Keio University

Thesis Abstract

No.

Registration Number:	□ "KOU" □ "OTSU" No. *Office use only	Name:	Sesulihatien, Wahjoe Tjatur

Title of Thesis:

Surveillance System Architecture for Mitigating Contagious Disease with the Adaptive Area-based Risk Model

Summary of Thesis:

This dissertation addresses the architecture of the surveillance system for managing the dengue spreading. It is built to answer the challenge of spreading of contagious disease, such as: (1) dynamic changing of the spreading of disease in a network, (2) realistic action to suppress the disease, (3) unobservable phenomena of transmission, and (4) complexity in the pattern of contact of human movement.

The system consists of three model: (1) The Location-Contraction Risk Model, (2) The Adaptive Area-based Risk Model (ADRESS), and (3) The Ecological Context-Dependent Strategy.

The Location-Contraction Risk Model is the spatial risk model based on the weighting of the the contagious area. The method for calculating the weight is the weight of evidence. The contagious area represents level of the disease transmission in the area as an impact of engagement between host(human) and vector(mosquito). The model transforms the unobservable phenomena of disease transmission into sensible attribute of the disease transmission. This model has simulated using a set of data Surabaya, Indonesia in 2012, the accuracy is 87%.

The Adaptive Area-based Risk Model is the algorithm of spreading of disease. The uniqueness of the algorithm is that the algorithm utilizes the agent who has "state-space temporary behavior" to simulate the propagation of disease. By this behavior, the spreading of disease is depending on the pattern of dynamic movement of human and the environment of disease. It simplifies the complexity in the pattern of contact among the agent. This model consists of: (1) the state-space model of routine movement cycle, (2) the algorithm of spreading, (3) the prediction model of infection area by graph relation, and (4) the model to calculate risk of area. The method is applied to simulate routine movement of people in Kecamatan Tandes, Surabaya. Compare with the real data, accuracy of the method is 76%.

The Ecological Context Dependent Strategy is the semantic strategy to determine the real action to combat the disease. This model performs a semantic action by projecting the data of abiotic environment of mosquito to the stage of mosquito life by using Mathematical Model of Meaning. It is applied to a set of monthly data of Surabaya from January 1984 to December 2014. The average result is 77%.

The dissertation also presents the combination between The Spatial-Contracting Risk model and The Ecological Context Dependent Strategy. It is implemented to perform the common strategy for 3 cities of 3 countries: Surabaya of Indonesia, Kuala Lumpur of Malaysia, and Bangkok of Thailand. It is investigated during ASEAN Dengue Day 2012. The result shows that accuracy of the system is 82.3 %.

Keyword: *dengue spreading, adaptive area risk, location-contraction, semantic strategy.*