Summary: Visibility of minorities in social networks

Visibility of minorities in social networks

Paper: https://arxiv.org/pdf/1702.00150.pdf

This paper analyzes how relative group sizes (attribute distribution) and homophily/heterophily affects the degree/visibility of nodes in the minority group(s).

Model

- the model combines preferential attachment and homophily using the fitness model. The probability of a connection is the product of the degree and fitness of the node. In this case, fitness depends on the attributes and level of homphily. Probability that node j connects to node i is

$$p_j(i) = \frac{h_{ji} d_i}{\sum_k h_{jk} d_k}$$

- h_{ab} is the homophily parameter between any members of group a and b
- Note: A single homophily parameter (like p_s in HBA) assumes that homophilic behavior of nodes in different groups is the same. This is too strong an assumption.

Impact of homophily and group size on degree

- For the minority, heterophilic situations are most beneficial. They receive the most attention from the majority, and the competition for attention among minority nodes is relatively low since they are a small group. heterophilic conditions are not beneficial, since nodes are mostly attracted by the minority
- in the case of extreme homophily, no competition exists between the nodes of different groups, and thus both groups compete only among themselves. The degrees of nodes in both groups grow similarly and their degree distributions are the same
- The power law degree exponent illustrates the ability of nodes to stretch their degrees to high values and thus receive more visibility. For example, minority nodes in heterophilic networks have high degree exponent.
- The degree exponent of the minority degree distribution varies nonlinearly with homophily. When homophily increases from $h = 0$ to $h = 0.8$, the exponent decreases because minority recieves less attention from majority nodes, and the minority nodes tend to link to the majority. When h increases from 0.8 to 0.1, the exponent increases because the nodes only link among themselves.
- In the extreme heterophilic case (h = 0), a minority group that represents 20% of the total population receives more than 40% of all degrees. The relation between average degree share of minority nodes and h is similar to the relation between degree exponent and h

Empirical networks

- visibility of nodes in real world networks vary similarly as a function of homophily
- real social networks do not necessarily exhibit symmetric homophilic behaviours
- 3 datasets: sexual contacts (extreme heterophily wrt role), scientific collaborations (moderate homphily wrt gender), APS (high homophily wrt subdomain)
- Despite the simplicity of the model compare to the empirical data, the degree distribution and fraction of minority in top d% percent of high-degree nodes of the data fall well within the standard deviation of the model fit