

Detecting socio-economic changes of the Northern Chugoku Region under the Great Heisei Consolidation (2000-2010) by using Topic Model and regional GIS data.

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(1) Motivation: The Great Heisei Consolidation policy (2000-2010) of the Japanese center government aimed to facilitate municipal mergers for achieving larger economies of scale and administrative cost reduction in depopulated municipalities. The northern Chugoku region is a less-developed area characterized by significant aging and depopulation even though the number of its municipalities reduced by two-third under the municipal merging policy. However, the social-economic growth among post-merged municipalities seems to be overlooked (Suzuki & Sakuwa, 2016). In order to build an effective strategy for regional rehabilitation under local limited resources, it is necessary to take a closer look at its inner socio-economic dynamics. Applying topic model for GIS data could point out spatiotemporal transition of regional characteristics.

(2) Method: Topic model, a kind of probabilistic generative models, helps annotate the latent themes in a large text data (Blei et al., 2010). In analogy with text analysis by topic model, Fig.1 described the combination of topic model and GIS data where each geographical location (mesh) is as a document (D), each socio-economic attribute class is as a vocabulary (W) and then some latent topics (K) could be interpreted as the outstanding features composed of socio-economic attributes. The spatiotemporal dynamics in topics for each mesh by pre- and post-merged municipality would be considered.

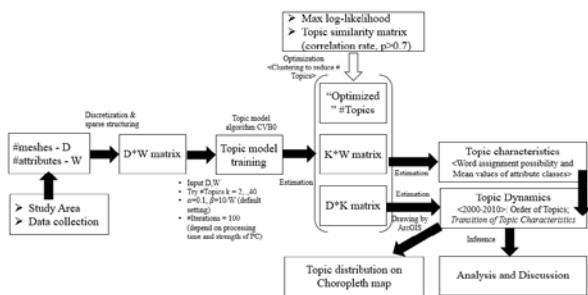


Figure 1: Procedure of processing and analyzing GIS data by

Topic Model

(3) Results: The socio-economic growth between pre-

and post-merged municipalities is not good as expected (Fig.2). The better socio-economic growth (by increase in land use development, infrastructure, service and population) occurred surrounding the remained local government offices and the newly established municipalities in comparison to the coverage of the ones merged. However, the strongest growth still concentrated alongside the Northern coastline with the big cities.

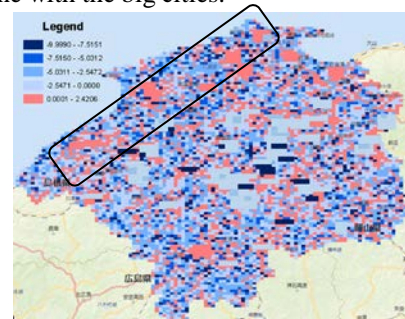


Figure 2: Spatiotemporal topic dynamics (by topic possibility)

(4) Data used: The dataset of 27 socio-economic attributes was collected at the tertiary geographical mesh level for 2000 and 2010 as Table 1. Each attribute should be broken into six classes by natural classification. The study area includes 8,183 meshes.

Table 1: Data attributes and sources

Data source	Unit	Attributes
Land use (NLFTP, 2000 & 2010)	m ²	Paddy field, Other agricultural land, Forest, Wasteland, Built-up, Transportation, Water surface
Population and Households (ZENRIN, 2000 & 2010)	Pers.	Total population, # People in Age 0-14
	HH	# In Age 15-64, # People in Age 65+, #Households, # Single-Elderly Households
Career/Job (ZENRIN, 2000 & 2010)	Pers.	# Employees, # Workers in 1 st industry, # 2nd industry, # 3rd industry
Accessibility (NLFTP, 2000 & 2010)	m	Distance to main roads, railway stations, bus stops, hospitals, city halls
Infrastructure (CSIS, 2000 & 2010) (ZENRIN, 2000 & 2010) (NLFTP, 2000 & 2010)	Facility	# 2 nd industrial facilities, # 3rd industrial facilities, # Public facilities, # Housing # Medical bases

(5) Acknowledgement: This paper is an output of the CSIS Project No.764.

(6) References: Blei, D., Carin, L., & Dunson, D. (2010) Probabilistic topic models. <<http://doi.org/10.1109/MSP.2010.938079>>.

Suzuki, K. & Sakuwa, K. (2016) Impact of municipal mergers on local population growth: an assessment of the merger of Japanese municipalities. *Asia Pacific Journal of Public Administration*.