Following the Crowd: How Herding May Affect Binary Decisions

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Background

- Social Networks, specifically those networks where information is traded, is ubiquitous today
- Sometimes, those networks create a “herding” effect, where individuals begin to “follow the crowd” rather than follow their own personal information
- Depending on the network in question, how does this “herding effect” affect binary decisions?
- Previously, networks have been looked at, but we want to focus on the “herding effect” and how that pertains to different network models; specifically, how it affects everyone’s probability of making the correct decision

Techniques and Approaches

- We assumed that agents make the optimal decision given the information he has available to him, including others’ choices
- To find this decision, we calculate conditional probabilities using Bayes’ Rule to find the decision that has a higher chance of being correct
- We continued in this fashion with each agent until we found a pattern and made proofs to confirm these patterns were legitimate
- We assumed that each decision has an initial probability of being correct; this probability changes for each agent depending on the information presented
- We looked at two networks: the Sequential Social Learning Model (SSLM), with sequential, permanent decisions; and the Social Network Model (SNM), with simultaneous, multiple decisions.

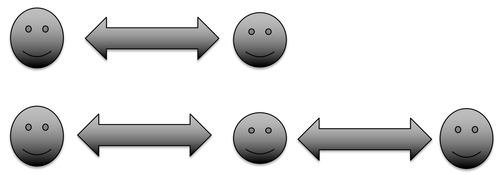
Results

- For the SSLM, we found that a threshold existed for each decision an agent can make, depending on the initial probability and others’ choices
    - The easier it is for the network to obtain these thresholds, the more often agents will ignore their own signals
        - Furthermore, if this can easily happen, then it follows that the first few agents determine the choices of a myriad of others, which decreases the overall effectiveness of the network
    - If the information given to each agent passes this threshold, the agent forgoes his own, private information and chooses to follow the crowd

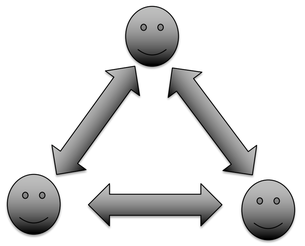
Results (cont.)

- For the SNM, we found that, depending on which agents can be seen by others, different instances of herding effects occurred
    - In a totally transparent network, agents were most often persuaded by a majority, no matter what the correct decision actually was; herding was abundant and many incorrect decisions followed
    - However, in two- and three-player networks, where agents were attached in a string-like fashion, there was no “herd” to follow
        - a tug-of-war began as a result of agents acting on their own information… the stronger signals always ending up winning; in fact, these networks guaranteed a correct decision

Guaranteed Correct, No Herding



Herding, Correctness not Guaranteed



Conclusions and Next Steps

- We confirmed that, in the SSLM, the first few decisions have a tremendous amount of influence on the rest of the network. Furthermore, herding most likely occurs when the probability of one of the decisions exceeds a threshold.
- For the SNM Networks, we found that, generally, much connectedness means faster convergence, but does not imply correctness
- Furthermore, in SNM we found that in a tug-of-war style of information, agents will eventually arrive at a correct conclusion. However, we know that a completely connected network is fallible.
- Our next steps include looking more at networks that are guaranteed to be correct. Furthermore, we want to see if changing the number of agents involved changes the likelihood of herding

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