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Misinformation in Social Networks

In recent years, countless new false information stories ranging in topics from health, politics, natural disasters, or conspiracies have surfaced and been shared millions of times. This kind of misinformation has a significant impact on both individual-level decisions (such as health-related decisions) and collective-level decisions (such as before voting). Hence, major institutions and organizations are considering misinformation as a threat to our societies and are calling for measures to prevent it. To evaluate adequate policies in the fight against misinformation, the reason for how it generates and the way it spreads in social networks have to be properly understood.

First, we introduce a model in which agents share true and false signals with different decays and to different people. We find the agents who are more central in the network of negative signal sharing are more prone to be misinformed. We derive a single threshold condition under which societies reach the true state or are misinformed in the long run. Additionally, we derive the speed of convergence to a given state, which is crucial for decision-making constrained by time. Both the threshold condition and speed of convergence depend on the combination of network structure, as measured by the largest eigenvalue of the adjacency matrix, and the decay factors. We illustrate these results using numerical simulations that incorporate societies segmented into groups and discuss policy implications.

Second, we focus on trust inference over the signed networks. We assume that the network nodes are of two different types and link signs correlate with the node types, which induces some patterns of structural balance. Given a signed network and information on the types of some source nodes, we consider an observer outside the network who attempts to judge the type of a given target node. Computing the globally optimal belief by Bayes' rule involves considering exponentially many states. We propose a much simpler heuristic that is based on the shortest paths between source nodes and target nodes. Theoretically, this heuristic is weakly better than another heuristic from the literature and it coincides with the Bayesian rule when the shortest paths between the source nodes and a target node are unique and non-overlapping. With simulations, we assess the accuracy of these three rules and find that differences can be substantial. The shortest path heuristic is better than the other heuristic in handling multiple source nodes, even though it aggregates information suboptimally. The crucial network statistic for accuracy is the average distance in a network.

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