Agent-based Simulation of Group Chat Interaction

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Abstract—Instant messaging (IM) has become a dominant method of communication for various reasons. One feature that is commonly present in IM apps is the ability to make group chat, allowing individuals to share/receive information from a shared virtual space with a group of people. In this research, we are developing new model to simulate people interaction in a group chat using agent-based modeling. Each agent will have internal model to initiate messages or respond to messages posted by other. Agents learn to adopt its behavior based on its utility function depending on the outcome of the interaction. The steady state condition of the group chat interaction is expected to reach either of the three following states: 1) No interaction, 2) Perpetual posters, and 3) Dynamic group. This model is going to be applied to develop a method for an individual to reduce the spread of fake news within a group chat.

Keyword: Agent-based modelling, social simulation, group chat

1 Introduction

With the rise of smartphone applications, instant messengers (IM) have become one of the most popular mode of communication in the world. They are widely used because of many reasons. Among them are their ease of use, accessibility, low cost, and various features. One feature that typically exists in IMs is the feature to make a group chat. Instead of having conversation between only two people, one can make a group comprises of more than two people who then can communicate through sharing contents and responding in a single shared channel between the group members. Despite the benefit of using group chat, there are also some problems associated with it. In some occasions, Whatsapp group has been reported to be used for cyberbullying, medium to spread hoax/misinformation, as well as extremism fueling hate speeches. In this research, we will focus on how to reduce the spread of hoax in IM groups.

The spread of misinformation in IM groups has been claimed to be contributing to various problems ranging from inciting violence to destabilizing democracies. While regulating IMs might be beneficial to curb the spread of misinformation, it could also be against the interest of the stakeholders having authority to do so. Therefore, we propose a bottom-up approach of combatting the spread of fake news meant for individual user of IM group chats. Before we develop a recommendation for individual IM group chat user, we will develop a model that reflects people's interaction in IM group chats at this stage. The model is going to be done using agent-based approach, where we could model individual IM group chat members as the agents. From here we would develop different scenarios that is used to model different context of IM groups. In the current research, we limit ourselves in developing only the most basic feature of interactions that present in the typical IM groups.

2 Model Summary

Consider a set of agent $Agent = \{a_1, a_2, \dots, a_N\}$ with $N \in \mathbb{Z}^+$ number of member agents in an IM group chat. Assume that the group chat topic is limited in one topic, where each agent holds negative or positive predisposition on the topic represented by $p \in \{-1,1\}$ respectively. Every agent possesses utility variable, $u \in [0, U], U \in \mathbb{R}^+$, that represents general comfort level an agent feels in its relation to the group. The higher the value, the more comfortable the agent is to interact in the group. Each of these agents have three possible actions they can do, 1) *Start conversation*, 2) *Respond to conversation*, and 3) *Silence* as $Actions = \{Start, Respond, Silence\}$ .Each of this actions affects personal utility directly and through externalities due to other agent's actions. The detail of the actions will be explained further in the next paragraph.

Let us use the subscript i to denote variable associated with arbitrary agent a_i. The model goes with discrete time tick where each time tick is represented by $t \in \mathbb{Z}^+$. The model is always started by determining whether there will be an agent that start conversation by probability

$$P[Start] = \frac{1}{NU}\sum_{i=1}^{N} u_i \quad (1).$$

Then the probability of arbitrary agent a_i to start a conversation is

$$P[Action_i = Start|Start] = \frac{u_i}{\sum_{i=1}^{N} u_i} \quad (2).$$

Once conversation is started, other agent can respond with two steps probability similar to the mechanism to start conversation. The probability to respond given conversation started is

$$P[Respond|Start] = \frac{T-(t_{respond}-1)}{T} \quad (3).$$

Where $T \in \mathbb{Z}^+$ represents the number of follow up responses we allow after a conversation has started and $1 \leq t_{respond} \leq T$. The probability for arbitrary agent a_i given that someone is responding is the same value with equation (2),

$$P[Respond_i = Respond|Respond] = \frac{u_i}{\sum_{i=1}^{N} u_i} \quad (4).$$

The same agent cannot follow up its own action directly, it can only respond action done by other agent. A conversation is considered to end if one of these conditions is fulfilled: 1) $Start$ followed up by $Silence$, 2) $Respond$ followed by $Silence$, or 3) $Start$ followed by $Respond$ for T times. Agents will try to make a conversation until one of the condition for simulation ending is fulfilled. The simulation is stopped if it fulfills either of two conditions: 1) The simulation reach the time limit provided or 2) It has been t_{stop} tick of consecutive $Silence$ after a single conversation ends.

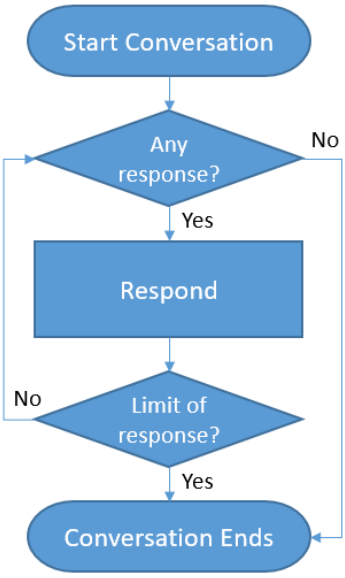

Fig. 1: Flowchart of one conversation cycle.

Each of these actions could increase or decrease agent's personal utility variable depending on the predisposition, whether personally or through externalities. In principle, actions that are done by any agent will result positive or negative externalities for other members of group chat depending on whether they have same value of predisposition with the agent who did said action. Unfortunately, we will present the course of actions corresponding to the values of externalities due to limitation of space here. Based on this, agents will be rewarded/punished based on the action they choose influencing the probability of actions they choose later.

3 Expected Result and Further Works

With this model, we expect we can fine tune the parameter to reach one of the following predicted steady states of the simulation: 1) No interaction, 2) Perpetual posters, and 3) Dynamic group. No interaction is when there is no action done in the group after within specified time period. Perpetual posters happen when only a few number of agents doing their actions in the group. Dynamic group is when we have each member having similar share of contribution in the IM group chats for a specified time period. We aim to understand the conditions that lead one group to reach a particular state and how to transition the state from one to another. In particular, we want to examine the possibility to change from having perpetual posters to dynamic group. Some social phenomenon that are observed in other kind of group interaction such as bystander effect is also expected to come out in the simulation results.

Since the original purpose of this research is to find out a method for an individual agent to stop the spread of fake news in a group chat, some parallel from real life example should be applied for this model. For example, in the context of family group chats, there might be few respected family members who like to share fake news but the younger member of the family is afraid to intervene due to fear of creating familial conflict. This kind of hierarchy is currently not included in the model, but should be considered for future further step for application purposes. Within the limit of this model it might be done by giving specific roles for different agents to simulate real-life scenarios closer.

Selected References

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