Problem: Community Detection in a Social Network

C44021032

May 6, 2017

1 Method Discription

The main idea is inspired by the concept of Louvain's algorithm to detect communities. In Louvain's algorithm, after giving a sequence of traversing order and unique community ids to each node, then each node tries to "join to its neighbor's community" according to the modularity gain. This process can be seen as "the propagation of communities label". In this homework, as Louvain's algorithm does, for each node, when deciding which community can replace the origin one of the node, **an intuitive method is to use the community occuring the most frequent in all neighbors and replace to its origin community**. The reason is that, people in real world are tend to believe(easiliy affected by) the major among friends.

Following is the method implemented in the homework:

1. Initialize labels on all nodes
2. Randomized node order
3. For every node, replace its label with occuring with highest frequency among neighbors(random if ties), if the replacement is helpful to modularity gain
4. update modularity
5. Repeat step 2. In order to avoid oscillation and ignore too little improvement of modularity when assigning community, set a iteration upperbound to break the loop

2 Analysis

My method performs unstable, it seems to be sensitive to the random order in the first round. Also, the detected communities number's range is very wide too. A possible reason is that the frequency base method maybe oscillate in

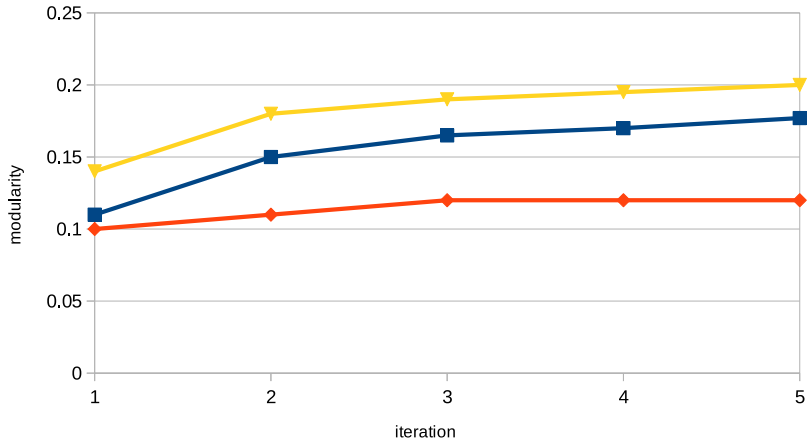

Figure 1: 3 experiments by my method

different order in a round, then modularity falls to local optimazation, once the first iteration complete, the improvement is limited. Generally, ANC(up to 0.93) is better than NMI. In terms of efficiency, my method check each node in an iteration, then check each neighbors(about 1 min per iteration). As a result, the complexity is higher than Louvain's algorithm because of the number of nodes(without merging node to supernodes, which saving much time in Louvain's algorithm).