Thesis: Role Of Influence In Complex Network.

Abstract: In this thesis, two 2-player games are used to understand properties of several types of graph structures. In particular, how information would travel if people had the tendency to follow friends/connections with higher influences than themselves. We created a simulation framework and experimented with Stag Hunt and Hawk Dove games in Torus, Grid, Random, Watts Strogatz, Barabasi-Albert, and a Facebook friendship datasets. The game is played in multiple rounds or until the steady state is reached. After each round, each player may independently decide to change their strategy. This change in strategy is determined using best response dynamics, given the player's payoff relative to their neighbors, in the previous round. This is also known as evolutionary dynamics or diffusion. In this thesis, a new method is introduced in which players use a Fermi like function to use relative centrality as a factor in choosing their strategy for the subsequent round of the game. Our model considers the centrality of each node related to the whole population. We observe evolution of strategies under various measures of centrality. This approach helps us understand how information flows through the network when nodes in the network are "influenced" by their neighbors' centrality (and hence power) in the network.

By comparing these two strategy update rules, we encountered some similarities as well as differences, in relation to the speed of convergence, the point of convergence, and the final steady state. In some networks, in order to reach a steady state in the Stag Hunt game with centrality based rule, more Stags are necessary for the stags to dominate the network at steady state. It was also very apparent that centrality is affecting the time it takes to reach steady state. This is a sign of how some centrality measures affect the dynamics of the whole population. These results have allowed us to delve deeply into understanding the social impact of decision making and what occurs as a direct result of that social impact on a population thereafter.

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