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Simulation Model of Social Network Environment using System Dynamics

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Abstract. Research on social interactions and networks in the field of social science is being conducted in various directions. Among them, we present a simulation model to analyze how each node responds to incentives or similar inputs to social networks. In addition, it is possible to confirm the reaction of the associated node when the value representing the attribute of the specific node is changed by real time. The proposed simulation was designed considering various environments such as simple/bidirectional, feedback, and weighting. Since a given environment requires repeatability, real-time analysis, and association analysis, we implemented a simulation using feedback based system dynamics environment rather than an agent based environment.

Keywords: Social Science, Social Networks, System Dynamic, Simulation

1 Introduction

In recent years, social science simulation has been carried out for social reality, and Social Interaction is evolving to focus on structure and network [1]. One of the areas where Social Interaction and Social Reality are best reflected is the Social Network.

In this paper, we construct a simulation model for a social network environment and present the results. In particular, we focus on the fact that social networks are based on network associations, and affect decision making of me and other people [2]. We will confirm this part through simulation.

Simulation can track changes in state of each node when input such as funding is provided, and change the response of another node in real time when weights of specific nodes are changed. This result can help identify important nodes of social networks, and identify nodes that have a significant impact on other nodes, which will be of great help to practitioners who want to use them in business.

2 Related Research

There are various techniques for social science simulation, but most of them are using System Dynamics and Agent Based Modeling [3].

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The goal of this paper is to understand the response of each node to a particular input and to identify the positive and negative responses of other nodes when weights are changed for a particular node during simulation. Therefore, we use Vensim, which implements System Dynamics without using NetLogo. [4]

What you need to use your social network for business is to look at the response of each node when you give input like an incentive repeatedly. In addition, we examine the effect on the other nodes when the weights given to specific nodes are changed (when the incentives are raised or decreased). To do this, we will construct a small model with all the characteristics of real social networks, and simulate & analyze the response of each node in real time.

3 Simulation Model

Simulation for social networks can be configured in various forms. However, Figs. 1 shows that the simulation is configured to have characteristics of link and node weights and initial values, unidirectional links, feedback links, circles, and link weights according to the purpose of the paper. Although small-scale models have been constructed in terms of land use, there is no change in the extent of expansion.

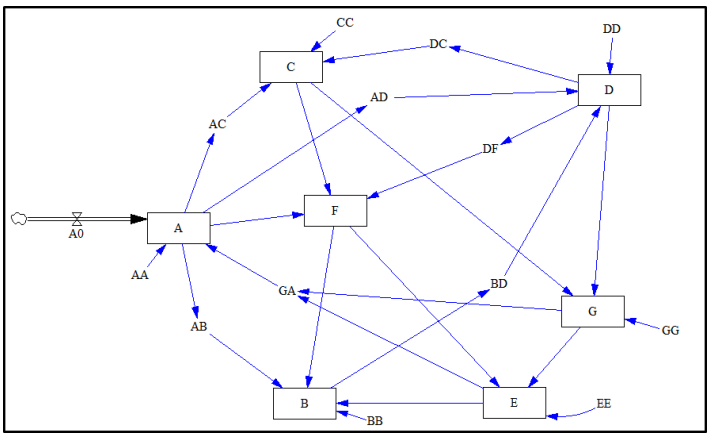

Fig. 1. Simulation model about Social Network

The characteristics of the model presented in Figs.1 are summarized as follows.
[Characteristics of Figs.1]

- The model is a seven-node social network
- Unidirectional links and feedback links are represented simultaneously
  - Unidirectional link
    : AC, AD, CB, BD, DC, DF - Unidirectional and weighted
    : AF, FE, CF, FB, FE, DG, If no weight is given
  - feedback link
    : GA node - G, E node feedback
    : DC node – D node feedback

- Circular model
  - Circular model example: D-G-E-B-BD-D.
- Weights of nodes and links are represented by the expression of connected nodes and links
- We constructed the model so that we can change the initial value and the weight per node in real time
- Direct feedback between two specific nodes is not taken into account

Models with these characteristics have flexibility and extensibility to accommodate various environments in the real world

4 Analysis of response of nodes to repetition of specific input

Social networks (such as Facebook and Twitter) work in conjunction with wired and wireless environments. In this case, many people want to use social networks for marketing. Marketing events will be conducted in order to achieve optimal effects on specific social networks. It is important how many times, and how strong it is.

Figs. 2 shows a graph of the response of each node when a total of 10 marketing events in the social network were conducted in the intensity range of 10.

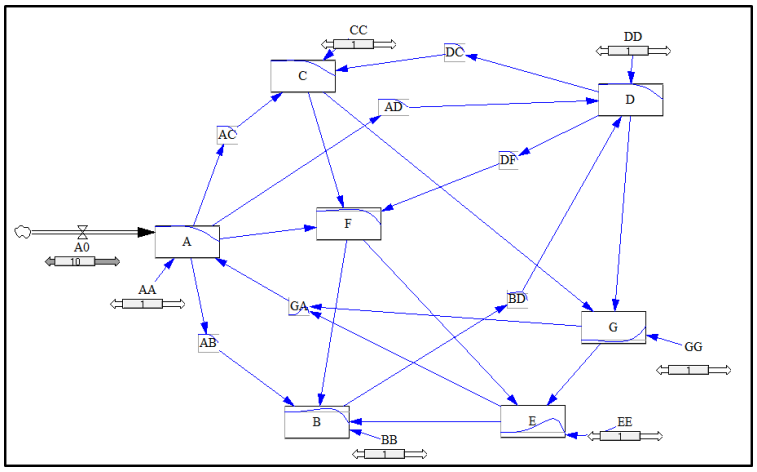

Fig. 2. Analysis of response of nodes to repetition of specific input

In the simulation results shown in Figs. 2, most nodes respond negatively when given a certain input, but Node G, E have a positive response. It is possible to preview the response of a node through simulation.

In the simulation model, weight 1 is set for AA, BB, CC, DD, EE, and GG variables. This is used to analyze the effect of a change in the weight of a particular node on the overall node later. In Figure 2, this is set to 1 so that it does not affect the overall simulation.

5 Analysis of the Response of Nodes when Weights of Specific Nodes are Changed

Once you have confirmed the response of the nodes to a particular input, it is time to perform the next step. That is, how a particular node affects another node. In other words, if you change support for a particular node, you need to analyze how the response of other nodes changes. This is the basic step for the analyst to determine how to process the node

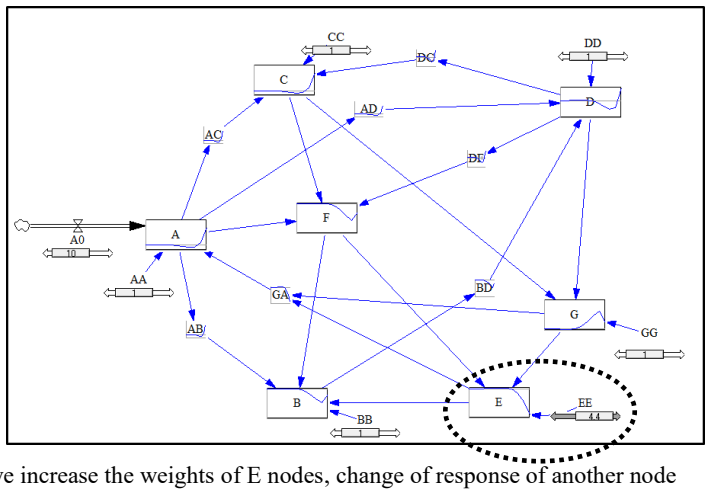

Fig. 3. If we increase the weights of E nodes, change of response of another node

Figure 3 shows the response of each node in real-time when the support for E-node, which showed a positive response in Fig.2, is strengthened from 1 to 4.4.

When node E increases its support, its response changes from positive to negative, and node C changes from negative to positive. The G node also has a negative tendency. In this way, it is possible to grasp in real time how changes in support for a particular node affect other nodes, including itself

6 Conclusions

Through social network simulation, we can see the response of each node to a given input. And when you affect a particular node, you can also check the response of other nodes. In addition, changes to the settings for the link can accommodate a variety of environments the model can have.

Simulation is structured similar to the reality by using the directionality (unidirectional, bidirectional) of the social network, node and link characteristics using variables, constants, and functions.

It is important to note that most of the social networks to be analyzed in practice are large in size. At this time, it may be effective to perform the analysis according to the purpose of the analysis (for example, only for nodes with three or more links). At

this time, it is possible to reduce the size to an analytical scale by applying the concept of the group node [5]. For a simple one-way model, refer to the Journal of the KIECS [6].

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