management of nationally important datasets that have lost designated administrators, the broadening of support to include amateur data scientists, and the continuous promotion of geospatial information utilization methods to local governments and the private sector.

(5) International Collaboration

Regarding CSIS's international activities, progress has been observed based on the feedback from the interim evaluation, and this is highly commendable. In particular, the advancement in concluding agreements with international research institutes and universities is expected to serve as an important foundation for future development. In addition, CSIS faculty members are actively involved in international conferences and in the editorial work of major journals, greatly contributing to the enhancement of CSIS's international visibility.

It is expected that by continuing such international activities, CSIS will further strengthen its influence. Furthermore, as international collaboration expands, it will likely become necessary to engage in legal discussions concerning issues such as regulations and personal information protection.

(6) Future Directions

While research at CSIS is being developed from a very broad perspective, there is a risk that expanding the scope of activities too widely could lead to the dispersion of resources and a lack of clarity regarding priorities. It is important to develop a framework that clearly defines CSIS's positioning and priorities, formulate a strategic vision for future directions, and foster a shared understanding among stakeholders.

One of CSIS's strengths lies in its potential to further enhance its leadership in data sharing. In particular, by expanding the current data-sharing framework and strengthening collaboration with other universities and the private sector, CSIS could build a more dynamic and evolving ecosystem.

Although the current scale of activities is maintained under limited resources and budget, for future growth, it will be important to explore opportunities for additional funding, expand social impact, and simultaneously enhance both the quantity and quality of research.

Future Plans and Responses

In response to the above feedback, we would like to implement the following actions.

(1) Research Activities

Although individual researchers received a certain level of positive evaluation, based on the interim evaluation by MEXT and relative evaluations within the university, it is necessary to further strengthen the publication of papers in international journals, including Top 10% papers, and enhance overall competitiveness.

While the Center has been characterized by its diverse membership across a wide range of fields, there has been a tendency to use this diversity as a reason for not proactively conducting objective evaluations regarding the number of publications, citation impact, and acquisition of external funding. Going forward, we aim to establish a system to develop visualization indicators that incorporate citation counts, impact factors, Altmetrics, and other measures, and to regularly share and analyze these evaluations.

In addition, when recruiting new researchers, particularly early-career researchers, we will place emphasis on objective evaluations, while gradually increasing the number of tenure-track opportunities to create an environment where researchers can contribute over the long term.

In terms of societal contributions, we will also explore the application of geospatial information technologies to support socially vulnerable populations and people with disabilities, from the perspective of social inclusion, through collaborations with other disciplines such as psychology.

With regard to integrated and interdisciplinary research, we are strengthening inter-departmental collaboration through DSS and advancing unified visualization and information dissemination initiatives under the University of Tokyo Digital Twin project. We intend to continue focusing on and expanding these

efforts.

Regarding the enhancement of public relations, we have established a Public Relations Team starting in FY2024 and have initiated information dissemination activities. We will continue to strengthen and enrich our public relations efforts moving forward.

As for fundraising, it is important for individual researchers to proactively apply for external funding. To support this, we will work to create a more supportive environment by systematically providing information on external funding opportunities and offering advice on the preparation of proposal documents.

(2) Research Support Activities

These activities serve as the core for promoting collaborative research that supports researchers nationwide, which is the fundamental mission of CSIS as a Joint Usage and Joint Research Center. Therefore, the gradual growth of these activities remains one of our highest priorities.

However, given that the core funding available for operations is limited, as pointed out, it is important for the Center to establish a clear vision regarding the scale to which data resources should be expanded. We intend to discuss this carefully and make decisions accordingly. In particular, since trends toward open data and changing research needs are expected to continue, it is necessary to remain vigilant, regularly review data specifications, and replace datasets as appropriate. Furthermore, as we have established comprehensive collaborations with the Geospatial Information Center (GIC), we aim to accelerate actual collaboration and work toward building a mutually complementary relationship.

At the same time, we will work on developing mechanisms that integrate datasets and tools created through individual researchers' activities and externally funded projects into JoRAS, thus reducing reliance solely on core operating funds.

Additionally, beginning in FY2024, we have strengthened our support structure by hiring Project Academic Specialists such as URAs (University Research Administrators), system engineers, and cross-appointed staff from private companies. As a result, the administrative burden on academic faculty has been significantly reduced, allowing them to focus more on strategic tasks such as developing visions, strategies, and reviewing data specifications. We intend to maintain and further enhance this improved environment.

(3) Educational Activities

While we are already producing a certain number of master's and doctoral graduates each year, as pointed out, the possibility of establishing a dedicated graduate school could be considered in the long term to further accelerate our activities. However, we are currently collaborating with several graduate schools, allowing us to effectively secure students, and considering the potential impact on these existing collaborations and the high costs associated with establishing a new graduate school, we believe that this option is not realistic at present.

Nevertheless, given that CSIS's international recognition is not yet sufficiently high, it will be necessary to actively consider initiatives such as holding international summer schools and appointing international faculty members for two- to three-year terms.

(4) Collaboration with Society

The continued existence and expansion of units such as the Corporate Sponsored Research Program and the Social Cooperation Research Department remain important. However, such partnerships cannot be built overnight; the establishment of strong, ongoing trust-based relationships is crucial. Particularly, private companies often expect contributions toward social implementation and transformation. Therefore, activities from this perspective are also necessary. Although such initiatives may differ from cutting-edge international publications, it will be important to manage resources appropriately and maintain a balanced approach. As mentioned in (2), we will also actively pursue collaboration with the Geospatial Information Center.

(5) International Collaboration

This will be one of our key areas of focus moving forward. As a first step, we plan to further internationalize JoRAS. Although the JoRAS website has already been partially translated into English, the explanations of individual datasets and publicity materials are not yet fully geared toward an English-

speaking audience, so this will be prioritized. Additionally, since providing data directly to international researchers requires permission from the data providers, we will work to confirm the necessary procedures in this regard.

Furthermore, we recognize the need to enhance our overall English-language communication through the Center's website and social media platforms. Beyond X (formerly Twitter) and Facebook, we have also started utilizing LinkedIn, a professional networking platform, since February 2025, as we believe it will be even more effective in reaching the international research community. We will continue to accelerate such networking efforts.

Moreover, the signing of inter-departmental MoUs with overseas institutions has also gained momentum post-COVID. As these agreements are closely linked to international joint research activities, we intend to actively provide support such as providing travel grants for early-career faculty members.

Finally, we believe that not only short-term visiting foreign professors but also appointments of international faculty members for two- to three-year cycles will be important in enhancing CSIS's international visibility. Depending on budget availability, we would like to actively pursue such initiatives.

(6) Future Directions

As pointed out, while fostering diversity, we must recognize that the Center's organizational resources are limited. Therefore, we intend to focus on three to four highlights such as increasing the number of Top 10% cited papers, securing external funding, and managing the JoRAS community, including data development. We would also like to include, as an evaluation criterion, the overall achievement of the Center toward the common goal, including the extent to which each Center member has contributed.

Summary of Evaluations and Recommendations

The comments made by the External Evaluation Committee have been organized into two categories: evaluations of the Center's achievements and current status over the past seven years, and recommendations for the Center's future development. Each item highlights key points extracted from the meeting minutes provided in the appendix. Opinions expressed by domestic committee members have been translated into English. The names of the committee members who provided each comment are indicated in parentheses (titles omitted).

Evaluation of the Center

From Domestic Committee Members

- While CSIS has a long history, I found it very attractive that it remains unique and consistently addresses cutting-edge needs alongside the advancement of the digital society. (Aizawa)
- I was also impressed by the interesting and vibrant research activities of the younger faculty members. (Aizawa)
- In terms of securing funding, the establishment of the Sponsored Research Division and the Social Cooperation Research Department is a remarkable achievement. (Aizawa)
- Operating the JoRAS system as a foundation for collaborative research is crucial to fulfilling your mission. (Aizawa)
- Each individual research project presented today is highly advanced and excellent. In particular, the initiatives for collaborative research and the high potential for applications of spatial information systems were especially noteworthy. (Ida)
- As for CSIS's societal contributions, they are beyond question. (Taniguchi)
- I was truly impressed by the wide range of excellent research presented—there is absolutely nothing to criticize about the quality of each project. (Nakaya)
- The Center's distinctive initiatives, such as the promotion of shared use of GIS data, the generation and sharing of pseudo-people flow data (a globally rare initiative), collaboration with the Geospatial Information Authority of Japan, the expansion of JoRAS services, and the provision of APIs to widely utilize research outputs, were highly evaluated. (Nakaya)
- This is a comment from the perspective of the field of economics: the faculty members are producing excellent research outcomes. In addition, faculty members who originated from CSIS and are now active at other universities are also highly talented, and the Center's success in fostering outstanding human resources is considered a major achievement. (Mun)
- It was once again recognized that the Center is engaged in a wide variety of activities. (Yamamoto)

From International Committee Members

- I also want to mention this is really a center that has a very broad and diverse number of activities, sustained publication record, and good funding. This is really, really impressive. (Behrens)
- CSIS actually operates excellently and with a lot of achievements. This center actually integrates different areas of applications. It covers a wide range of systems and also applications. They are all built on this geographical information, and temporal and spatial information. CSIS has a lot of deliverables, including the research on the methodology, the systems, and also applications, and also

with very high-quality applications. (Cao)

- The Center contributes to presentations at top-level academic conferences and to the improvement of educational quality, fostering the development of many new researchers. It also plays an important role in human resource development, as evidenced by the promotion of many researchers and their appointments to positions at other universities. (Cao)

- The Center's research projects are highly diverse and impressive. It's really encouraging to see that you are diversifying your funding streams increasingly through engagement with corporate sponsors as well. I think that's probably very important for the future. (Jarvie)

- I congratulate you on the strong impact of your research. You rightly emphasize high-impact publications, which is very important. Increasingly, international expectations also include demonstrating relevance to policy and contributions to economic and industrial competitiveness, and I believe you perform very well in all these areas. (Jarvie)

- CSIS's international development has progressed based on feedback from interim evaluations and is commendable. In particular, agreements with international research institutes and universities are expected to serve as a key foundation for future growth. Faculty members' active involvement in international conferences and major journal editorial work has significantly enhanced CSIS's international visibility. Continued international activities are expected to further strengthen CSIS's influence. (Jarvie)

- Through today's presentation, I was thrilled by listening to different division presentation. That was productive, diverse and comprehensive in the broader area of spatial information science. (Yang)

- Regarding the Division of Spatial Information Analysis: a wide range of research is being conducted, covering topics from natural environments, such as geomorphology, to urban analysis. The scope is highly comprehensive. (Yang)

- Regarding the Division of Spatial Information Engineering: In particular, it is highly impressive that near real-time data acquisition has become possible, enabling the capture of dynamic changes in urban environments. Research on urban digital twins is also a noteworthy aspect. (Yang)

- From today's presentations, I have knowledge of the CSIS activity and achievements in the past six years. I know the funding, the research activities of each division. I know the collaborative research organization, DSS, and the services provided, especially JoRAS dataset. I am very, very impressed by these activities. Especially, I think in this new AI era, the dataset is very crucial. (Zhao)

- From the research results, achievements and activities, I think CSIS demonstrates a very high level of scientific and technological merit. (Zhao)

Requests and Recommendations for the Center

From Domestic Committee Members

- Providing stable services over time requires considerable cost and effort. It is important to make the challenges and the value of such sustained efforts more visible and to advocate for them. (Aizawa)

- When it comes to distributing data to companies or overseas, discussions around legal issues, personal data protection, and similar matters will likely become necessary. As these collaborations expand, I believe it will be important to prepare for and engage in such legal discussions to some extent. (Aizawa)

- With the arrival of the AI era, we are facing a crisis of data scarcity. I believe it would be valuable for the Center to articulate a vision regarding how much to expand the volume of data going forward. Beyond simply providing existing data, it would be interesting to hear how the Center plans to move forward—whether by installing sensors to gather new valuable data, working with synthetic data as mentioned earlier, and overall, deciding the scale and scope of the data it aims to handle. (Aizawa)

- The Center's research outcomes have strong potential to contribute to solving challenges in educational settings. (Ida)

- At many universities, even when collaborative research is attempted, it often stalls after initial exchanges of ideas, with difficulties arising when it comes to publishing joint research outputs. I hope your center can become a pioneer in establishing effective collaborative research frameworks. (Ida)

- Incorporating psychological perspectives and exploring applications for supporting people with disabilities could further enhance the significance of the Center's activities. For example, research on navigation and support systems for individuals who have difficulty accessing information could be considered. (Ida)

- The Center is expected to manage nationally utilized datasets, such as the "Konjyaku Map." As these are important resources for educational institutions and local governments, we hope that the Center will continue to manage and provide them. (Ida)

- Although the Center's research outcomes have the potential to benefit many people, public outreach efforts are currently insufficient. By disseminating information more widely to local governments and the general public, the Center can further enhance its social contribution. (Ida)

- I hope CSIS will continue to serve as a central institution that values high-quality data and lead the development of Japan's data culture into the future. (Taniguchi)

- One issue currently occurring at many universities is that researchers are overly constrained by evaluation criteria, which can undermine their motivation. I hope CSIS will continue in a way that fosters and maintains strong motivation among its members. (Taniguchi)

- There is some concern that the decrease in administrative and technical staff may be affecting the operation of the organization. (Taniguchi)

- It was mentioned that other grants have been secured; however, there is some concern about the slight downward trend in Grants-in-Aid for Scientific Research (KAKENHI). (Taniguchi)

- The task of preserving maps as archives will likely become increasingly important. It will be necessary to consider ways to carry on such work and to ensure the continuation of high-quality research. (Taniguchi)

- In an era where fake data is increasingly prevalent, it is necessary to consider how to preserve a culture that values reliable data. (Taniguchi)

- There is some inconsistency in how research outcomes and services are promoted. Adding emphasis, such as highlighting them as "world-first initiatives," could help make a stronger impact. (Nakaya)

- Spatial data is increasingly valued across fields such as data science, social sciences, and the humanities, and there are high expectations for the Center to function as a "one-stop hub for spatial data science." (Nakaya)

- Not only professionals, but also amateur data scientists and journalists are making greater use of spatial data, and broad support from the Center is increasingly needed. (Nakaya)

- One of the Center's strengths lies in secondary processing of GIS data and the creation of pseudo-people flow data. We hope to see further development in these areas. Additionally, new initiatives such as the creation of a "pseudo street view" could also be explored. (Nakaya)

- In the social sciences, research combining microdata with geographic information is increasing. By providing microdata enriched with geographic information, similar to initiatives like SSJDA at the University of Tokyo, the Center could make an even greater contribution. (Nakaya)

- The updating of the Urban Employment Areas has been suspended, but it is hoped that this work will continue. (Mun)

- The tenure-track system is very important for securing excellent human resources. (Mun)

- From an administrative perspective, there are significant differences in the awareness of geospatial information utilization among municipalities. It would be beneficial if the Center could widely introduce various methods of utilizing geospatial information. Continuous dissemination of good practices and proactive outreach are important, always keeping in mind how to promote social implementation and encourage use by local governments and the private sector. (Yamamoto)

From International Committee Members

- Regarding the evaluation metrics for research outcomes: many research institutions have established KPIs (Key Performance Indicators) that assess not only the number of citations of papers but also the utilization of generated data and technologies—such as who is using them, how they are being used, and the number of downloads. Systematically recording these indicators and presenting them as part of research achievements may also be important. (Behrens)

- The topics covered are extremely broad, making it difficult to concisely convey the overall picture. It is suggested that a 2–3 page summary be added to the self-assessment report to clearly define the Center's key characteristics. (Behrens)

- Since there are overlaps in research areas across divisions, it is desirable to more clearly illustrate the relationships between different divisions. (Behrens)

- The JoRAS system is an outstanding initiative and a highly valuable and important resource for the research community. It is important to promote broader awareness of it. (Behrens)

- There is a unique mix of competencies and skills at CSIS. Some other interdisciplinary research centers have introduced graduate programs to provide students with a broad range of skills. I think that would be probably something that's worth considering in the future. (Behrens)

- If the scope of activities expands too widely, there is a risk that resources will become dispersed and priorities will become unclear. It is important to strategically focus efforts. In particular, regarding data utilization, it is necessary to clarify CSIS's distinctive features by balancing academic value with collaboration with industry. Efficient operations should be pursued by leveraging external funding and university support. (Behrens)

- CSIS's research resources are valuable not only for their academic value but also as key assets for further development, and their strategic use is essential. Moving forward, it is important to leverage CSIS's strengths, clarify priority areas, and establish a direction that leads to sustainable growth. (Behrens)

- While diverse research is being conducted at CSIS, it may be possible to strengthen research on foundational methodologies to more effectively integrate different research fields. (Cao)

- CSIS may be able to further strengthen its leadership in data sharing. In particular, by expanding the current data-sharing framework and promoting collaboration with other universities and

industry, it is believed that a more advanced ecosystem can be developed. (Cao)

- Research on the large language models and spatiotemporal data is advancing, and by leveraging existing open-source models while appropriately tuning them with CSIS's rich datasets, more specialized applications can be realized. How CSIS utilizes its vast amount of data will likely be a key factor in its future development.

- I support the development of a foundation model specialized in the field of spatiotemporal information. By utilizing existing open-source foundation models and appropriately tuning them with CSIS's rich datasets, it is possible to create a powerful model specialized in spatial information. (Cao)

- For CSIS, which is characterized by the fusion of different disciplines, promoting interdisciplinary collaborative research is essential. (Jarvie)

- Although the current CSIS is maintained under limited resources and budget, for future growth, it will be important to explore opportunities for fundraising, expand social impact, and simultaneously enhance both the quantity and quality of research. (Yang)

- CSIS is expected to play a central role in data-driven spatial information analysis and urban computing, and to promote urban innovation through industry-academia collaboration. In addition to providing research outputs, CSIS also has the potential to build a framework that enables the university community and society as a whole to utilize data. (Yang)

- While research is being developed from a very broad perspective, it is necessary to establish a framework that clearly defines CSIS's positioning and priorities. (Yang)

- The current direction of the University of Tokyo to which CSIS belongs is also an important factor. A clear vision may be needed regarding the role CSIS should play within the university's future strategy. (Yang)

- Based on the interim evaluation by MEXT, which emphasizes the further development of international joint research and the strengthening of social impact through deeper collaboration with local communities, it is important for the Center to formulate a strategic vision for its future direction and to foster a shared understanding among faculty and researchers. (Yang)

- Regarding the Division of Spatial Information Analysis: As a future direction, it is necessary to establish core research questions that address today's pressing issues. For example, climate change is one such area. The research agenda might be leading this research division to the next step. (Yang)

- Regarding the Division of Spatial Information Engineering: It may be important to consider funding and organizational strategies for future research development. (Yang)

- It may be important for CSIS to clearly define two or three highlights that represent its strengths. The value and utilization of its datasets could be considered one of CSIS's major strengths. By organizing these features and strengths and clarifying the future direction of its research, CSIS will be able to demonstrate an even stronger presence. (Zhao)

Appendices

1. Minutes of the External Evaluation by Domestic Committee Members

○ Date and Time: December 5th, 2024, 13:00-17:30

○ Venue: Conference Room, 3rd Floor, Itoh International Research Center, The University of Tokyo

○ Committee Members: Yoshiyasu Ida (President of the Association of Japanese Geographers; Professor Emeritus, University of Tsukuba), Akiko Aizawa (Deputy Director and Professor, National Institute of Informatics), Mamoru Taniguchi (Professor, University of Tsukuba), Tomoki Nakaya (Professor, Tohoku University), Se-il Mun (Professor, Doshisha University), Satoshi Yamamoto (Director General, Geospatial Information Authority of Japan, Ministry of Land, Infrastructure, Transport and Tourism)

○ CSIS Members: Yoshihide Sekimoto (Director and Professor), Ikuho Yamada (Vice Director and Professor), Kaoru Sezaki (Professor), Takashi Oguchi (Professor), Takaaki Takahashi (Professor), Daisuke Kurisu (Associate Professor), Dinesh Manandhar (Associate Professor), Yuuki Nishiyama (Lecturer), Yuki Otsu (Lecturer), Renhe Jiang (Lecturer), Takahiro Yoshida (Lecturer), Yanbo Pang (Project Lecturer), Kotaro Iizuka (Assistant Professor), Abel Pinheiro (Assistant Professor), Yuriko Yazawa (Project Assistant Professor), Yusuke Kimura (Project Researcher), Ai Suzuki (Project Academic Specialist), Kazue Sakata (Administrative Staff), Yuko Miyata (Administrative Staff), Yoshiki Ogawa (Lecturer, presentation provided via video)

○ Agenda (Honorifics are omitted)

- Introduction of the Evaluation Process (Sekimoto)
- Introduction of CSIS (Sekimoto)
- Q&A Session1
- Research Activity of the Division of Spatial Information Analysis (Oguchi and Yamada)
- Research Activity of the Division of Spatial Information Engineering (Sezaki and Sekimoto)
- Research Activity of the Division of Spatial Socio-Economic Research (Takahashi)
- Q&A Session2
- Research Activity of the Division of Joint Usage and Research (Sekimoto)
- Research Activity of the Division of Spatial Formation for Innovation Hubs and its Evaluation (Yamada)
- Research Activity of the Collaborative Research Organization for the Digital Spatial Society (DSS) (Ogawa, via video)
- Services Offered by CSIS (Nishiyama)
- Q&A Session3
- Review and Discussion

○ Minutes (Honorifics are omitted)

<Q&A Session 1>

[Taniguchi] You have faculty members from various divisions, but where are they physically located?

[Sekimoto] Our Center's main office is located on the 4th floor of the Research Complex at the Kashiwa Campus. Basically, both students, faculty members, and administrative staff are based there. However, in some cases, for example, some professors hold joint appointments with the Institute of Industrial Science at Komaba Campus. Those professors have offices at Komaba as well and work at both locations.

[Mun] At the end of the discussion, the topic of tenure-track appointments came up. I understand that it must be quite challenging for such a small center. If I remember correctly, one of the difficult aspects of the tenure-track system in Japan is that a permanent position must be prepared once the tenure-track period ends. Has this issue already been addressed, allowing you to move forward with these appointments?

[Sekimoto] The basic answer is yes. Securing both a position and the necessary funding is critical. As long as the total number of faculty positions does not exceed the maximum limit, creating a new position is possible. At our university, there are, of course, limits to the total number of posts, but if a certain level of funding (such as operational grants) is secured, there is some flexibility in setting the number of faculty positions. In order to secure funding, for example, we have been working to move system hardware to the cloud — about two or three years ago, the university built a shared cloud system called MDX — and through such efforts, we have finally managed to secure roughly enough funding for one new position.

[Yamamoto] "Spatial information" itself covers a very broad range of fields. In addition, I found it very interesting that your center also serves as a core department for the Collaborative Research Organization for the Digital Spatial Society, DSS. Could you tell us about the balance between the center's original activities and the DSS-related activities, in terms of workload and budget?

[Sekimoto] The framework for Collaborative Research Organization at the university started about four or five years before DSS was launched. We do not receive any direct budget from the university for DSS, but instead, we were granted one associate professor position for a five-year term. As I mentioned earlier regarding the endowed divisions, we have accepted that we need to secure resources on our own and have been raising donations from private companies. Using this private funding, we hire project faculty members and carry out our activities. Currently, DSS is operated with around three core faculty members. Within DSS, we are beginning to see some very positive developments — for example, faculty members from other departments have expressed interest in collaborating with our center, and we have found a few particularly enthusiastic colleagues who actively support our efforts.

I feel that through DSS, we are building new kinds of connections that cannot be measured simply by budget or staffing numbers.

[Aizawa] I have two questions regarding the "research funding-supported collaborative research." First, is there such a thing as collaborative research that is not funding-supported? Second, I would like to hear more about the design of this initiative—specifically, what you aim to achieve through these collaborations and what kinds of outcomes or impacts you expect.

[Sekimoto] As for our collaborative research, there are two types we have traditionally conducted: one involves lending data free of charge, and the other involves individual collaborative research projects based on formal contracts with private companies. In terms of numbers, the latter—contract-based collaborations—are fewer than the former, but they allow for deeper research.

The funding-supported collaborative research initiative is intended to accelerate research activities by providing actual budget allocations. Our main goal with all these efforts is not only to advance research within our center and university, but also to actively engage external researchers and expand the research community.

[Aizawa] So your stated objectives are things like promoting broader data utilization and revitalizing the research community, correct?

[Sekimoto] Exactly. To be honest, we have been offering data-lending-based collaborative research for about 25 years now, but it still seems to have relatively low visibility. Recognizing this as an issue, we have established a dedicated public relations team.

When it comes to the use of physical facilities, each project requires considerable resources, making it difficult to increase the number of users. However, for data use, the cost on our side is relatively minimal, so we are keen to encourage greater and broader utilization.

[Sezaki] Originally, collaborative research that was officially counted by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) was limited to projects that used our center's data free of charge. However, with the recent trend toward open data accelerating, we decided about five years ago to also support more fundamental research that may use external spatial data, and thus we launched the funding-supported collaborative research initiative.

[Aizawa] I see. Since it involves budget allocation, would it be possible to consider a concept that adds value, perhaps?

[Sekimoto] As you pointed out, there are cases where researchers from other universities approach us, saying, "We've created a dataset; could you register it here so that others can use it?"

In that sense, I believe there is potential for further development in that direction as well.

<Q&A Session 2>

[Nakaya] I believe that the methodological developments introduced by divisions like the Division of Spatial Information Analysis and the Division of Spatial Socio-Economic Research have tremendous significance for CSIS as a research hub. For example, SANET has served as a flagship project that has greatly raised CSIS's international profile. Since then, with various new developments underway, I wonder whether there have been efforts to promote open science—such as by publishing libraries or developing R packages—so that the methods can be more widely reused by others.

[Oguchi] As for models, we don't necessarily create programs entirely from scratch. However, we have published papers showing, for example, that combining existing machine learning libraries can improve accuracy. While this might not qualify as developing entirely new tools, I believe it still contributes to methodological innovation.

Regarding openness, when developing GIS educational materials and websites, we have made efforts to share them through platforms like GitHub, which is like a social network for programmers. This has generated a positive cycle, where unexpected people leave helpful comments, for example. In some cases, we have released GIS educational materials under Creative Commons licenses, making them freely available to anyone. In doing so, we've also been careful to use open-source software like QGIS to ensure that both our outputs and activities are kept as open and collaborative as possible.

[Yamada] Some individual researchers are publishing the programs and code they develop on GitHub or as R packages. However, because these are released individually and not officially under the CSIS name, they may not be widely recognized as contributions of the Center. In that sense, as you suggested, it may be important moving forward for the Center itself to publicize that it is producing such outputs.

[Takahashi] To add to that, regarding the development of statistical methods, some statistical R packages have been developed and released by Dr. Sugasawa and Dr. Kurisu, again as personal contributions. These are already being actively used, so in that sense, we are making a social contribution. That said, I agree that the Center could make a greater effort to promote these activities more visibly.

[Taniguchi] Listening to your presentation, I sensed there may be a considerable dilemma between conducting research that leads to Top 10% cited papers and initiatives for shared use of research outcomes that are expected by society. I would appreciate it if you could share your thoughts on how you manage or strategize the balance between "research that earns academic recognition" and "initiatives that meet societal

expectations."

For example, I personally think the development of pseudo people flow simulations across Japan is an excellent research achievement. However, adapting those simulations to meet the practical needs of transportation planning—such as improving the accuracy of analyses for both intra-city and inter-city transportation—might not result in papers that rank among the Top 10% cited papers.

Similarly, I find the work on estimating future costs of compact cities at the mesh level quite impressive. From the perspective of shared use, I would hope that those calculation results could be shared with local governments. However, again, I suspect that such work may not easily be acknowledged as Top 10% papers.

[Sekimoto] With regard to the pseudo people flow models, we do of course develop them with an eye toward making an international impact.

However, the original motivation was more practical: to provide low-cost simulation tools that could be useful even in regions with smaller populations—for example, helping decide whether to double the number of bus services. In reality, because pseudo people flow data are not real GPS data, there are areas where accuracy is lacking. Currently, we are working on the next stage: researching how much accuracy can be improved by incorporating a small amount of real GPS data into the pseudo flows. From the research perspective, we are building upon the foundation of pseudo people flow studies.

In terms of real-world application, we are collaborating with several local governments, particularly those involved in smart city initiatives, to create city forecasting platforms—what we now call "My City Mobility"—through web-based services. This aspect of our work is more focused on social implementation rather than aiming for Top 10% cited papers.

While we do try to fulfill both goals, in practice, achieving social implementation is the greater challenge. As for Top 10% cited papers, our approach is simply to keep working diligently, submitting solid international papers with the hope that they will be appropriately recognized.

[Mun] In the first presentation on the Division of Spatial Information Analysis, there was a mention of Transit-Oriented Development (TOD). TOD generally brings to mind the idea of planned developments around train stations. I would like to ask two questions:
First, to what extent has TOD-style development actually taken place in Japan?
Second, could you share any insights gained from more detailed analyses of pedestrian data?

[Yamada] In this study, we focused on Tokyo’s 23 wards. Rather than analyzing newly developed TOD areas, we assumed that some station areas already show characteristics of TOD, compared to others.

Typically, a high number of pedestrians would suggest a successful TOD. However, in our analysis, we used three indicators: the number of pedestrians, the length of their stay, and how much they move around in the area. Even in places with many pedestrians, some areas are mainly pass-through zones, while others encourage people to stay or move around actively.

We hope to use these variations to better understand what forms of TOD design should be aimed for in the future.

[Yamamoto] As someone working in local government, I would like to ask a question related to the use of your initiatives by various stakeholders, including municipalities and private sector players.

In your presentation, you mentioned that SANET receives about 100 usage applications, that you have worked with local governments to monitor road damage, and that the Urban Employment Area services involve various databases.

Could you share if there have been cases where public agencies have made inquiries or requests regarding these initiatives, or if there are particular areas that seem to attract especially strong interest from private-sector practitioners?

[Sekimoto] From my perspective, road damage monitoring seems to be one of the areas drawing the most attention. In addition, there has been a growing number of joint research projects with mobile carriers regarding human mobility data.

Around 2007, we launched the "CSIS People Flow Project," based on person-trip surveys, as smartphones were not yet widespread. Later, mobile carriers began producing human mobility datasets based on smartphone data. During the COVID-19 pandemic, government agencies and media outlets began to routinely present private-sector mobility data—showing metrics like "today's human flow" or "street-level flow"—which helped embed the concept of "people flow" more firmly in society.

Building on this growing societal recognition of "people flow", we are now moving forward step-by-step, for example by developing our own foundational models such as pseudo people flows.

[Aizawa] In the next five to ten years, I expect we will see a growing trend of using large models, such as foundation models, to connect fragmented fields of study.

Since many of the projects you presented involve deep learning, could you share any examples or ideas for collaboration based on deep learning models—or more broadly, any plans for generating synergy between different research efforts?

[Sekimoto] This connects closely with what I mentioned earlier about open-sourcing and open data. We are very interested in pursuing such initiatives. Ideally, we would also like to improve both the variety and quality of available datasets. However, doing so is quite challenging and requires a substantial amount of human resources. As our budget gradually increases, we hope to expand these activities and make meaningful, visible contributions over time.

[Ida] I would like to ask two major questions.

First, when it comes to the individual research being conducted, is there an effort to consolidate these works at the division level and make collective statements or claims as a division? Also, regarding the achievements of each division and the interactions between divisions at the center level, could you share your views on how these relationships might evolve in the future?

Second, I would like to ask about the degree of progress in achieving the Center's six-year plan as a Joint Usage and Joint Research Center. Since I did not hear much discussion on this point in the interim report, could you please comment on how much has been accomplished so far?

[Sekimoto] Regarding your first question, our Center is relatively small, so I feel that there are not strong boundaries between divisions. We have an all-center meeting every two weeks where everyone gathers, so we generally have a good idea of what research others are working on.

Rather than being strictly bound by divisional structures, we sometimes collaborate on research projects, apply for funding together, or co-author papers—though perhaps not as frequently as we would like.

One reason for this, as I mentioned earlier, is that many of our younger researchers are on fixed-term contracts. Since they are primarily focused on advancing their own research, it can be difficult for them to allocate time for broader collaboration. I believe that senior members, such as professors, or long-term staff need to play a more catalytic role in encouraging collaboration, and we recognize the need to work on that more actively.

As for your second question, regarding the six-year plan for the Joint Usage and Joint Research Center designated by MEXT, I feel that the ministry does not demand extremely detailed plans.

[Sezaki] In fact, the way we wrote our plan allows for a certain degree of flexibility. If the plan were too rigid, it would restrict our ability to adapt to changing circumstances.

[Sekimoto] Nevertheless, as I showed earlier, we are required to report our achievements very thoroughly, and these reports are scrutinized quite carefully. Therefore, we prepare detailed performance reports to ensure full accountability.

<Q&A Session 3>

[Nakaya] Is the ArcGIS site license something that CSIS must manage under the university's system? Also, are there any particular advantages or disadvantages to CSIS managing it?

[Oguchi] Providing the ArcGIS service is also a way for us to demonstrate that we are contributing to the entire university. Being mindful of our role within the university, we decided to purchase the license ourselves and provide it university-wide. That arrangement has continued up to the present.

[Sekimoto] The university as a whole is facing budget constraints and probably does not wish to take on the full cost centrally. Considering the significance of our center's contributions to the university, as mentioned earlier, I believe it is still reasonable for us to continue managing and providing the license for now.

[Mun] Regarding the services provided by CSIS, I imagine that maintaining them requires a high level of technical expertise and a significant amount of personnel. Is the budget for this secured through the university's operational subsidies? I would like to ask whether this setup is financially sustainable.

[Sekimoto] This is a very important aspect of our work—arguably the most essential part of our center's mission. Purchasing datasets, in particular, is costly. However, by handling those purchases ourselves, we can provide access to users nationwide for free, which creates a major benefit in terms of scale. Roughly one-third to one-half of our operational subsidies are allocated to data purchases and related activities. Since we receive many inquiries, we have formed appropriate teams consisting of faculty, researchers, and engineers to handle them effectively.

[Sezaki] To add to that, since our center has been designated as a Joint Usage and Joint Research Center, MEXT has requested that the university provide institutional support for us. In line with that, we have received special allocations from the university's operational subsidies every few years, which are used primarily for data purchases. Maintaining these datasets also requires a high level of technical expertise, and we have secured funding for the equivalent of three staff positions. In this way, we are receiving substantial support from the university headquarters.

[Yamamoto] Could you explain how the themes for collaborative research projects are decided? Do you accept most proposals as they come in, or do you narrow them down through discussions? I would appreciate it if you could share how the process works.

[Sekimoto] We receive about 200 collaborative research proposals per year. Basically, these are bottom-up proposals submitted by researchers themselves, so we try to minimize any selection or rejection and generally accept all proposals. For each application, the members of the Research Advisory Board review the research objectives before formally approving it, but in principle, there are very few cases where a proposal is rejected.

That said, occasionally, applications mistakenly come in from students. Since students may not be fully responsible for data handling and other matters, in such cases, we require that the application be formally submitted by a supervising faculty member.

[Taniguchi] I have two questions. First, regarding the continuity of data:

For example, you provide data that uses Person Trip Survey results, but I am concerned that if the Person Trip Surveys themselves are discontinued due to budget issues—though this would not be the Center's responsibility—it could still significantly impact your activities. I feel that, as a nationwide trend in Japan, there is a tendency for data that is in high demand to gradually disappear. Since I believe your Center has considerable influence, I would like to ask that you actively advocate for the continuation of crucial data sources.

[Sekimoto] Thank you very much. We would certainly like to advocate more proactively. That said, there are many uncertainties, so we also think it would be beneficial to develop complementary resources, such as pseudo people flow data, alongside existing datasets.

[Taniguchi] My second question concerns the structure of the Division of Joint Usage and Research.

Compared to the three divisions you initially explained, this division seems to have a slightly different orientation. I am not quite sure how these divisions relate to each other. Of course, I assume that the original three research divisions are also deeply involved in joint usage and research activities. If there are any strategies or concepts behind this organizational structure, I would appreciate it if you could explain them.

[Sekimoto] We sometimes receive comments that the structure is a little confusing, and I agree. As Prof. Sezaki explained earlier, the additional three faculty positions that were created when we were accredited as a Joint Usage and Joint Research Center by MEXT are now officially assigned to the Division of Joint Usage and Research, which contributes to the complexity. However, in practice, operations such as managing JoRAS and providing other CSIS services cannot be handled by the faculty members in that division alone. If CSIS were no longer designated as a Joint Usage and Joint Research Center, we would likely be unable to provide services nationwide. Therefore, we have agreed internally to distribute responsibilities across all members to maintain stable and balanced operations.

[Aizawa] I was looking at the JoRAS page and understood that when applying for a project, users can select and combine multiple datasets. In doing so, is there any difficulty regarding interoperability—for example, mismatches in data formats or the need for data conversion before datasets can be linked? I assume that if the datasets were developed independently, such issues could arise. How do you support users in dealing with those kinds of challenges?

[Sekimoto] For example, combining datasets like Zenrin's Zmap-TOWN II residential maps with real human flow data or GPS data is a common practice. In most cases, researchers are capable of overlaying and using such datasets without much difficulty. Since all the data we provide are geospatial data tied to specific locations, our general impression is that users are able to work with them relatively smoothly.

[Ida] I have a question regarding outcomes when collaborating with other departments. For example, if you collaborate with researchers in medicine, do you publish the results as a medical paper, a spatial information science paper, or under another field? I would like to know how you decide on the form of the research output.

Also, I have a question about regional collaboration. You mentioned activities in consortium-style partnerships with local governments in Susono City (Shizuoka Prefecture) and Nanto City (Toyama

Prefecture) through DSS. I understand these are currently experimental efforts. Could you share your strategy for expanding such initiatives nationwide?

[Sekimoto] Regarding your first question: Typically, the main author determines the field where the paper is published. If the lead researcher is from the medical field and our center's role is more supportive, then publishing in a medical journal would be fine. Conversely, if it seems appropriate, we might also publish separately in a spatial information journal.

From our perspective, the main goal is to promote DSS activities, strengthen networking, and increase the number of collaborative projects across departments. We aim to create new projects and obtain new funding by leveraging each other's assets. Therefore, we do not insist that the papers must be published in our field's journals; it is acceptable for them to be published in the collaborating partner's field as well.

[Ida] We also tried collaborating with other departments, but although information exchange was possible, it was often very difficult to produce tangible outcomes, and in the end, we frequently ended up publishing individually. So, I would like to ask how you manage to produce joint research outputs as actual projects.

[Sekimoto] We do not have a strict rule requiring that all collaborative projects result in co-authored papers. It depends on the level of contribution. If one side's contribution is very minor, publishing separately is understandable. However, we are now making a conscious effort not to simply provide funding and leave it at that. For example, we encourage holding regular monthly meetings after funding is provided. Through such interactions, communication deepens over time, and it becomes easier to produce joint papers. I think it would be interesting to track these collaborations over time.

As for your second question regarding expanding case studies in regional collaboration: I agree that this is a very important point. The Global Spatial Data Commons Initiative (GSDC), a division within DSS, has signed comprehensive agreements on digitalization with Susono City (Shizuoka) and Nanto City (Toyama) about four to five years ago. These activities are more oriented toward social implementation. We are testing how much technical support we can sustainably provide for specific local needs and whether we can continue supporting projects until they are fully solved. The goal for GSDC is to support about 10 municipalities over the next three to four years. In November of this year, we signed an agreement with Takehara City (Hiroshima Prefecture) as our third site, and we plan to sign another with Ichinoseki City (Iwate Prefecture) this winter.

Since starting support for Susono and Nanto, we are now about halfway through the intended project period. We have begun to understand better how to offer common know-how that could be applied to other cities. We are also receiving increased cooperation from private companies, such as offers to provide GPS data for free if used within local areas. Moreover, since it is difficult for us to bear all the costs, we have started discussions about whether local governments could partially support the projects financially. With these developments, we are becoming more confident that we can expand this model to other regions.

<Review and Discussion>

[Ida] I believe that each individual research project presented today is highly advanced and excellent. Based on that, I would like to offer three comments.

First, regarding the structure of collaborative research, which I also asked about earlier: At many universities, even when collaborative research is attempted, it often stalls after initial exchanges of ideas, with difficulties arising when it comes to publishing joint research outputs. I hope your center can become a pioneer in establishing effective collaborative research frameworks.

In terms of collaboration, it might also be valuable to incorporate psychological studies related to human

movement. Moreover, considering today's presentations, I feel that applying these spatial information systems to support people with disabilities—such as helping those who are deaf, visually impaired, or using wheelchairs navigate more easily—could further enhance the societal significance of your work.

Second, about the importance of education: While educating university students is of course critical, there are many pressing issues in the broader education sector. For example, setting school routes for students is often done based on experience rather than data-driven analysis. Given that today's presentations included analyses of traffic flow, people flow, and temporal patterns, if your work could help propose optimal school routes, it would significantly ease the burden on teachers. Rather than focusing only on teaching GIS technologies, contributing to education by applying your research outcomes could strengthen the Center's role and relevance. Of course, I understand the importance of conducting international research, but I also believe the importance of social implementation has been well recognized.

In that sense, if you could provide tools and insights that benefit educational settings nationwide, it would be highly meaningful. Additionally, regarding current issues such as children's interactions with social media, I feel the Center could also offer valuable information and analysis.

Third, regarding social contribution: In the geography field, there is a resource called the "Konjaku Map" (historical maps database), which was previously managed by a professor at Saitama University.

After the professor passed away, there was a major concern as there was no institution to take over its management. Since this resource is widely used by elementary, junior high, and high school students, as well as university students across Japan, it is highly versatile. When your Center agreed to take over its management, it was received with great appreciation. While it is wonderful that your Center develops and offers new resources, I also hope you will continue to manage important resources that cannot easily be handled elsewhere—resources that are accessible to schools, society, and the general public nationwide.

In addition, effective outreach is crucial for promoting such social contributions. Rather than reaching only a limited audience, I hope you can find ways to reach more people—including local governments—so that they recognize the value of your services and actively use them. This would further enhance the significance of your Center's activities.

[Nakaya] I was truly impressed by the wide range of excellent research presented—there is absolutely nothing to criticize about the quality of each project.

That said, I feel that incorporating expressions like "the world's first" would enhance the appeal of the work and reinforce the reputation of CSIS and the University of Tokyo. As a fellow researcher in Japan, I would be very proud if you could continue to showcase more initiatives in that spirit.

Personally, I have long been interested in spatial data analysis, and I feel that spatial data is now gaining importance in fields like data science, computational social science, and the digital humanities. There is also a growing number of amateurs and professionals handling spatial data in society at large, and I have even had journalists approach me with questions about spatial data analysis. In this context, I hope CSIS can serve as a one-stop hub for supporting everyone from amateurs to professionals in spatial data science.

The collaborative use of GIS data is extremely valuable, and I believe the Center's efforts to create new data, such as people flow data and pseudo-people flow, through internal processing and unique methods, are quite rare even by global standards. I hope you will continue to expand such initiatives. For instance, since you already have pseudo-human flow data, perhaps you could next develop something like pseudo-Street View?

Finally, regarding archives like JoRAS, I hope you will continue to enhance and expand these services. I

also learned for the first time today that CSIS's services have been subtly incorporated into the maps of the Geospatial Information Authority of Japan. I think it is wonderful that APIs and services enabling secondary use are being released, and I hope you will continue your efforts. You have my full support.

[Sekimoto] Thank you for mentioning the importance of collaboration with emerging fields such as computational social science and digital humanities. Within DSS, we are also well aware of developments in computational social science. In terms of digital humanities, we are actively collaborating with institutes like the Historiographical Institute, and projects are starting to take shape with scholars interested in working together. We would like to accelerate these efforts even further moving forward.

I also appreciate your comments on pseudo-human flow and original content creation. Beyond pure academic research, we recognize the importance of being able to produce our own open-source content and provide data ourselves, even from a national security perspective. While it is difficult to execute perfectly, we hope to preserve this culture.

Regarding Street View, one of our recent PhD graduates has worked on a project where citizens can input descriptive words—like "clean," "organized," or "lively"—and generate new Street View images reflecting those conditions using generative AI. If we can develop this into a practical service, it would be very exciting.

As for the integration with national map services, we have become so accustomed to it that we often forget to promote it properly—perhaps we should be more proactive in our PR efforts.

[Nakaya] In social sciences, especially sociology and economics, there has been an explosive increase in research using microdata. In this context, it is becoming more common to attach geographic background information, cumulative regional data, and abstract spatial relationships to the datasets. The Social Science Japan Data Archive (SSJDA) at the University of Tokyo is one institution promoting secondary use of survey data. I personally hope that CSIS and spatial information science can also contribute more broadly by collaborating with such initiatives.

[Sezaki] Let me add some explanation. We are very conscious of this issue as well. In addition to the data we already provide, there are other datasets—some directly linked to spatial information, and some from social science surveys—that we aim to make more easily usable across fields. On the first slide of the DSS, we have already declared an intention to integrate and enable cross-use of such data. We are also planning to incorporate the data into large university databases, like MDX, to make them more accessible and to encourage research use. However, a shortage of human resources means we are not yet able to push this effort as strongly as we would like.

Related to this, as Professor Aizawa mentioned earlier, it is very important to properly format indices and publish them in a standardized way. While there are simple datasets, many spatial datasets are complex, often involving not only spatial but also temporal and spatiotemporal information, making them much harder to handle compared to data types like images or language. We have declared our commitment to make spatial data more accessible and structured for researchers.

[Sekimoto] As a second supplement: Within DSS, we are putting significant effort into building a base registry for geospatial information and hold quarterly research meetings on this topic. Currently, information provided by various national agencies—such as roads, rivers, and buildings—is quite fragmented. We are working to create an integrated system where, for example, if you input an ID for a facility, road, or river, it returns related attribute information, or if you input latitude and longitude, it returns the corresponding ID. While geolocation information is useful, it raises privacy concerns, so we are also considering ID-based operations. This field is low-profile and labor-intensive, and although progress is slow, we believe it is highly original and meaningful. Despite receiving low evaluations in university budget requests over the past one or two years, we continue to build the basic infrastructure, supported by external donations. In the future, we

hope to promote these activities more visibly to society. Thank you very much.

[Taniguchi] After listening to the various explanations, I now have a very clear understanding of your activities. In the past, we had to input data manually, and CSIS has helped transform that world. In that sense, I hope CSIS will continue to serve as a central institution that values high-quality data and lead the development of Japan's data culture into the future.

I believe that maintaining the motivation of Center members in their research is crucial. One issue currently occurring at many universities, including ours, is that researchers are overly constrained by evaluation criteria, which can undermine their motivation. I hope CSIS will continue in a way that fosters and maintains strong motivation among its members. As for your societal contributions, they are beyond question, and I encourage you to continue those efforts as well.

On the other hand, I would like to raise a few concerns. Looking at the staff transitions on page 9 of the self-assessment report, it appears that the number of members has decreased between 2021 and 2024. In particular, administrative and technical staff have been reduced from 20 to 11 in three years—nearly half. I am concerned that this could gradually have a serious negative impact, much like a body blow. Additionally, as shown on page 16, scientific research funding also appears to be trending slightly downward. Although you mentioned securing "other grants" as well, I would appreciate it if you could later provide a brief explanation regarding these points.

Moreover, I believe that one of the Center's future tasks will be to place greater emphasis on archiving—properly preserving historical maps and similar resources. Are there any measures being considered in this regard?

Another potential issue is that, even when excellent research is conducted by Center members, if they leave, it can become difficult to pass on their work. I think strategies to address such losses should also be considered.

Finally, we are entering an era where even datasets themselves may contain fabricated information.

Under such circumstances, how to maintain a culture of reliable data is an important challenge, and I feel it is something we must work together to address.

[Aizawa] Thank you for presenting such a wide range of research centered on spatial information. While CSIS has a long history, I found it very attractive that it remains unique and consistently addresses cutting-edge needs alongside the advancement of the digital society. I was also impressed by the interesting and vibrant research activities of the younger faculty members. In terms of securing funding, the establishment of the Sponsored Research Division and the Social Cooperation Research Department is a remarkable achievement. I also felt that operating the JoRAS system as a foundation for collaborative research is crucial to fulfilling your mission.

I have three comments regarding the future.

First, providing stable services over time requires considerable cost and effort. I believe it is important to make the challenges and the value of such sustained efforts more visible and to advocate for them. I hope you will actively communicate the difficulty and importance of continuing such operations.

Second, regarding collaboration: You clearly explained the three layers of collaboration—within CSIS, within the university through DSS, and with research institutions nationwide through collaborative research—and I understood them well. However, when it comes to distributing data to companies or overseas, discussions around legal issues, personal data protection, and similar matters will likely become necessary.

As these collaborations expand, I believe it will be important to prepare for and engage in such legal discussions to some extent.

Finally, with the arrival of the AI era, we are facing a crisis of data scarcity. This has become a critical issue for Japan as well. While geographic data itself may not need to increase dramatically if its quality is maintained, I believe it would be valuable for the Center to articulate a vision regarding how much to expand the volume of data going forward. Beyond simply providing existing data, it would be interesting to hear how the Center plans to move forward—whether by installing sensors to gather new valuable data, working with synthetic data as mentioned earlier, and overall, deciding the scale and scope of the data it aims to handle.

[Mun] Since my field of expertise is urban economics, I would like to focus my comments mainly on the Spatial Socio-Economic Research Division.

Regarding research, since the early 2000s, spatial economics has seen major developments worldwide, and Japanese research achievements have played a significant role within that trend. Within this context, Professor Takahashi has been producing leading research results and has taken on a highly influential role. He currently serves as the president of the Applied Regional Science Conference, further demonstrating his leadership. Recently, he has also expanded his research into new areas, such as the aging society, and I believe he is producing excellent outcomes.

Among younger researchers, Lecturer Otsu and former member Lecturer Nakagawa, who has since moved on, have both conducted very unique and outstanding research.

In terms of methodology, Associate Professors Sugasawa and Kurisu have published in very high-ranking journals, and their research results are truly excellent.

Additionally, former young researchers who once held fixed-term positions at CSIS—such as Professors Kidokoro and Kawabata, whom I know well—are now actively contributing to academic societies. I believe that CSIS has achieved remarkable success in fostering such talented individuals.

One point that caught my attention in today's report is that the updating of the Urban Employment Area (UEA) data has been halted. At the municipality level, famous statistical patterns such as the rank-size rule often do not appear clearly, but when viewed at the UEA level, these patterns are properly observed, making the dataset extremely valuable. Perhaps the mission of the UEA data has been completed, but alternatively, there may be a need for a new form of public good to replace it.

As I mentioned earlier, although it is understandably difficult to operate a tenure-track system within a small division, I believe it is very important to create opportunities for excellent young researchers to remain at the Center. Currently, securing talented young personnel is a major challenge everywhere. Therefore, I think it might be necessary to devise mechanisms that allow outstanding individuals to continue beyond the expiration of their fixed terms.

[Yamamoto] I was once again reminded of the remarkable diversity of activities being undertaken at CSIS. As the use of spatial information has expanded throughout society over the past five to ten years, the Geospatial Information Authority of Japan has also reaffirmed the importance of maintaining and updating our base maps (the Basic Map of the National Land). Looking ahead, with the public release of 3D maps and point cloud data expected to progress, I feel that further development of the base maps will be necessary.

Although the use of spatial information is spreading, there is still a significant disparity among local governments in terms of their awareness and utilization of geospatial information. While municipalities receiving support are highly aware, there are still many regions nationwide that are lagging behind, which I see as an important challenge. As a request to your Center, I would like to ask that you continue to widely

showcase advanced initiatives, strengthen your public outreach efforts consistently, and maintain a strong focus on promoting real-world implementation.

[Sekimoto] Thank you very much for all the valuable comments. Rather than responding to everything at once, I would like to address the main points in order.

First, regarding Professor Taniguchi's comment about the decrease in staff and KAKENHI (Grants-in-Aid for Scientific Research), we are aware of the situation and recognize the need to address it properly.

However, as I mentioned earlier, because the number of faculty members at the Center is relatively small, the departure of even one person can have a noticeable impact. For example, the decline in research funding is partly due to the retirement of a faculty member who had secured significant external funding. As for the reduction in administrative staff, this includes counting secretaries attached to each laboratory. When professors leave or transfer, the associated two or three secretaries often leave as well. While there is this kind of turnover at the individual lab level, at the Center's administrative office and among URAs (University Research Administrators), we have not actively reduced hiring; in fact, we recently hired a new URA to help reduce the faculty's administrative burden.

Regarding research funding, although there are areas where it has declined for some individuals, we will continue treating it as a high-priority issue and work on countermeasures.

On the matter also raised by Professor Taniguchi—that with personnel changes, valuable assets such as data might be lost—I completely agree. For example, JoRAS operations have been running for quite a long time, and the systematic nature of the operation is now well established. Since these tasks are handled by teams, we do not rely solely on individuals, and operations have been sufficiently standardized. However, it is true that if individual researchers who developed specific datasets move elsewhere, those datasets could become obsolete. We have not yet fully addressed this issue, but we would like to find ways to build relationships that benefit both CSIS and the departing researchers.

Regarding the archiving of map information, the G-Spatial Information Center has made significant progress in archiving and publishing data from national and local governments and private companies. With a clearer division of roles between the academic side and the G-Spatial Information Center, the academic sector is shifting toward developing original data, such as pseudo-people flow datasets, rather than simply collecting existing data, and also taking on challenges that are difficult for government organizations due to vertical divisions.

Regarding fake data checks, we can only say that we are aware of the issue and will make efforts, but I think it is an excellent research idea in collaboration with the humanities and social sciences, and we would like to pursue it.

As for Professor Aizawa's point about internationalization and collaboration with private companies, personnel exchanges and collaboration with the private sector have been progressing through initiatives like the G-Spatial Information Center.

Regarding internationalization, as mentioned in the MEXT mid-term evaluation, we recognize the need to further globalize JoRAS.

Director General Yamamoto also raised the issue of disparities in the utilization of geospatial information among local governments. While this is a difficult challenge, we have been receiving requests through our sponsored research divisions and private sector partnerships. We would like to develop minimal yet scalable operational models that enable us to deliver education and support using limited resources, possibly in collaboration with the G-Spatial Information Center.

Finally, regarding Professor Mun’s comment about tenure-track and fixed-term positions for young researchers, we would like to explore various ways to address this as well.

[Takahashi] Regarding the Urban Employment Areas (UEAs):

As you pointed out, the UEA data has been widely used and is very valuable. However, currently, most economic data is collected at the municipal level. Due to municipal mergers, the basic units have become larger cities, and consequently, urban areas defined based on these units no longer align well with the actual metropolitan areas. While it is possible to consider using mesh or neighborhood-level data as a base, it would then become difficult to handle data available only at the municipal level. We are now at a point where a fundamentally new approach may be necessary to address these challenges.

2. Minutes of the External Evaluation by International Committee Members

○ Date and Time: February 5th, 2025, 10:00-17:00

○ Venue: Conference Room, 3rd Floor, Itoh International Research Center, The University of Tokyo

○ Committee Members: Kristian Behrens (Professor, Université du Québec à Montréal, Canada), Jiannong Cao (Professor, The Hong Kong Polytechnic University, Hong Kong), Helen Jarvie (Professor, University of Waterloo, Canada), Perry P J Yang (Professor, Georgia Institute of Technology, USA), Huijing Zhao (Professor, Peking University, China)

○ CSIS Members: Yoshihide Sekimoto (Director and Professor), Ikuho Yamada (Vice Director and Professor), Kaoru Sezaki (Professor), Takashi Oguchi (Professor), Takaaki Takahashi (Professor), Daisuke Kurisu (Associate Professor), Dinesh Manandhar (Associate Professor), Yuuki Nishiyama (Lecturer), Yuki Otsu (Lecturer), Takahiro Yoshida (Lecturer), Yanbo Pang (Project Lecturer), Kotaro Iizuka (Assistant Professor), Abel Pinheiro (Assistant Professor), Yuriko Yazawa (Project Assistant Professor), Andrea Hamm (Visiting Researcher), Yusuke Kimura (Project Researcher), Naoki Mihashi (Project Academic Specialist), Ai Suzuki (Project Academic Specialist), Shinobu Iiizumi (Administrative Staff), Yukiko Jennings (Administrative Staff)

○ Agenda (Honorifics are omitted)

- Introduction of the Evaluation Process (Sekimoto)
- Introduction of CSIS (Sekimoto)
- Q&A Session1
- Research Activity of the Division of Spatial Information Analysis (Oguchi and Yamada)
- Research Activity of the Division of Spatial Information Engineering (Sezaki and Sekimoto)
- Research Activity of the Division of Spatial Socio-Economic Research (Takahashi)
- Q&A Session2
- Research Activity of the Division of Joint Usage and Research (Sekimoto)
- Research Activity of the Division of Spatial Formation for Innovation Hubs and its Evaluation (Yamada)
- Research Activity of the Collaborative Research Organization for the Digital Spatial Society (DSS) (Sekimoto)
- Services Offered by CSIS (Nishiyama)
- Q&A Session3
- Review and Discussion

○ Minutes (Honorifics are omitted)

<Q&A Session 1>

[Cao] You talked about the position of the research institute, same as graduate schools and other research units. Do you have also students or just staff members?

[Sekimoto] Our faculty members are usually related to the related department such as the civil engineering or urban engineering or geography or economics or something like that. Yes, usually, we can take students from the related department.

[Cao] Another one is that you have very impressive achievements over the years. What actually will be the main KPIs for this research institute?

[Sekimoto] As I told you before, the Ministry of Education requested us to have a number of the

publications itself or including external researchers who used joint research or something like that. But recently, they requested more, focusing on to the top 10% papers or, related to the impact factor or something like that. In that sense, they request more, not only the number of the publication itself.

[Jarvie] I guess one of the things I was interested in, and I think you brought it up in terms of the midterm evaluation, was a desire to increase international research activities. I wonder if you can tell us a little bit about your strategy and plans to expand your international remit.

[Sekimoto] The first step is the internationalization of JoRAS website. At this moment, we already have the English explanation, but this is just a simple translation from Japanese. From the view of the international researchers, we have many rooms to improve the website itself. But not only the website, but also the dataset itself should be improved. Because the explanation of the dataset itself is Japanese in many cases. Dataset explanation should be also international—in English or other widely used languages.

Then, of course, relationships or the human network itself is also very important. In that sense, recently, we set up the travel support budget, support money to the young researchers inside of CSIS. If you have any other suggestions, please tell me now or later.

[Jarvie] Thank you. Maybe we can chat later. But I noticed that you have a public relations team now to help with these activities, so that's I think really promising.

[Yang] I have one comment, one question. The comment is the observation about your faculty number and also the budget. From 2021, the faculty number decreased every year. The budget is kind of pretty much stable but slightly decreased, which is quite good. I think that the budget is not dropping down quickly.

My question is about the budget—you have budget from the government and external funding, right? There are two parts. And there is a few corporate funding. For example, the corporate funding from Mitsubishi Estate, as I believe you mentioned in your presentation. Also, from the report, there's funding from MLIT—the Ministry of Land, Infrastructure, Transport and Tourism— related to the urban digital twin. They are quite substantial. I think what is the policy from CSIS about external funding versus government funding? Are you aiming for more external funding in the future or what is your policy and strategy for this budget situation?

[Sekimoto] About the external budget, we do not have a specific policy because some members are strong at the relationship with the commercial companies, but some other members are strong at the national budget or national ministries. It depends on the faculty members. But in the case of the University of Tokyo itself, recently, they strongly suggested having a commercial budget, commercial industrial budget because the national government budget is some kind of not so flexible. The industrial budget is more flexible.

[Behrens] I also had a question with regard to the budget. From what I understand, most of the budget that comes from external funds from the private sector is specific to projects. I was wondering, do you have anything like a budget that can serve to endow chairs or things like that?

Because I noticed also from the report that especially in recent years there are lots of projects where there are on a yearly basis coming in smaller amounts, which creates a lot of overhead because these things have to be managed. I was just wondering whether it would make sense to approach a few major partners and say like look, we could have, I don't know, the Mitsubishi endowed chair in Spatial Information Science and can you give us a multi-year grant to fund these things? I don't know if there's any plan at the university level to, for example, have something that's equivalent to endowed chairs to hire additional faculty or things like that.

[Sekimoto] Actually, we have three types of the kind of endowment-type research divisions for these three. In that sense, it's a very flexible budget for us because endowed-based budget is very flexible. The University

of Tokyo itself is very emphasizing now to get the endowment from the private sectors. But, of course, this is based on the long-term relationship or trust with the, for example, geospatial industries itself or the real estate industries itself. In that sense, at first, that kind of long-term relationship or trust is very important.

[Zhao] I have a question or a comment. I noticed that there's a decrease in the number of the full-time faculty members. Are there any restrictions from the university or do you have any plans to enlarge or increase this number?

[Sekimoto] In some cases, maybe two long-time faculty members retired at this moment or moved to private sectors. In that sense, these 2 years have had a little bit less publication. But it depends on the situation. Maybe I believe this is not pure decreasing movement or trend, I think.

[Zhao] Okay. I also noticed that in the document you sent to us that the CSIS placement. Yes, on page number 10 there's a figure, number of faculty and staff. There's a decreasing tendency of the number of faculty and staff.

Are there any restrictions from the university or is there any way to maintain the volume or the scale of the faculty members?

[Sekimoto] You are correct. But we don't have so much strong constraint or capacity now. This is the total number of the CSIS, including the staff itself. If two faculty members retire or move to other institutes, so other researchers or secretaries in that university also move to other institutes. In that sense, immediately after the movement or retirement, two or three years, the number of the total members is decreasing. But this is not a fixed trend, I think.

<Q&A Session 2>

[Yang] It's very impressive. I would like to have a very quick comment to first and second division. The first one on spatial information analysis. This division, the research ranged from geomorphology to urban analysis, from nature to city, right? I think there's a very comprehensive analysis from large-scale analysis to micro-scale mapping, and using high-definition topography, Professor Oguchi; and also like drone remote sensing to urban neighborhood thermal mapping, Professor Yamada.

My observation is a very comprehensive research framework. We might compare this piece of work with other leading laboratories in other universities, like CASA in UCL, Center for Advanced Spatial Analysis in London. I would say this level of research is very high and advanced, in my observation, because I have a question in mind. I think it's so comprehensive, but then what would be the central research question from here that is addressing the prompting problem today?

Because climate change is one of them, right? I think that the research agenda might be leading this research division to the next step. I think I really appreciate this presentation, very strong.

My observation for the second group, the Spatial Information Engineering Division. First of all, I see that urban technology using IoT ubiquitous computing or pervasive computing, and Professor Sezaki talked about the methodology from acquisition from capturing real-time data using IoT sensors, turning to analytics or analysis. And as a second step to the application for urban problem such as urban planning and so on. I think that piece of work is amazingly impressive to me. Especially those near real-time data are producing high frequency data. It's kind of a high-frequency city we are tackling today, and I see lots of potential application between the two divisions, between the two. And also, the work from Professor Sekimoto and people flow, also high frequency data.

But at the same time, you are handling urban digital twin. This is a very exciting emerging area. We are still far away from actual digital twins. We are moving in that direction. I think nobody has done urban digital twin. It's much more complicated than aircraft going to the moon, right? According to my colleague from aerospace engineering, urban digital twin is the vision, and you might steady forecast projecting not only high frequency data but projecting future urban development, like next decade's urban population decreasing.

And so, I am interested in seeing that connection between high frequency city near real-time data, like human flow and so on, and low frequency city forecast. That will be really exciting, that connection between the two.

My comment for this division is that we may compare the piece of work with, again, another leading laboratory in the world, MIT Senseable City Lab, Carlo Ratti. I think they are amazing. They have lots of resources. The resource is huge. They get a lot of funding. And I do see similar level of research quality from this group. Maybe we may look into how the strategy for organizing this kind of research, I mean funding strategy to expand the research. There's a huge amount of optimism from this group.

[Oguchi] Thank you very much for the detailed and encouraging comments. Concerning global warming, I think it's a really key issue and I talked a little bit about his work about monitoring the urban heat environment. But also, my laboratory deals with geomorphology, landslides, rainfall-induced ones. It will be more serious under the global warming conditions. Because just simply in the case of Japan, if sea surface temperature in the Pacific is high, we have stronger cyclones or more frontal activities or like that. Actually, we are facing the increasing number of landslides.

The traditional analysis usually considers only land conditions for susceptibility analysis because the triggering factors like rainfall and earthquakes, it's occasional, right? Normally, we just use land information. But now, we are seriously thinking about introducing also triggering factors, particularly rainfall. That's an important issue.

For the leading laboratories in the world, in my case I try to work with some leading scientists, not necessarily laboratories. For instance, CASA, I think, is focusing more on social aspects, not physical aspects. So, for example, I have a collaboration with one Italian researcher called Alessandro Mondini and he's one of the leading scientists in the field of landslides, InSAR, or like that. I am trying to develop something like that in my case.

[Sekimoto] As for the second point, we always take into account global competitiveness, such as MIT and other leading institutions. In fact, my first Ph.D. student stayed at the MIT Senseable City Laboratory for half a year. In that sense, we have some connections or collaboration with them.

Strictly speaking, we don't have any large international collaboration projects at this moment, because managing such a project is very difficult. I am working on several national government projects related to the Urban Digital Twin including the Mobility Digital Twin, Disaster Digital Twin, and Infrastructure Maintenance Digital Twin. These projects are limited to Japan. Therefore, I would like to work on a truly international project — a large-scale project.

The road damage detection data collaboration is an advanced international collaboration project. One reason is that it is led by an Indian project researcher in my laboratory. She has a very international background, which contributes to the project's international nature.

[Behrens] I had a couple of questions, so I think this is really impressive. There's a lot of work and a broad breadth of products that I actually worked on at the center.

One question I was thinking about is so there's a lot about producing data. There's producing new technologies for measuring and producing the datasets actually. I come more from a background where we are users of data, so we are not good at producing data but we're really good at using the data to look at the important societal and economic questions. And so, I was wondering, so within CSIS, is there a collaboration between the data-producing units and the data-using units?

For example, I was thinking about this fantastic animation about the flow of mobile phone data across Tokyo, which is data that we love to use to think about a number of questions, like neighborhood change, like how do jobs change, how we can measure a certain number of things that we don't see in more traditional administrative data.

I was wondering, for example, the socioeconomic division, are they using those data? Are there talks between, like, the different divisions at CSIS, like in terms of we would need that data to look at this question and then data could be produced. I was thinking more like a coherent package, going all the way from generating these datasets to exploiting the datasets later on within the center.

That brings me to my second question. You talked a lot about these demands that you are facing about publishing in the top 10% cited papers, whatever that means, so it's not very clear to me. Another thing that's really, really important and for a lot of good places is actually the datasets that you are producing, how are they used, by whom are they used, how often are they downloaded? There are lots of KPIs that you can actually generate concerning the data and the technology that you produce. Is there something systematic here to monitor this? Like those institutions, those teams that are using our data, this does not necessarily show up in more traditional citation measures, but it's really, really important and there are a number of places that have built the reputation and actually producing those datasets and using them. I think this is something that's probably also to put forward a bit more strongly.

My last point was – and this is because I was using the data and I thought this was actually data that comes out of CSIS, but it's not. It's, for example, the IIS at the University of Tokyo, they have this hydro-merit dataset for example.

Which brings me to my question. There are a lot of places at the university where huge databases and original data are generated and maintained. Is there anything within the University of Tokyo that would be pushing towards having one sort of central place that would federate and maintain those datasets and would this be something where CSIS is actually well positioned to sort of serve as a sort of umbrella under which you could basically like collate and interface those data and actually provide a sort of very large repository of data. Because there are large scale economies in maintaining these infrastructures for actually accessing data, etcetera. I was just wondering whether this is something that could fall in the future under the mandate of the center.

[Sekimoto] For the last comment, actually even in the University of Tokyo itself, there are some researchers who are developing the very original and very powerful dataset in the world. I also belong to IIS. His name is Professor Yamazaki. He is very famous for water drainage data. Anyway, of course, CSIS should work on centrally integrating and managing such datasets.

That is why we started the DSS, Digital Spatial Society, integrating 18 departments. At this moment, we are just developing the prototype by selecting representative data from individual departments and displaying them according to their scales. But as you pointed out, we would like to collect more data, integrate it, and visualize it. In that sense, we are doing the University of Tokyo Digital Twin and initiatives together with researchers from various fields.

As for collaboration on the dataset developers and users, of course, there are no barriers within CSIS,

because we are very small institutes. In that sense, we are always communicating and it's not difficult to share the opinion about the user and providers, developers. But in many cases, it takes so much effort to develop the data and improve the dataset itself because we also have the users from outside of the CSIS, like joint research users. We simultaneously receive many opinions from them. We need more resources, particularly human resources, to maintain the dataset itself. The employment of personnel depends on the project's funding.

[Takahashi] I agree with you, Kristian. One of our programs is to bridge the data producers and data users. And for social scientists the data is too big to use. We need to customize the data. But actually, in fact, we don't succeed in that attempt. Yes, I know that it is one of the very important agendas. But one thing is in the JoRAS system, some social scientists use the big data, and we have some synergy between those two divisions. I think in the future that young researchers will use that kind of big data. Probably now, we have some problems about that. It is true.

[Jarvie] I think I'd like to pick up on the question with regard to collaboration across the CSIS divisions beyond just data integration and the like. I wonder whether you can comment a little bit on the benefits of working in a relatively small institute, but with different disciplinary approaches. You have human geographers, physical geographers, engineers, social scientists working together. What are the benefits of being in this institution for leveraging those multidisciplinary approaches?

[Sekimoto] It's difficult to give a good answer. Originally, our center started with spatial information science. Application fields are various. That is why we gathered. After the start of the CSIS, 20 or 25 years almost passed. After that, the big data trend already came, and the AI trend also came. In that sense, data-oriented research is always increasing. Our motivation is kept based on the data technologies or data-oriented academic research. This is one of the motivations in our center, I think.

[Jarvie] Professor Takahashi mentioned one specific project which is cross division working on geographic agglomeration of homeless people, flying drones. I guess it's those kinds of opportunities of bringing together different disciplinary approaches.

[Takahashi] Exactly. I think it's a very novel attempt. I hope that such kinds of studies will come in the future.

[Oguchi] I'd like to give one example of collaboration between divisions. I introduced one research of my Ph.D. student about prediction of archaeological sites. She first used just normal statistical methods, but she wanted to introduce machine learning. Then, she met another student from China. She belonged to Professor Shibasaki, a former member of CSIS. They became friends and she told her lots about machine learning. In the end, these two students and I co-authored that paper. This is not kind of intentional. This happened naturally. But just because we are staying together within a unit, so there are some benefits sometimes like this.

[Jarvie] Yes. Sometimes, a relatively small grouping of people can be. There's more chance of those serendipitous collaborations coming about. Thank you.

[Cao] I think members already asked questions. First of all, I think the presentation covers different domain area applications and it's also a very wide scope of research projects. I think all of them are very, very good research projects. I'm more familiar with the engineering part, so system sensing and then modeling and behavior analysis, etcetera. But, actually, as Professor Sezaki mentioned, there's a shift from model driven to the data-driven AI. I think that probably paradigm shift also applies to many other areas, social, economic, etcetera, all these different models.

My question is that for this kind of a model shift, some investigation using AI like large language model because it's getting very popular now. People use the large language model for different domains. Also, many of the data actually are quite confidential and private. Many people are using federal learning, this kind of thing. My question is, is there any research actually developing this kind of more advanced AI models?

The second one, I think following Kristian's question, I think there's many, many multidisciplinary research, but how about interdisciplinary research, I mean, inter research center research? Because although you have different kinds of domains, but the common ground is special information sciences. On the research on spatial-temporal data, I think all the centers probably have focus on the fundamental methods. Any sharing of the research and fundamental models for spatial data analytics, spatial-temporal data analytics. Because spatial-temporal data analytics is a very hot topic, and there probably you can have some common ground for different application domains.

Those are my two questions.

[Sekimoto] As for the second question, it concerns spatial-temporal research or modeling. Of course, the biggest example is the people movement data analysis, as they have such spatial-temporal models. Especially Dr. Jiang, a lecturer in CSIS, specializes in this area. He is developing spatial-temporal modeling about the people movement data using various kinds of the mathematical running models. Recently, he has been publishing in NeurIPS or AAAI. In that sense, he has good papers integrating mathematical spatial-temporal modeling and running machine learning techniques at first.

Then, as for the first question about the LLM model, of course, some of our members are trying to develop it. For example, in my case — pseudo people flow generation processes— the basic process is not really based on an LLM model because this is just generated based on the individual family building location data or family location data to activity generation and trip generation and finally, trajectory generation. This is a kind of the four-step generation process.

But apart from these kind of simple generation processes, we are trying to use the LLM model for activity generations because sometimes these kinds of LLM model-based approach can achieve the high accuracy. Now, we are developing and going through trial and error. And maybe some other laboratories such as Sezaki Laboratory or Lecturer Dr. Nishiyama will also be developing the LLM model for ear sensing devices and other sensing devices now.

[Nishiyama] Our research group is also using LLM for empowering our research topics. Especially the ear devices, like air pod devices, so it has a motion sensor and some audio recognition and also the speaker function. It is a basic function. It is easily connected with LLM because LLM is generating some word or some sentence. We are using the function to how to encourage their behavior or transfer their behavior through the audio-based interruption. That is what we are doing now.

But in the future we will expand our research further and also transfer these technologies to other research groups. That is our vision.

[Behrens] I am coming from an economics background and so most of the really interesting questions that we want to look at, we require detailed spatial data. But we also require a lot of things that you can't measure and where you need administrative datasets. Okay, so income tax data, socioeconomic characteristics. Like for example, if you think about mobility, I mean cell phone data is great, but cellphone data, if it's just the ping that I can see moving around and I cannot associate any socioeconomic characteristics to it, like age, like income, like sort of a number of things, there are a lot of questions that we cannot answer.

I was wondering, what's the status of CSIS. Is there any interaction with statistical agencies or with

administrative data providers to interface data? Are there any programs in Japan? I know, for example, in Canada, like Statistics Canada, they have turned increasingly to outside providers and academics to also help them with developing their databases for things that they cannot really do. Are there any interactions there in Japan in the CSIS talking to statistical government agencies and are there any plans to use your research to feed also back into administrative data and vice versa?

[Sekimoto] In the case of Japan, there is a bureau about the statistics in the Ministry of Telecommunications and they have very good open data about the general statistics, including some geographical data experiments. But most of them are very traditional. And we have several connections with them, but this is still a personal connection. We don't have a strong project-based connection. But as you say…

[Oguchi] Well, how's the Sinfonica?

[Sekimoto] Yes. But we just purchased their data and used or distribute…

[Oguchi] We distributed the important data for research, so we contributed to research…

[Sekimoto] Yes, that's right. But in that sense, our research budget is limited, so if we can provide them with very good insight or introduce cutting-edge research, they may start improving their dataset using their governmental budget or other sources of funding.

But for the Ministry of Land, Infrastructure, and Transport, we have a kind of a strong connection with them. For example, they recently started to develop the three-dimensional data of the building for many local governments called Project Plateau. But we have a strong connection, and I am also the director of the Project Plateau Consortium. In that sense, we have a strong connection, and we can share the feedback, usually.

[Zhao] I am also very interested in the data situation. For example, the spatial data infrastructure, like about GPS trajectories. For example, if I want to or someone, some researcher wants to do research, how can they get the data and how large is the scale of the GPS data? I think they could be very, very large. And as a scale, like the website scale, so are they easy? Is there any interface or mechanics that researchers can access this data in Japan?

I think that among the objectives of CSIS, the one main objective is to build the spatial data infrastructure. And so, are there any activities concerning promoting this infrastructure in CSIS?

[Sekimoto] Firstly, about the mobile phone GPS data, we started to purchase it from the commercial company last year. These datasets covering all the areas in Tokyo can be used by any researchers through JoRAS procedures. In that sense, the data represents a population of about 10 million, which is the actual population of the Tokyo Metropolitan Area. But the sampling rate is 5% or 6%, so the number of data points is actually under 1 million. Every year we receive data for the same fixed month, so researchers can compare changes from year to year. But this only started last year.

Then, about the development of the data infrastructure itself. I think this is a very important activity, so we are not only purchasing data from the commercial data provider, but also developing the nationwide flow data from the activity model, as well as national governmental open statistics data and other sources.

It’s not just human mobility data — other types of data infrastructure, such as spatial data infrastructure, will also become very important in the near future.

For example, one of the reasons is national security, as well as the high cost of commercial data products. In this context, we'd like to continue developing techniques for building and maintaining our own data

infrastructure.

For example, if we pick up the Zenlin building data of Japan, we still purchase this data from the private company Zenlin. But prior to that, Project Plateau three-dimensional data was opened by the Ministry of Land, Infrastructure, Transport, as free and open data. In that sense, if we utilize data like Plateau's 3D building data, we may no longer need to purchase commercial data from Zenlin in the future.

<Q&A Session 3>

[Yang] May I have two questions? One is for Professor Yamada on the MEC-UTokyo Laboratory. It seems to me it's a big project and what is the role of CSIS in this big project? That project is probably driven by some kind of objective agenda, right? The big project and the role of CSIS in the project. That's my first question.

The second question is to Professor Sekimoto. The idea about DSS, Digital Spatial Society, is so interesting. The concept is different from the big data condition today dominated by tech companies, so universities take the leadership to build such a concept, like a digital platform for sharing. And CSIS is the lead, right? You are the lead of many, many different departments. I am curious what kind of mechanism behind this initiative allows CSIS to organize different departments. For example, what is the benefit or incentive of other departments to join you for this DSS?

[Yamada] The first one, the MEC-UTokyo Lab is a large project, and it contains several independent projects and one of them is located in CSIS, and CSIS is leading that part of the research. And once a year, we have a big meeting and people from different projects come together and we discuss our independent projects.

[Sekimoto] Originally, other departments were primarily interested in the special information itself — either the data CSIS developed or the joint research with CSIS. In many cases they also needed technological support from our side, or they wanted to learn about cutting-edge technologies, data support, and related knowledge. So in that sense, their motivation was very simple.

Of course, other departments also have some skills about spatial information. But in terms of the total amount of knowledge, experience and technical skills, our center has a clear advantage. So they have a motivation to work with us. And there is also funding motivation — for example, we sometimes provide research support funding, such as endowment, sponsorships, or external funding,

But ultimately, it depends on the individual and the situation. Sometimes we asked members from other departments to join our DSS. Younger researchers in particular often have a strong motivation to learn something from us.

[Yang] For example, at Georgia Tech, we have nine interdepartmental research institutes, including like sustainability, energy, and so on. So they are across departments. I belong to one of them on sustainable system. That center needs to coordinate with different schools on sustainable development of any kind. Funding resources is the key.

For example, this institute has an endowment, so the center can allocate funding for as an incentive to get different departments to submit proposals for different themes on sustainable systems. Or we develop a joint proposal to make it happen. This is an agenda for universities to drive sustainable systems in many kinds. If I can compare this DSS as a similar initiative you are coordinating across Todai on this digital platform of some kind, right?

[Sekimoto] Yes.

[Yang] I'm not sure that is a good comparison. That's why it's quite difficult to coordinate many different departments.

[Sekimoto] Yes, of course, this is quite similar to your collaborative framework. But originally, the situation was different. When we established this kind of collaborative research organization, the main office of the University of Tokyo told us that they would provide additional research funding. But actually, no such budget was allocated. So when the participating department complains about the lack of funding, I take the initiative to collect funds from the private companies.

[Jarvie] Professor Sekimoto, in your presentation about the division of joint usage in research, you outlined a number of projects where you have young researchers, project faculty. Clearly, you have a great group of young, enthusiastic researchers and projects.

I noticed that in your report, amongst the future plans and priorities, one of the aspects that you were looking to really take forward is expansion of tenured positions for young faculty members. You mentioned national universities, there are management expense grants, and the like. I wonder whether you could tell us a little bit about your plans and aspirations for the career development of some of these young faculty members and researchers.

[Sekimoto] It's a very important issue for our research center. At this moment, so this fiscal year, we created one tenured track position, but it is limited to female applicants. This is our first such position. Because we have a research budget, we may be able to create more tenure-track positions in the future, but at the moment, it's very difficult to increase drastically or rapidly.

Of course, if we have additional funding, we could do more. As you already noticed, we also need to purchase commercial data for the joint research. So it's kind of a trade-off.

[Jarvie] I also had a question for Mr. Nishiyama. Obviously, you are collating, and you are analyzing a lot of commercial data. And with your intellectual property on developing the people flow data, presumably some of these datasets that you are creating are commercially valuable.

Do you provide those datasets to commercial organizations, to companies? And if so, do you charge them for it or is it provided because you're a national facility? I mean, presumably, things like your geocoding activities are really valuable to the commercial market. So, are there opportunities for kind of commercialization of some of your activities?

[Nishiyama] Actually the service is just provided by the research center as a whole, not just by me. I can say this dataset is intended for the research community basically, not for commercial companies.

The users of our dataset are very diverse— ranging from the university students and professors to researchers in national institutions and officials from local government departments. These people are also our collaborators.

Basically, users don't need to pay any fee for using our dataset, but they have to report their research output to the public. That is their responsibility when usind the data.

[Sekimoto] Let me add to his explanation. Basically, it's impossible to charge the prices in the university. This is the rule. But, of course, we can sell the patent or similar intellectual property to commercial companies.

For example, in the morning session, I explained about the road-damage dataset. The training dataset itself is completely open in the Internet from our laboratories, GitHub, or similar platforms. But based on this training dataset or some other web services, startup companies sell the services to the local governments.

Of course, we receive some patent usage from the startup company, but the amount is not so big. Because they are the startup company, we cannot collect so much from them. Similarly, for example, our Pseudo People Flow data is currently available for free for research purposes. But through the NPO company, called AIGID, we can ask them to sell the data for commercial applications or governmental applications in the future. I am thinking we need much more time, such as a year or more.

Also, our geocoding service has a very long history. Before the start of Google's geocoding, around the year 2000, this was very famous for many users. This is completely free. I am not sure whether it will remain free in the future, but at this moment, it is.

[Cao] I also have a question about data sharing. You have a large number of datasets. Are those data provided by the center only, or they can be contributed by your collaborators? For example, if you have a collaborator from another university, they also create datasets. Are you going to incorporate the datasets into your datasets and share it to other collaborators?

[Nishiyama] The answer is, I think, yes. Actually, we have our DSS. This is some collaboration research community in the University of Tokyo. Actually, we are offering other professors to please provide their dataset into our JoRAS system.

So far, we are just purchasing and also creating our dataset ourselves. But in the future, we are thinking to, I guess, integrate other people's research as the output inside the JoRAS system.

[Cao] Usually, data sharing is very difficult, challenging because how can you provide incentives to contributors? You see, if I have data, it is not that easy to share the data because I have many concerns. As you said, privacy, confidentiality, commercial values. Have you considered providing any mechanism, incentives to encourage people to share data so you have a larger and larger pool of data?

[Nishiyama] Actually, I can say, so far, it is kind of a gentlemen's agreement. I'm not sure how can I say it, but for example, if a company wants to contribute to the research community, they provide their data and say, "Please use this data for research purposes." That is the basic structure. But I'm not sure if this approach will continue to work well in the future, but so far, it is working in this process.

[Cao] Currently, if some people want to share the data, they need to send the data to your center, and then you share with others?

[Nishiyama] Yes.

[Cao] So, how can they provide data to you? You just make a copy, or you just have a link to their datasets?

[Nishiyama] So far, they are sending the data to us and we put their dataset inside our server.

[Cao] Okay. Another question. I mean, is it possible you extend this data sharing data sets to a wider community, not only to your collaborators? Not only for...

[Nishiyama] That depended on the type of data. They already have some open datasets. That open dataset, we don't need to care about some privacy issues or some risks. In that case, they can use that data.

But some data is not open, it's a little bit hard to open. But the data provider wants to contribute to the research community or find more applicability or usage of that dataset. In that case, they provide data to us and make some collaboration. So, we can provide them some opportunities for collaboration with other researchers.

[Cao] That's what I actually want to suggest. In the future you may have a Web3 approach, decentralized, rather than…

I think currently your model is centralized.

[Nishiyama] Yeah.

[Cao] Everyone sends data to you, then you share it to others. But now, Web3 is getting more and more attention. So, you may have a blockchain, recording all the sharing, and then also you can protect the data. If I got the data and then I modify, and then I claim this is your original data, and nobody can find it out. That blockchain approach may help.

[Nishiyama] Yes, it makes sense. Thank you so much. Thank you very much for your suggestion.

[Sekimoto] Let me add a few points. Of course, you are right. Collaboration is very difficult or complex. In the case of DSS, we have two types of collaboration. Some departments have interesting datasets. If they are satisfied with the dataset from their department website, that's okay. But we suggest linking their website and visualizing it in our WebGIS or something like that. But the download is going to the original website in the department. That is the kind of collaboration.

The second case is when the researchers do not have the incentive or motivation to host the dataset itself. In that case, we received the dataset from them and hosted that data in JoRAS and visualized it in WebGIS website. Maybe in that case they are, of course, okay and satisfied. Maybe divided into two types, and we'd like to combine flexibly, depending on their situation.

Web3 is, of course, very promising technology in order to realize this kind of flexible combination.

[Cao] I think we are in a very good position to do this, to push this.

[Behrens] I have two questions. The first is, so in the objectives of DSS, it's stated that it has to ensure research findings are effectively shared with society. So, what's CSIS's strategy, or all the members of DSS for sharing effectively the findings with society? Do you have discussion paper series? Do you have vulgarization of research findings for the large public? What's the dissemination strategy actually, policy reports? I don't know. What actually is the strategy for sharing research findings with society here?

My second question, that's more specific to the MEC-UTokyoLab. So, I was just wondering whether you would like to have someone from economics, management, or geography actually in the team. These communities have really worked a lot on startups. They've worked a lot on entrepreneurship. So, part of what you want to do there is also about program evaluation, if I understand this correctly.

You want to be sure that you identify the causal effect of a policy measure on outcomes there. So, I think you probably would like to have someone from management or from economic geography or economics onboard. Because these people have been working really a lot, so there's a huge, huge leverage on startups, and clusters, and innovation, etcetera. I think that would certainly be beneficial to have someone onboard for these things.

[Sekimoto] The first question about the DSS organizing motivation from our side is, our CSIS was originally a very small research center. In that sense, of course, I am not really sure about the future. But CSIS itself could be reorganized in the future based on the activity of the DSS.

Nothing is decided at this point. However, if we were to reorganize the research center--- CSIS or something similar, we would need support or agreement from other departments. In that sense, this is kind of preparation. Still, since nothing is decided, I cannot say anything for sure about the future. Through these kinds of ongoing, everyday collaborations, it becomes much easier to reorganize into a larger institute if needed.

This is more of a strategy, I would say. But, that is just my opinion. Generally speaking, wider collaboration across departments often leads to unexpected meetings of the various kind of the combinations.

[Behrens] My question was more about — do you have a strategy to explain to the general public what your research findings are important for, and to disseminate, basically, the research findings with the society at large? You see what I mean? Society at large cannot really read the research paper, so is there any strategy of having briefs, for example, like vulgarized versions of the research that would be…

I don't know what you mean here by ensure that research findings are effectively shared with society and the objectives.

[Sekimoto] You mean the strategy for social implementation?

[Behrens] Yeah, for example, making society as a whole understand what you are doing, and how you're doing it, and why it's important.

[Sekimoto] I see. In that sense, unfortunately, today's materials don't include enough information about the social implementation itself. But we have an exclusive contract with, for example, an NPO that operates the Geospatial Information Center in Japan, supported by the national government. I am actually one of the directors of that NPO. Because of that, we collaborate with them on a daily basis. Once we develop cutting-edge technology related to geospatial processing or AI implementation for service, they can implement and operate it. Sometimes, they start selling these services to local governments and so on. So, in that sense, this is one of the possible pathways.

[Yamada] Thank you for the question about our division. I totally agree that there is a huge accumulation of research on startups and innovation hubs in economics and management field. Actually, some members of our project also belong to our Center for Real Estate Innovation (CREI) in the University of Tokyo, and where in that center, there are many economic researchers, including Professor Takahashi.

We don't have formal collaboration, but we have informal communication between our members and CREI members. For the moment, it's informal, but in the future when we have – our project that's just started, so in the future and if budget allows us, we would like to invite researchers from different fields, like economics and management. That's our hope and future plan.

[Zhao] I am very impressed by the talks, especially the JoRAS. I hear that they already have many questions and discussions concerning the JoRAS dataset. I have another one I would like to. For example, I think I understand your concern about the privacy, security of the data usage. But there are many, and I think there are many different kind of data. And the data have different levels of security and privacy sensitivity. Maybe you can divide them into different levels and manage them in different ways.

I think one major purpose is to promote more and more people to make use of this data, so that for some

data maybe if they are not very, very privacy-sensitive, maybe you can lower, reduce the bar for more people to easily access the data. I think this will be very important to let more people understand and know the data, and also maybe in future they also want to contribute to this data. This is one of my comments.

Another is – I don't know whether you have already done this. I think, maybe standardization of the data is very important to let more and more people easily use of this data. Maybe I don't know whether you have already done such standardization on the data. Maybe these are my questions and comments.

[Nishiyama] I'd like to answer the first question. Actually, we are taking an ongoing approach. In our department, we are discussing how to make more kinds of sample data or lower-risk datasets, to encourage broader use. So, in that sense, I agree with you. We also want to build that kind of system. That's what we're aiming for.

The second question is — actually, Professor Sekimoto is much more knowledgeable about that.

[Sekimoto] Regarding standardization, at this moment, we don't have a clear strategy. Because we are not government officials or members of major industries, it's quite difficult for us to take the lead in standardization activities. However, from the researchers' side, as a first step of the standardization, we may be able to contribute in some way.

Because, for example, in the morning session, I talked about the dataset publication, specifically about the road-damage dataset. At that time, there were no existing datasets on the road damage. So, we referred to a road management guideline in Japan extracted typical road damage types and assigned eight labels. Once we published that kind of dataset, researchers in other countries started using it as it was. In that sense, it became the starting point of standardization. Of course, it's difficult to engage in standardization activities, because they require a lot of effort.

We could ask governmental organizations to take on such activities, but they are already busy with other standardization efforts, like autonomous driving or ITS. So, it may take a long time.

But maybe Professor Zhao already knows about the people movement data itself. About five years ago, the National Institute of Advanced Industrial Science and Technology (AIST) in Tsukuba, and Hitachi, and Prof Shibasaki collaborated and published a standard format for moving object data, based on IEEE TC 211 or something like that. This is one example of a path toward standardization.

[Sezaki] I made a brief additional comment on this standardization. Actually, I am a member of ISO/TC 211, which is responsible for geographic information and geomatics. However, digital information in this area is not so strong, because de facto standards — set by companies like Google, Oracle, and others— are much more influential nowadays. Still, we do have opportunities to contribute the outcomes of our research to these kinds of standardization bodies. So, did you contribute to ISO/TC 211, and as well as ISO/TC 204, which is in charge of standardization for ITS systems?

[Sekimoto] In that sense, we have some connections to ISO activities as experts.

<Review and Discussion>

[Sekimoto] In the evaluation discussion, I am going to ask you about the pure evaluation, pure impression of our activity itself first, for the first round. And then for the second round, I'm going to ask kind of requests, improvement requests, or some additional requests for better activity for us.

[Hamm] I would like to share just a few very small questions, suggestions maybe, or ideas. One is for

Professor Oguchi, for this morning's presentation.

I took some notes on your slide on educational research working with high-school students, and I wanted to ask if you are doing in this work some kind of continued networking or collaboration with the students. I am asking that because I remembered from my research on civic tech that the civic tech community has also aging issues. I was wondering — and this is just an idea that I want to share – if there could be a connection between this high-school project and the CTDI work together with the civic tech community, so to have young students that are interested in technology.

[Oguchi] I think it's a very good point. I mean, whether we have a long-term connection with students or something like that. Normally, we ask high school teachers to allow us to use one class hour or so to do this kind of implementation. We collect questionnaire survey results and so on, and that's basically the end of our connection with students.

But sometimes, for example, we explain there's an annual event called CSIS Days. When high school students have presented there, it's been a very unique opportunity. Normally, at least undergraduates or higher-level researchers give presentations, so their participation was impressive, and we gave them a kind of special award. This case was made possible because of our connection with the high school teachers.

I didn't notice this point. Because we have limited time, I had not really thought about whether we could spend more time with high school students as well. Of course, our own students are the priorities. But — thank you for pointing that out.

[Hamm] Thank you. Maybe just my second and last question is for Professor Sezaki's talk on the Division of Spatial Information Engineering.

When you presented the members of this division, and the faculty members, the graduate students from graduate schools, I was remembering the creation of the UTokyo Design School that is currently ongoing, if I remember correctly. So, I was thinking, because of the project you mentioned from information engineering, there seemed to be some kind of overlap to design, and I was wondering – and this is also just an idea that I want to share, if there could be, for future plans, some connection.

[Sezaki] We do know that the university headquarter is now pursuing the project of College of Design. Since we are a very small institute, we do have very little input to the headquarters. But we do have a connection, and so we have to put our input to this headquarter project. The one more reason is now the Ministry of Education put a huge budget "Universities for International Research Excellence" to the very, very selected university. Unfortunately, or surprisingly, the University of Tokyo was not selected last year. So, it's a kind of surprise in academia. So, we are now trying the second round right now. We are in a very tough situation.

[Yamada] Information about the College of Design, I am not sure how much I can tell here. But the students are supposed to join the kind of standard educational process, and also participate in research activities, such as internships in research labs. Basically, departments like the engineering department and undergraduate schools take care of the education part, while research centers and graduate schools are supposed to join the research part.

We might be able to take some students from the College of Design, and maybe in Professor Sezaki's lab or any other places. That would be the kind of way that research centers can be involved in that project.

[Hamm] Yeah, thank you very much.

[Sekimoto] If there are no other questions, let's move on to the evaluation round.

[Zhao] The morning session and the afternoon session, very, very interesting and impressive presentations.

From these presentations, I have knowledge of the CSIS activity and achievements in the past many, past six years. I know the funding, the research activities of each division. I know the collaborative research organization, DSS, and the services provided, especially JoRAS dataset. I am very, very impressed by these activities.

Especially, I think in this new AI era, the dataset is crucial, very crucial. It's the base for many, many applications. I think maybe in future, CSIS can take more and more important role in promoting the Spatial Information Science and Technology.

Briefly, I think from the research results, achievements, activities, I think CSIS demonstrates a very high level of scientific and technological merit. The results are very promising and align with the original goal of CSIS. I think very, very impressive results for my review.

[Behrens] I also want to mention this is really a center that has a very broad and diverse number of activities, sustained publication record, and good funding. This is really, really impressive.

One thing that I noticed when listening to the talks and when reading the report actually is like, it's extremely vast the number of topics you are working on. If you ask me to characterize in a couple of sentences what is CSIS, I would be hard pressed because it's so broad.

I think, as a center, what would have been really good, also as an exercise here in the self-assessment report, is to give us an executive summary of two or three pages, like what are we, and what's our main specialty? What's our defining characteristic as a center? I think that would have been really good.

You see this also across the different divisions that you have. The topics overlap. So, sometimes at least as an outside observer, you see that some divisions working on one issue, but it also shows up in the other divisions. So, I understand that this is basically a division that's essentially based on methodology more than topic, from what I understood. But I also think you should more put forward the topics and how they cross actually the different disciplines that you have.

As I said, I think the performance measures are really good. I was thinking about this, what you mentioned, this top 10% publications in terms of impact, so I don't clearly see what this is. It would have maybe been good to give us a couple of quantitative measures as to the impact of the work that is done by the center. Some of the publications, it's mentioned that they are in top journals, but more systematically maybe some citation measures or bibliometric measures of the center's performance would have been good in the report.

One thing I noticed, and this I don't know exactly whether this is a general trend or whether this is something that's more specific to CSIS, is although the research funding is quite good, it seemed to me that the performance at the Grants-in-Aid for Scientific Research was declining over time in terms of how much money you get from there. So I don't know whether the budget envelopes in Japan generally have decreased or whether the center has just been less funded there. But since you have globally a stable budget, I don't think this is any problem.

But from what I understood, these grants, the JSPS, KAKENHI, and the Grants-in-Aid for Scientific Research, they're relatively prestigious. So, I don't know whether in the official evaluation they are going to put much emphasis on this trend, actually.

Then I think the activity of the center is really impressive. This JoRAS system is really something great. I think that's a great value to the research community. I think that's really, really important to emphasize this. I didn't know about this, but I think it's something that people should know more about because it's really interesting.

I think that's a really impressive performance for the center.

[Cao] After the whole day presentation discussion, I think the center actually operates excellently and with a lot of achievements. Built on the spatial information sciences, this actually is one of the most important information and also application areas. This center actually integrates different areas of applications. It covers a wide range of systems and also applications. They are all built on this geographical information, and temporal and spatial information.

In the morning, I asked what the KPIs are. After the whole day presentation, I see you have a lot of deliverables, including the research on the methodology, the systems, and also applications, and also with very high-quality applications. I know the engineering center. I meet Professor Sezaki every year at PerCom. This is the top conference. And also UbiComp. The quality of education is excellent.

Also, you nurture many new researchers. I see many researchers here. They are either now actually promoted or they actually went to other universities as a leader. This is, I think, a very important mission for this center.

I also noticed you have services. You also emphasize on startup, entrepreneurship, commercialization. This is also very important for the social impact. I can see the centers. I agree with Kristian. I congratulate the center for the outstanding performance and also the achievements. I will provide comments later on for the next session.

[Jarvie] It's been a real pleasure to see the scope and range of projects that you are working on. I think it's a very impressive portfolio of research projects. It's really encouraging to see that you are diversifying your funding streams increasingly through engagement with corporate sponsors as well. I think that's probably very important for the future.

I'd like to congratulate you on the impact of your research. Quite rightly, you place a high emphasis on high impact publications, and that's very important. But also, increasingly, internationally, we are being asked to provide more in the way of demonstration of impact in terms of relevance and input to policy at local, government, and national levels, being able to demonstrate the impact in terms of competitiveness in the economy and industry. I think on all of these things you score very highly.

I think you could easily provide some really nice impact case studies to demonstrate to your national funders the kind of work that you are doing in terms of policy, in terms of the tools that you're providing, that are contributing actively to society. I mean, we've seen some great examples today in terms of disaster prevention, climate change mitigation and adaptation, urban planning, human behavior, mobility, health, crime, and telecommunications, all of these things are really contributing to society here in Japan and internationally. We've seen examples of the work that you are doing internationally as well. I think this is all really important in terms of impact.

The other thing that I would like to say is how pleased I was to see your wider engagement in terms of training the next generation of researchers, academics, and innovators, but also developing young talent and going into schools, and things like virtual reality field trips. All of these things are providing engagement with the wider society. From my point of view, I think all of these things are extremely promising, and I am excited to see where things go in the next 5 to 10 years.

[Yang] I have attended a few review meetings like this. I think the purpose of review meetings, especially external review meetings, is to constantly examine current conditions and challenges, so constraints and new opportunities of the center, right, to make sure that the center would play an important role in the university and have impact to the broader society. I think, my observation this whole day, I was thrilled by listening to different division presentation. That was productive, diverse and comprehensive in the broader area of spatial information science. That's my general comment.

But I have one question in mind when I have this exciting conversation with you. What is the current research agenda of CSIS today? One of the comments is we see a very broad perspective. Do we have a big picture or a clear framework to define or redefine CSIS with priority among the landscape. We see the kind of very rich, amazing landscape of research output that was produced by the faculty and researchers here.

Maybe one way to look at this question is to reflect what is the biggest challenges of our time. On the one hand, we define a critical research question, I think related to spatial information science. And two big problems emerged among us. One is climate change, including mitigation adaptation. The other one would be the impact of emerging technology, AI data science, the Big Data and so on.

Also, this is a global concern. Probably we also need to look at what the biggest challenge in this place, Todai, University of Tokyo. What is the current trajectory this university is moving toward in which CSIS would play an important role?

I think out of this big question, I don't have answer. But this is kind of question for everyone. I have some observation about presentation today. In this broader category, spatial information and science, I think I have seen a shifting of research focus from traditional GIS — geospatial science, and of some kind of new observation from presentation today.

For example, those data are becoming much, much more finer-grained, higher resolution, all the way down to buildings and human scale system. I think there's a kind of broader trend, moving this fine-grained data. There are multiple scales, from regional scale to urban, to neighborhood, to human spaces. I think that's very important. I see a lot of exciting research output today.

We also see the high-frequency data, the real-time data captured by sensing technology, high-frequency city. Michael Batty described it in his new book, 'The Computational City.' I think there is spatial information engineering division on this dimension, which is very exciting. Also, the digital-twin predictive modeling adding for the problem. That's my observation.

I'd like to echo the midterm review by Ministry of Education, Science and Technology. There are two of them. One is international collaboration could be further developed in the next step. At the same time, how do we develop our work around the local community with broader societal impact? I think that will be interesting direction to move forward.

Many centers, like my university, my department, we normally like to come with a vision statement. I think that the faculty and researchers of the center has a consensus about the future vision of this center, and maybe come with a strategic plan, which you developed altogether, will be a very good foundation moving forward.

[Sekimoto] Thank you very much for your concrete comments about the current status of our research center. Thank you very much again.

Let's move on to the second round. Please have any requests for improvement comments for our future activities.

[Zhao] Concerning the spicy, spicy comments— after listening to your presentation today— if you ask me, compared to other comparative research units, what's the strength or what's the specialty, the uniqueness, unique role of CSIS? If you ask me this question, I need to think. It's not very obvious, in fact.

For example, for a larger research unit, comparative research unit, they may have more funding, more research project, more publication, more students, and more research topics. So that from my side, I think from my observation, I think maybe you need to focus on two or three highlights, the very unique thing, very strength, specialty of CSIS. Then what will be those two or three very highlights?

From my observation, I think one can be the dataset. The dataset is very important. I think it's very, very important. It's a key for many, many researches. However, the dataset, maybe you also need to present that the dataset can be used and also can answer the needs in this AI era.

For example, from my observation, I see the datasets are different, very different kinds. I suppose that the datasets are developed by different companies or researchers or for different usage. Can they be used together? Or what kind of datasets – for spatial information science or technology, what kind of datasets are needed for training larger AI models for future applications? It's not clear. Whether the current dataset can be adapted to answer these needs is also unclear.

So, that maybe I think my spicy comment is maybe it's better to focus, to show your strengths, or two or three highlights, and to also answer the questions for the future research, especially in this very, very highly moving AI era. This is my comments.

[Sekimoto] Thank you very much. Let me confirm your comment accurately. Of course, our CSIS should highlight several strengths, two or three specialties or strengths at first. Your first promising part is dataset, right?

If you have some other specialty within the two or three specialties, could you share your opinions from your side, after hearing our presentation today?

[Zhao] For example, in my research and also my colleagues' research, now we need to address the question of how to adapt our research to the very fast movement of AI development in this new era, so that we also collect data and answer the question how the data can be used to be adapted to this new era. This is the question we all need to think about.

And to show the strengths of our research and to survive in the near future, I think maybe it is very important— from my observation — to focus on datasets and whether they can meet the needs of training the larger and larger AI models.

[Sekimoto] Yes, the needs for a training datasets are, of course, always changing for the current AI era. Maybe we have to feed the ability to consider social needs for next research — looking ahead to the next generation, while also thinking about current and future directions in technology. Is my understanding correct?

[Zhao] Yes.

[Sekimoto] Do any of the members have comments —perhaps Professor Sezaki, or Lecturer Nishiyama?

[Sezaki] I have a question about foundation models —specifically, do you feel there is a need for a foundation model dedicated to spatial information? Currently, we are generally relying on more general-purpose foundation models, right? I mean, a foundation model specifically designed for spatial information

—do you think such a model is necessary?

[Zhao] I think this is very important. I think it's very special, this difference with the large language model of AI, their virtual language model. Spatial information model is very special. It's different, quite different. It could do a lot of things, I think.

[Sezaki] So I believe we ourselves may create this kind of spatial foundation model, but so I am afraid our budget is limited. Then what we should do now?

Maybe getting a very, very huge national government budget is one option, but right now, at least scalable, our annual budget, so it could not be possible at this point, but I really understand your concern.

[Zhao] May I make myself clear? In fact I don't think the researchers or university can train a very large foundation model. It's not our job. We have very limited budgets. But I thinkwe can do something else like generate or build a bridge between connecting university and industry, and develop some pipeline or interface to let the industry and university collaborate together, to do something together.

In that case, it may not be the university that builds the dataset, but rather the university can create a platform where industry and university can contribute data. Others could then use this shared dataset to train large foundation models. CSIS could serve as this kind of interface, playing a crucial role in connecting industry and universities.

[Sezaki] I quite agree with you. We are always struggling to create this kind of bridge. Your point is that the university should not create its own model. It is very helpful for us. Thank you.

In any case, it is very helpful that external reviewers clearly state that creating very large models is not the role of academia. Instead, our role should be to build bridges between industry and universities. We are constatntly trying to find the best way to build those bridges and to foster meaningful interactions with the private sectors.

[Sekimoto] I agree with your opinion, too. On our side, we are developing, for example, pseudo people flow data.

This is a kind of generative model but it is not based on a large foundation model like a language model. A large foundation model — such as a large spatial model— sounds promising, but there are many possible approaches, so I am not sure which one is appropriate.

Professor Zhao, do you have any trials or attempts in that direction? You are, of course, involved in autonomous driving, or robotics, or autonomous robotics— so have you conducted any similar experiments?

[Zhao] I think it's quite different with autonomous self-driving and the large language models like that. In those fields, industry at the frontier, they are taking a crucial role. But in spatial information science, the industry is not taking any very crucial role, so that there is still a lot of room that universities can take action. That maybe I think it's the correct time that CSIS can do something.

[Sekimoto] Okay. Thank you very much for your additional comments. We would like to cooperate with industries about this kind of approach.

[Behrens] There is one thing that came up several times in the report, and I was thinking about this, so you are saying you have no grad program, you have no grad school, actually. I was just wondering, there is a unique mix of competencies at the center, and I think there's probably a unique mix of skills that grad students

could acquire.

In many places where there are these interdisciplinary research centers, it's precisely because they want also a grad program, because they can teach a unique mix of things to students that students cannot acquire just by being in one department or in one graduate school. I was wondering whether this is something that the center might want to think about.

I don't know whether this is institutional possible or not, but it certainly would be something interesting. There's going to be huge demand for spatial modeling, for spatial data, for generating the data, using it, training these models. I think that it's not the geography department, it's not the computer science department, it's all these departments jointly who need to train people for that in the future.

Since you are also very active in supervising students, and you are doing a lot for actually training young faculty and students, I think that would be probably something that's worth considering in the future. That's one thing.

The second thing is, and that's more like a general observation that I've seen in a certain number of centers. Your centers get overstretched at some moment. They are going to go get funding, but with funding comes new demand, and so the center is going to get involved in more and more things. I think you should try to avoid that. There's the DSS and the new center on entrepreneurship, etcetera. All these things is going to require time. Time is really the resource that's in very limited supply. This comes back to what I said before, so the center try to see what is the unique thing that the center can advertise for itself and avoid or resist this temptation that you're going to face that the more success you have, the more you will be dragged into many projects. You should probably avoid resisting being in too many of those things. This grad school, I think, would be really a good idea.

Then in terms of data, yeah, I think that's really important. I mean, I think we talked a lot about this today. This idea that you are sitting on unique resources, which I understand it's very time-consuming and also resource-consuming to leverage these things in an optimal way. You are probably going to need help from either the university or some external funding to set up if this platform is going to grow, and if it's going to be like a signature of the center. So, maybe this is something that you may want to consider.

We had this discussion during the break that there might be a possibility to sell also part of the data to the private industry. The private industry is charging horrible high prices to academics when they want to use that data, but they are also very quick in wanting to use the data of academics for free. I understand that they don't have access to your data — the private sector, but maybe this is something that you may want to consider in the future.

There's a host of problems that comes with this in legal terms etcetera, so I don't know how much the university would be willing to help with that. But you are sitting on a sort of goldmine here that you might want to leverage at some point. It's a goldmine for academics, obviously, but it could also be a goldmine in terms of the resources that you need in order to push the activity of the center further.

If you want to hire more tenure-track faculty. That's costly. And that might be one way of leveraging additional resources. That would be my comments here.

[Sekimoto] Okay, thank you very much for your useful comments. Maybe to start a grad program, you are defining our policy.

Actually, it's a little bit difficult under the current circumstances at the University of Tokyo, but your idea will stay with me. Also, the uniqueness of data should become more valuable in the future — like a goldmine.

We will keep that in mind.

[Cao] Yeah, I have two suggestions. The first one, I think the center can further synergize, okay, the research of different centers by consolidating existing research on the foundation methodologies. I think we have many different areas. But many applications actually are based on the similar modeling and also methodology, especially for using AI nowadays.

I would suggest that you may have a taskforce with people from different centers focusing on fundamental research. Then that can be applied to many centers. I can see this one can be the further consolidation of the existing. You have already very good interdisciplinary research, but I see this common foundation based on the methodology part and AI modeling part.

My second suggestion is that you have a very unique position in the whole university, maybe also in the whole Japan, that you can further strengthen your leadership in several areas. I mentioned previous discussion. One is that, for example, data sharing. You already have very good datasets. How can you further develop this into a real data-sharing economy or ecosystem?

You can extend the current centralized approach by involving more contributors, for example, from other universities, from industry, but that need to think about the Web3 approach. I think it's a very good position for you to push this.

The second one, actually, I echo Professor Zhao's suggestion. The foundation model, large-language model for spatial temporal. Actually, there are many ongoing researches now in universities. You do not need many resources for train the foundation model. There are many open sources foundation model. Most importantly, you have already got a dataset, so you just have do the fine-tuning. The foundation model already pre-trained, and then to actually tailor it for a spatial purpose area.

For example, actually, in our research institute, we are doing this large-language model for ocean predictions. You don't need a lot of resources. You just need to probably do some fine-tuning or parameter adjustment to make it particularly useful for that particular kind of data. I think you have a lot of data, and it's very good for you, actually, to push this one. If possible, we can collaborate in this way.

[Sekimoto] Thank you very much for your good suggestion. A data-sharing strategy is very important. Creating synergy with other centers — especially by focusing on AI and data as our strength — is key.

[Jarvie] A couple of points that I wanted to pick up on for this part of the discussion. The first was to follow up on the comments that were made from your midterm review and the encouragement in terms of internationalization of CSIS. I would say that you are making good progress with this, and I was encouraged to see your memoranda of understanding with international research organizations and universities, your PR engagement activities.

The other thing I think that really perhaps didn't come out in the discussion today, but I really picked up on in the report is that actually your faculty are extremely active internationally. We have here editors of major international journals, faculty are very involved with leadership in terms of international learning societies, and all of these things are a really important component of that internationalization.

I'd encourage you to continue with those kind of activities, because in terms of the wider recognition of CSIS around the world, the kind of activities that some of your faculty are doing are really important in that regard and I am sure will yield benefits in years to come in terms of collaborative endeavors with international organizations and research facilities and universities. I think it's certainly looking very promising in that regard.

The other thing I'd like to pick up on really follows on from what Kristian was saying in terms of the grad school ideas. I think, in many regards CSIS's superpower is the different disciplinary approaches and methods, and their applications in terms of spatial information science. I'd very much encourage you – we've heard a couple of examples of research collaboration across divisions. I think this is an area where this could be developed further and will really play to the strengths of this particular organization. My encouragement is to seek further opportunities to collaborate across the divisions.

[Sekimoto] Thank you very much. We should continue the international activities and also try more about the collaboration across the division of the CSIS.

[Yang] For this second question about area for improvement, I would like to talk about that in a slightly different way, what are the opportunities of area for future growth of CSIS? In this meeting today, we talk about CSIS is quite small. That's relatively speaking. We meant CSIS is run based on limited resources and budget. That capacity might be small at the moment but are there areas for future growth for this center? For example, potential funding resource, greater societal impact that at the same time will facilitate faculty researchers to enhance research in quantity and quality. That will be my main comment.

I think there are probably plenty of opportunity. I'd like to highlight two examples that I listened from the presentation today. The first one is MEC-UTokyoLab, the HONGO-Marunouchi Innovations, HONGO, right? I think this project could be understood in the context of smart city movement from 2010-2020, like Google's Sidewalk Laboratory, Toronto, Korea, Songdo City, Singapore Smart City, and so on.

Cities are seen as living laboratory for experimental emerging technology. From there, we would argue data-driven spatial information analysis and urban computing will be central. I think that is exciting that CSIS is playing a role here. That should go beyond the real estate development, like Mitsubishi Estate, to build such a future city innovation hub. That's why maybe Mitsubishi come to Todai.

I think that also addressed to the industry-university partnership or industry-academia partnership. I think that's maybe one new focus of this university in the context of Todai's initiative to build such a partnership, not only Mitsubishi, but also Mitsui Fudosan UTokyo Laboratory.

In this very specific context in Japan, the urban development was moved by private sector. I think that's probably a good opportunity that could CSIS kind of carry over this agenda to become one of the important driver or engine behind that initiative.

The second example is DSS, the Digital Spatial Society, is kind of very exciting agenda. I am excited because in the US we kind of failed to look at this issue, to build a digital ground, a common digital data platform for research community, a real-time spatial temporal data infrastructure and so on. I think there's again a context of smart city when we talk about AI, big data shaping our future society.

In the US, for example, they are dominated by tech companies. So, a lot of other places trying to look into, okay, what about we built the urban data center, and to look at the data not to be controlled, owned by tech company, or national state in other contexts, but can we move the data from capturing, process, analysis to application, like Professor Sezaki talk about kind of acquisition to analysis to application. That's three steps. That process can be democratized. Universities play an important role to build such a university data center, or a university-based urban data center. I think that's a very exciting idea.

There's a discussion today about this. Should we simply loot at data-level coordination, like CSIS can offer services, not only research output but services for university community and kind of broader society to utilize the data? Or should we advance that to be spatial knowledge center, including analytics application, being developed from this center? I see a lot of opportunities in this area.

[Sekimoto] Thank you very much for very useful comments.