Information spread and infection of computer virus on the scale-free network

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Recently, research for networks in real worlds is a very active area that differs from the conventional graph theory. It has been shown that all real networks, such as WWW, router on internet, citations, language network and collaboration of movie actors, have the features between random and regular networks: the distance between any two vertices is small and they are well clustered. Such a feature is called small-world networks. Moreover, in WWW, the degree distribution follows a power law. Such a network is called scale-free network, also observed in the collaboration of movie actors and social networks.

The above-mentioned two features are necessary for analyzing the information spread by using simulations. However the small-world network model does not have the power law distribution, however it is not whether scale-free network model have small-world network or not.

Moreover, though many researches for the infection of computer virus are analysises on random and regular network, the prediction of damage and immunization are not well-studied for real networks.

Based on the active researches for the scale-free network, we study the following;

1. It is examined whether scale-free network model has the features of small-world network or not.
2. Using network model based on the actual number of mail transmission and reception, infection of computer virus applied for the stochastic state transition is analyzed.

For 1., we have shown scale-free network model has the features of small-world network. We have found the generated model is close to real networks. Moreover it has been shown that information widely spread if average path length is between 4 and 5. This result suggests information seems to be spread in real networks.

For 2., we discuss the recovery prevalence, which not be explained the by threshold theory in the conventional epidemiology. It suggested that recovery prevalence is happened by growth of the network by the new users. Furthermore, we verify the damage can be efficiently suppressed by immunization of PCs as the hubs.