Modeling transition of human interests using large scale social data

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概要– We show the dynamics of frequency of trending words observed from a large-scale blog database, which are characterized by an exponential function and a power function. We reproduce these dynamics by an agent-based model based on the SIR (Susceptible-Infected-Recovered) model which is well known in mathematical epidemiology to clarify the origin of these dynamics from the view point of bloggers interactions. In our social model, we introduce a " ground ", " excited "and " final "state respectively instead of susceptible, infected and recovered state. Agents move from the ground state to the excited state and from the excited state to the final state according to transition probabilities. Our model reasonably reproduces the dynamics observed from our data.

キーワード: Socio-Econophysics, Trends and rumor spreading, Stochastic process

There has been interest in the dissemination of trends and rumors by various fields of researchers for many years[1)]. However it was difficult to quantitatively observe the propagation of trends and rumors until recently. The development of information technology has made it possible to quantitatively figure out changes of popularity about topics by analyzing huge texts on the Internet such as blogs and Twitter posts[2)].

We analyze the huge database of blogs which consists of approximately 70 million blog articles written by 300 thousand bloggers for about 1800 days. The time series of Figure 1 shows a volume of blog articles including the word, "TABERU-RAYU"[3)], which was one of the famous hot-selling food products in 2010. We also have found many other examples with trending dynamics characterized by exponential growth[4)5)].

The dotted line of Fig.1 is a simulation result by our model which is based on the SIR (Susceptible-Infected-Recovered) type model. The SIR model characterizes epidemics well such as a flu and ebola. We replaced these states to a " ground ", " excited "and " final "state respectively and developed the model in order to be effective for social modeling. Agents who have a exited state are very interested in the topics, whereas agents who are in the final state have gotten tired of the topic and agents who have the ground state have not known the topic yet or are not interested in the topic enough. Agents move from the ground to the excited state and from the excited state to the final state according to the parameters.

Our model reasonably reproduces the time series especially the early period of growing trend and the latter period of relaxation, however around the peak our model does not work well and we assume this is caused by mass media effects such as TV which accelerates the trend. We can quantitatively discuss these effects by comparing the actual and simulation result.

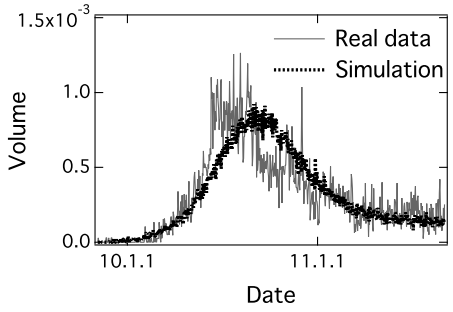

Fig. 1: Time series of volume including the word, TABERU-RAYU. The solid line is an actual data and dotted line shows the simulation result.

In addition we find other types of dynamics such as power law growth and relaxation in the number of blog entries including specific word, for example Christmas[6)] and our agent-based model reconstructs the dynamics[4)].

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