Individual-based epidemic simulation of new-emerging disease in Tokyo city

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(1) Motivation: The past two decades, several new emerged air-borne disease, such as SARS and H1N1, spread global wise and made huge health and economic loss. Listed literature shows that daily commuting is a major factor of disease spreadings, especially for air-borne diseases, that is the reason why school-closure disease control policy run. However, not all the newly infections occur in office, school and other static places, some newly-infections occurs in stochastic encounters. The most indelible kind of encounters to mention is encounter in mass rapid transit (MRT) system, MRT system enhanced the range and the speed of disease spreading of those encounters in MRT system. Networked equation-based epidemic models explained such enhancement in a global scale. We applied individual-based agent simulation for this study because that the well-mixed population assumptions is challenged in a scale of minute.

(2) Method: Core of agent simulation is MPI + OpenMP Fortran code, running on supercomputer K. Ruby code is for pre- and post- process. PostScript language is for visualization.

(3) Result: Simulation study shows that new infections most happen in the time period of commuting. For a specified epidemic agent, the distance of committing is proportion to the number of generating newly infections. MRT system should take responsibility for reduce the risk of making new infections.

(4) Data used:

・【空間配分版】2008 年東京都市圏 人の流れデータセット

(5) Acknowledgments: This study is under a cooperation project with Joint Research Program No. 728 at CSIS, UTokyo.

(6) Related literature:

Wang, S. & Ito, N. (2018). Pathogenic–dynamic epidemic agent model with an epidemic threshold. *Physica A: Statistical Mechanics and its Applications*, **505**(C), 1038-104.
DOI: 10.1016/j.physa.2018.04.035

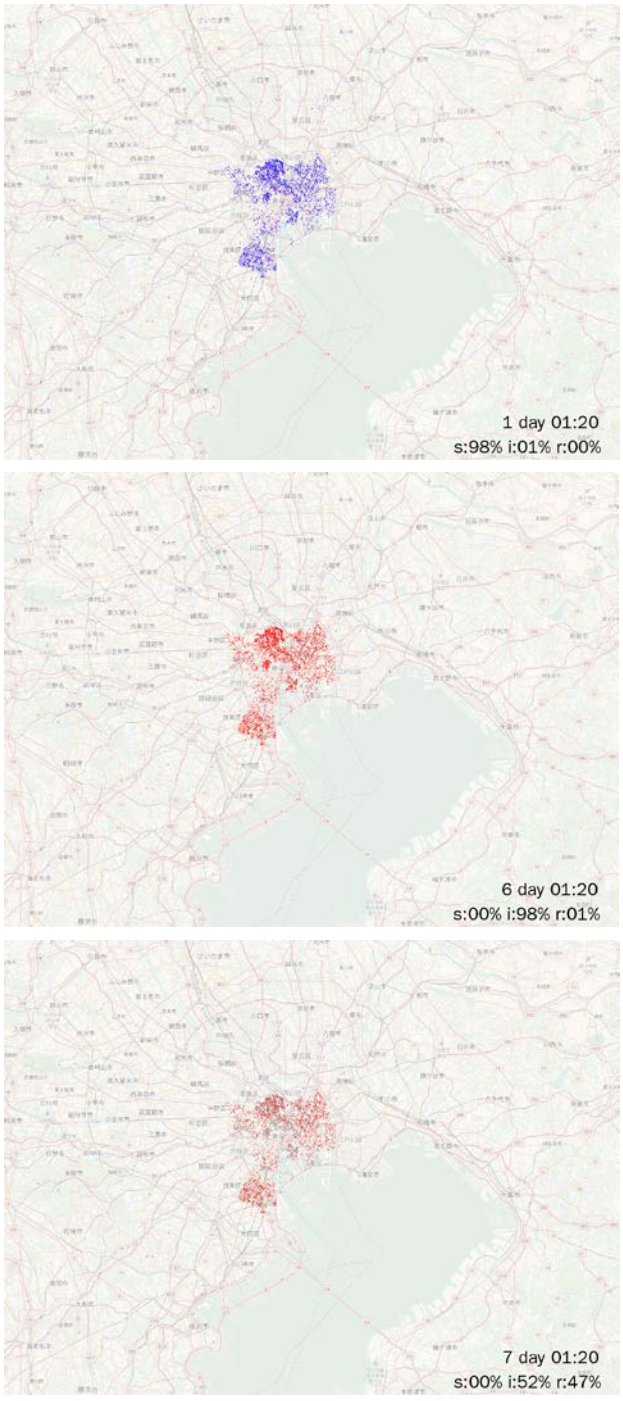

Figure: A snapshot of epidemic spreading in Tokyo in the 6-th day of disease breaking-out in midnight 1:20. One red dot represents one infected agent. Agents in infected state is 52%. The other 47% of recovered agent is in gray. Four thousand downtown-lived agent is selected in this simulation.