AMRITA VISHWA VIDYAPEETHAM
DEEMED TO BE UNIVERSITY

19CSE337 Social Networking Security

Lecture 14

Topics to Discuss

- Louvain Algorithm

Louvain Community Detection

- Louvain community detection algorithm was originally proposed in 2008 as a fast community unfolding method for large networks.
- This approach is based on modularity, which tries to maximize the difference between the actual number of edges in a community and the expected number of edges in the community.
- However, optimizing modularity in a network is NP-hard, therefore have to use heuristics.
- Louvain algorithm is divided into iteratively repeating two phases;
  - Local moving of nodes
  - Aggregation of the network

Louvain Community Detection

- The algorithm starts with a weighted network of N nodes.
- In the first phase, the algorithm assigns a different community to each node of the network.
- Then for each node, it considered the neighbours and evaluate the gain of modularity by removing the particular node from the current community and placing in the neighbour's community.
- The node will be placed in the neighbour's community if the gain is positive and maximized.
- The node will remain in the same community if there is no positive gain.
- This process is applied repeatedly and for all nodes until no further improvement is there.
- The first phase of the Louvain algorithm **stops when a local maxima of modularity is obtained**.

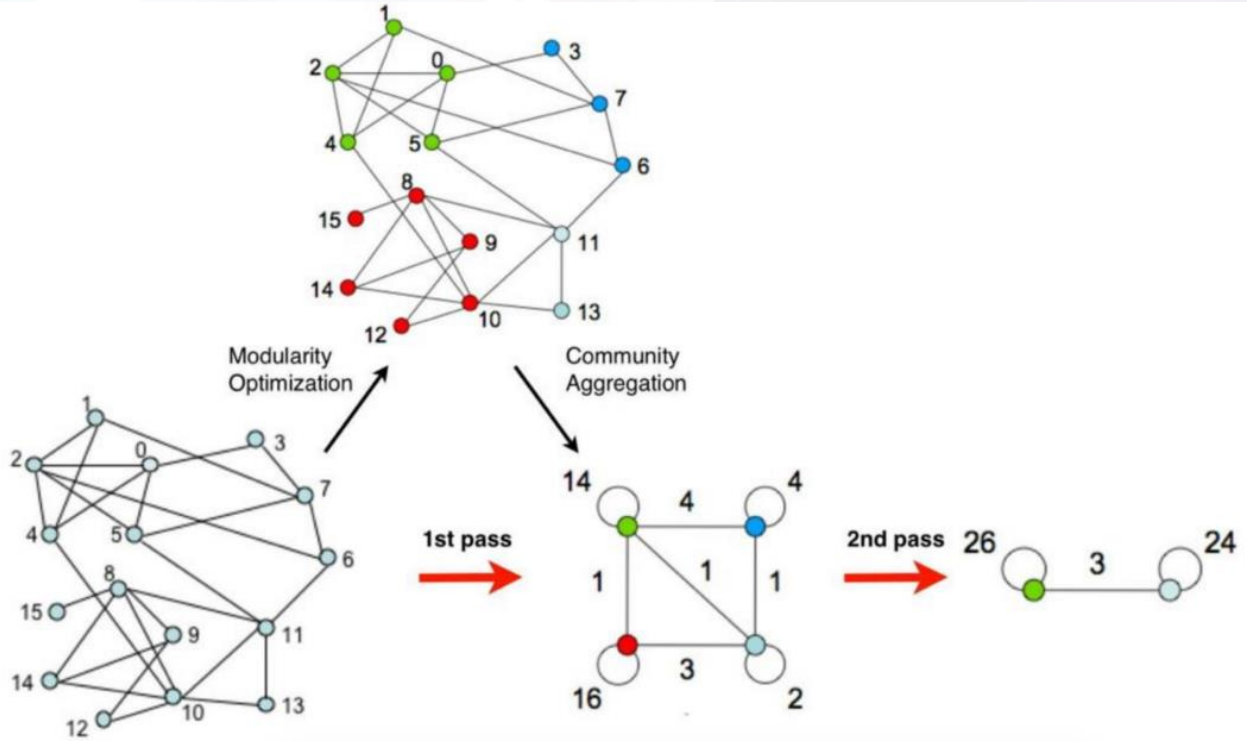
Louvain Community Detection

- In the second phase, the algorithm builds a new network considering communities found in the first phase as nodes.
- Once the second phase is completed, the algorithm will reapply the first phase to the resulting network.
- These steps are repeated until there are no changes in the network and maximum modularity is obtained.
- Louvain community detection algorithm **uncovers communities of communities** during the process.
- It is very popular because of the ease of implementation and also the speed of the algorithm.
- However, one major **limitation** of the algorithm is the **use of storage of the network in the main memor**y.

Louvain Community Detection

- One nice thing about this method is that it is parameter-free; you don’t have to specify the number of communities or the criteria to stop the algorithm.
- All you need is to provide network topology data, and the algorithm heuristically finds the community structure that is close to optimal in achieving the highest modularity.

Louvain Community Detection



Thanks……