Georgia Institute of Technology
CSE 6730

Simulation of rumor spread in social network

Project proposal

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1 Introduction

Rumor spreading is an important factor in social communication, which has triggered vast research interest. It is much more complex than epidemic spreading or news spreading since there are uncertainty during the process. Sometimes a person doesn't believe the rumor at all, sometimes he buys it and becomes a rumor spreader. The probability will affect the result of the rumor spread. It is fairly useful in many areas, like market branding, entertainment business, communication, etc. Our project aims to simulate the process of rumor spread in social network using Discrete Event Simulation.

Currently, there are many researches focusing on social network and rumor spreading. SIR models[1] are most famous by adopting the idea mentioned above. Also, there are some simulations focusing on large-scale social network, like SUPE-Net model[2].

However, there are several limits among current study : (1) With social network being dynamic, it usually has a lot of interaction. The complexity of the model is much higher than a static model. So the original model can be too simple to be real. We need a parallel model to simulate this properties[3]. (2) Social network usually involves higher participation, which makes the model harder to simulate due to its large scale. Some large-scale models even need large scale parallel computers to simulate. (3) In a social network system, the outcome of rumor spreading can be largely different if some uncertainties happens. Most of the models are built with a lot of assumptions. Therefore, the prediction of a model will only be correct if there are no uncertainties at all, which seldom happens. All these properties bring more difficulties to building an accurate social network simulation, which will also be the biggest challenges for our project.

2 Simulation approach

In our project, we implement Discrete Event Simulation to model the social network system that we use to simulate rumor spreading. According to Maki-Thompson (MK) model[4], there are three kinds of people in our network, including S as spreaders who spread the rumor, I as ignorants who don't know the rumor and R as stiflers who know the rumor but don't spread it. If a spreader meets an ignorant, the ignorant can become a spreader. But if two spreaders meet, one of them will become a stifler. And if a spreader meets a stifler, the spreader will become a stifler. The cases above are expressed in the form of equation as following:

$$S + I \rightarrow 2S \tag{1}$$

$$S + S \rightarrow S + R \tag{2}$$

$$S + R \rightarrow 2R \tag{3}$$

However, on the basis of our understanding for typical rumor spreading phenomena, we define a new model based on the MK model that introduces one new kind of person named as truther(T), which represents those people who knows the rumor and tries to negate the rumor to everyone in the network. Apart from that, we also alter the actions of those entities. For example, the spreader changes the ignorant to a spreader with probability α, and to a stifler with probability β.

As a Discrete Event simulation, we perceive every person in our network as a queue for anyone else in the system. Any spreader or truther contacting any other one in the system will occupy the person for a while, if another spreader or truther want to reach out to that person in the meantime, they'll have to wait, As is shown in Figure 1:

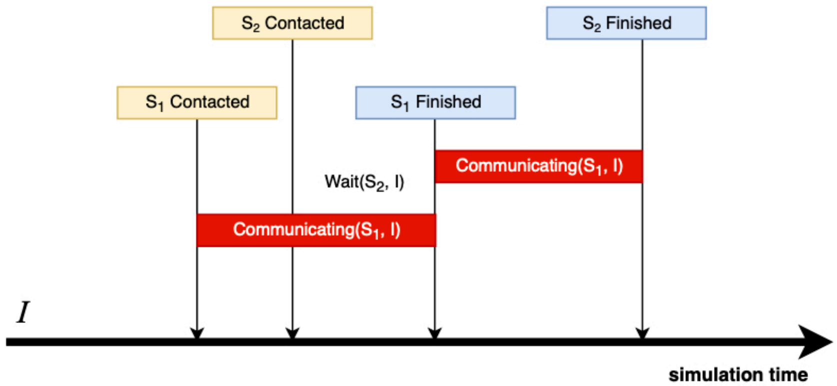

Figure 1: An interaction queue in the social network system

Still, there are several other parameters of this simulation to be clarified in the future, like the way we pick people in the system to interact, how often a spreader contacts other people, etc. By creating this new model, we can scale up the complexity of our system, making communication more frequent with uncertain results, so the rumor spreading inside the network can be more realistic. Hence, to build a convincing model, we need to collect data from research papers in sociology to decide the possibility of certain outcomes after different kinds of meetings. Besides, its necessary for us to get data from previous research on rumor spreading to check whether our simulation result fits the real cases and modify our system if necessary.

3 Project plans

Our plan for this project is to first produce our program that can simulate the rumor spread in the network and verify that the simulation program runs as we planned in the beginning. Compared with traditional simulation methods, Discrete Event Simulation can play an important role when the simulation network is very large. We can implement a priority queue when we are building the program for Discrete Event Simulation. When the simulation involves a large scale network, we can choose also heap to build the priority queue. Even if the system is very large, like real-world human society, we can implement the Ladder Queue[5] to construct the priority queue. Discrete Event Simulation will make the simulation of large-scale system possible. Besides, Discrete Event Simulation can also help us complete the prediction process of the system[3]. After establishing a system, we'll compare it with our conceptual model to see if those two are a match

Then, after we finish a verified model, we'll use this model to simulate the rumor spreading with different parameters, such as the possibility of different role-changing, the initial spreader to truth ratio, and the time interval between the first action of spreader and truth, analyzing the bottleneck information of the rumor spreading system[6]. We can analyze the rumor spreading system efficiency information using the bottleneck information. For example, we can calculate the speed of rumor spreading and the average spread time through each person. We can also calculate how long it takes for each rumor to spread through certain amount of people in one social network. This can be done through giving each event a timestamp. Meanwhile, we'll collect data from previous research or conduct survey ourselves to check whether our simulation fits the real case.

Because the system is a event-driven system instead of a time-driven one, we don't need to calculate each situation at each time point. So it can reduce the complexity of building a self-organization world, which is very important to the simulation of a social network, making it possible that we analyze some large-scale social communication models after we simulate this rumor spreading successfully.

References

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