

論文 / 著書情報  
Article / Book Information

題目(和文)	ソーシャルネットワークにおける予防接種モデル
Title(English)	A Pandemic Immunization Simulation based on Population-wide Social Network Model
著者(和文)	薛キョウ
Author(English)	Jiao Xue
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

# 論文要旨

## THESIS SUMMARY

専攻:	知能システム科学	専攻
Department of		
学生氏名:	薛キョウ	
Student's Name		

申請学位(専攻分野):	博士	(工学)
Academic Degree Requested	Doctor of	
指導教員(主):	出口弘	
Academic Advisor(main)		
指導教員(副):	金谷泰宏	
Academic Advisor(sub)		

### 要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

Immunizations are the most effective method of preventing and ameliorating morbidity from infectious disease in the population-wide community. Personal vaccination behavior, which constitutes to the whole immunization system, are viewed as a prophylactic and active immunoprophylaxis measure taken in order to protect vaccinator himself or herself and prevent the spreading of infectious diseases for the susceptible groups around the vaccinator. Relative prognostic importance of the various factors predisposing to vaccination behavior modification of individuals is determined by personal values, health beliefs, and influence from interpersonal relationships within population-wide social network during the process of immunization decision modification. In order to determine the relative prognostic importance of the various factors predisposing to personal vaccination behavior modification and analyze the influence of immunization awareness diffusion on overall social network architecture, this thesis carries out an agent-based simulation method to construct a pandemic immunization model and analyze the influence of immunization decision-making process in self-awareness and attitudes toward vaccination during social interaction.

During the past decades, experimentation, controlled observation and questionnaires are primary ways that gave us a valuable insight into vaccination decision-making, awareness diffusion in social networks and mechanism of in immunization system. Comparing with the most of the previous researches, this work use an agent-based simulation approach, which is better to consider aspects usually ignored in most of previous models: interactions among individuals, activities of daily living, and in particular individual decision-making adapting to the individual's changing internal behavior intention and external social environment. In this thesis, all individuals in the community are viewed as independent agents. All agents and their personal relationship networks constitute a population-wide social network and their vaccination behavior is component of an immunization system.

On social interaction side, we focus on the universality and intimacy existing in agents' personal networks, which are embedded in a population-wide network structure in reality, as well as structure and influence of a social network on agents' personal behavior. This work purposes to provide a specific method to generate a population-wide social network in community. Firstly, we predicts the features (such as intimacy between social interaction, personal leadership, etc.) inside a real social network through the analysis of all types of personal relationship networks in the real world based on Japanese General Social Survey data. Then, we carries out an agent-based simulation method to generate a realistic spatial social network based on a virtual city model by

achieving the real geographic information of a specific city area and applying data analysis results as a contribution to intimacy between agents. The constructed social network consists of all personal relationship networks of agents and indicates the ways in which agents are connected through various social familiarities ranging from casual acquaintance to close familial bonds. In this thesis, by specifying the personal information (age, sex, job, etc.), geographic location, social interaction, and a series of entity rules of behaviors for each human agent, we have generated a population-wide social network model of Oshima city using computer simulation.

On vaccinator side, the focuses of our research concentrate on personal voluntary vaccination decision-making and its relationship with the personal relationship networks. In this work, Theory of Reasoned Action (TRA), which is a typical paradigm of behavior modification in the field of social psychology, is supposed to be a potential mechanism for improving vaccination decision-making performance for every human agent living in the community. In order to determine the relative prognostic importance of the various factors predisposing to vaccination behavior modification of individuals, we have figured out prospective factors in vaccination behavior modification and evaluated degree of the influence from the factors for each individual by applying the variables of TRA to distinguish inoculation program participants from nonparticipants. Besides, considering infectious risk, kinds of vaccination, inoculation pattern vary in a big way for different pandemic, this research focuses on vaccination behavior towards seasonal influenza vaccine.

The constructed simulation model with agent-based approach links micro-level individual vaccination intention analysis to macro-level immunization phenomena by making an insight of the properties of individual agents. Therefore, this thesis has analyzed the simulation results in a more comprehensive manner from both macro-level and micro-level perspectives. Macro-level characteristics of the immunization system in influenza season are analyzed from the viewpoints of the relationship among immunization coverage, epidemic period and infection number, while micro-level simulation result analysis explains the internal decision-making process and discuss immunization intention under social norms in the social network.

Furthermore, the constructed simulation model is viewed as a tool for predicting the variation patterns of the reality. In order to support vaccination policy decision-making, several policies which including herd immunity, delay of countermeasure, range of vaccination targets, etc. are systematically studied. As a result, the simulation suggests that reasonable vaccination policies tend to promote vaccination behavior modification and gives decision support to assess the relative impact of public health services for pandemic control.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note：Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).

注意：論文要旨は、東工大リサーチリポジトリ(T2R2)にてインターネット公表されますので、公表可能な範囲の内容で作成してください。

Attention: Thesis Summary will be published on Tokyo Tech Research Repository Website (T2R2).

(博士課程)

Doctoral Program

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