Initial Plan
Tracking Beliefs and Trust in Social Networks

CM3203 - One Semester Individual Project - 40 Credits

Author: Dimosthenis Antypas
Supervisor: Dr. Richard Booth

1 Project Description

In a social network, people receive information about the world from people they are ”friends” with. These friends are in turn influenced by their friends, and so on. However, as we do not trust every friend on the same degree some opinions coming from more trusted friends would be more influential than others. Moreover, it is possible that even though we trust a person on a particular subject, e.g politics, and we value her opinion we do not trust them in another subject, e.g sports. Finally, in such a context interesting questions arise about (1) the possibility of one persons belief pervading the network and also (2) if the level of trust between two persons can evolve.

The evolution of beliefs in such a network can be simulated by using Belief Revision Games (BRGs). BRGs are “zero-player” games where at each step every agent, e.g a person in a social network, revises her own belief by taking into account the beliefs of her acquaintances (Schwind et al. 2015). By using BRGs we are able to formalise the problem and with the combination of propositional logic, belief revision theory and belief revision solvers to study the dynamics and the development of the network as well as attempt to answer the aforementioned questions (1), (2).

The project is going to extend the functionality of an existing Java application which provides the ability of constructing a network of agents with individual beliefs and also a selection between numerous of revision policies.

2 Project Aims and Objectives

The project aims to study the propagation of beliefs in social networks. By simulating social networks as Belief Revision Games we attain a formal framework which we can use to test different existing belief revision policies and by developing it further we can achieve a more realistic representation of a social network. This way we aim to acquire results that are going to be potentially useful in order to study several interesting notions such as influence, manipulation and gossip.
Main objectives of the project are to:

1. Form a better understanding of what it means for one agent to trust another by using related scientific work (Hunter and Booth 2015) as a starting point.

2. Incorporate trust through a form of selective revision. To achieve this we are going to extend the definition of BRG (Schwind et al. 2015) to include trust, where each agent i in the network assigns to each of its neighbours j the topics over which i trusts j.

3. Examine if the beliefs of an individual agent can pervade across the network.

4. Attempt to model changes of the level of trust between agents in the network.

We aim to achieve the above by expanding on the functionality of the existing Java application and then gathering and analysing experimental results.

3 Work Plan

The nature of the project requires a good understanding of the theoretical background and a thorough research on Belief Revision Games. Thus, a waterfall approach will be used for the developing process of the project.

To be more precise a weekly plan is presented below.

Time Schedule:

- Weeks 1 - 2: Initial research on previous studies and related bibliography on Belief Revision Games. Analyse and understand the existing Java application we aim to build on.

- Weeks 3 - 5: Search for and develop new techniques (e.g revision policies) required to fulfil the project's objectives. Firstly, simple accounts of trust between agents will be explored, e.g trust in the other with regard to specific variables, and then arbitrary propositional sentences will be considered. By the end of Week 5 arrange meeting with supervisor to review progress done and adjust the plan for the project.

- Weeks 6 - 8: Implementation of additional functionality in the application. Based on the research done in the previous weeks incorporate the trust aspect in the program. Modify the interface of the application so trust relationships between the agents are visible and allow the user to configure them. Aim for at least three functional revision policies which will be able to account for trust relations. Use previous related work (Hunter and Tsang 2016) as a guidance.

- Week 9: Arrange meeting with supervisor to review the code implementation and discuss methodology of experiments to be performed. Perform experiments on:

  - Conditions under which one agent can have their beliefs held by everyone else in the network.

  - Possible convergence of beliefs.
  - Optimizing the algorithm for better run-times.

- Weeks 10 - 11: Summarize the results of experiments conducted and write the final report.

4 Deliverables and Milestones

Following the work plan described above, by the end of Week 2 a solid understanding of the background related to BRGs as well as familiarity with the existing application will have been achieved.

After the initial research and by investigating further how trust relationships can be represented we aim to have a more concrete view on the additional functionality needed for the existing application. By Week 5 most of the scientific and theoretical research will be have been completed and skeleton plan, e.g. UML diagrams, UI prototype, for the implementation will be available.

By Week 8 all the necessary extended functionality of the application will have been implemented and we will begin conducting related experiments. All of the experiments will be completed by the end of Week 9.

Finally, by Week 11 the final report that will include all the research done, the results of the experiments and the documentation of the added functionality will be completed.

References

Hunter, Aaron and Richard Booth (2015). "Trust-Sensitive Beliefe Revision". In: *Proceedings of the Twenty-Fourth International Joint Conference on Artificial Intelligence (IJCAI 2015)*, pp. 3062–3068.

Schwind, Nicolas et al. (2015). "Belief Revision Games". In: *Proceeding AAAI'15 Proceedings of the Twenty-Ninth AAAI Conference on Artificial Intelligence*, pp. 1590–1596.

Hunter, Aaron and Eric Tsang (2016). "GenB: A General Solver for AGM Revision". In: *JELIA 2016: Logics in Artificial Intelligence*, pp. 564–569.