Project 1: Gephi

Chalkiopoulos Georgios | $p3352124$

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Interactive visualization and exploration for all kinds of networks

Visualize the communities of a sample network from facebook.
This project requires that we import a network into Gephi, resize and color its nodes by measuring statistic and applying filters to highlight certain attributes, visualize it using a drawing algorithm, and export it to a web application that enables interactive network display.

First we imported the file `facebook.gdf` in *Gephi* software, which created the network. The main window/interface may be found in Figure 1.

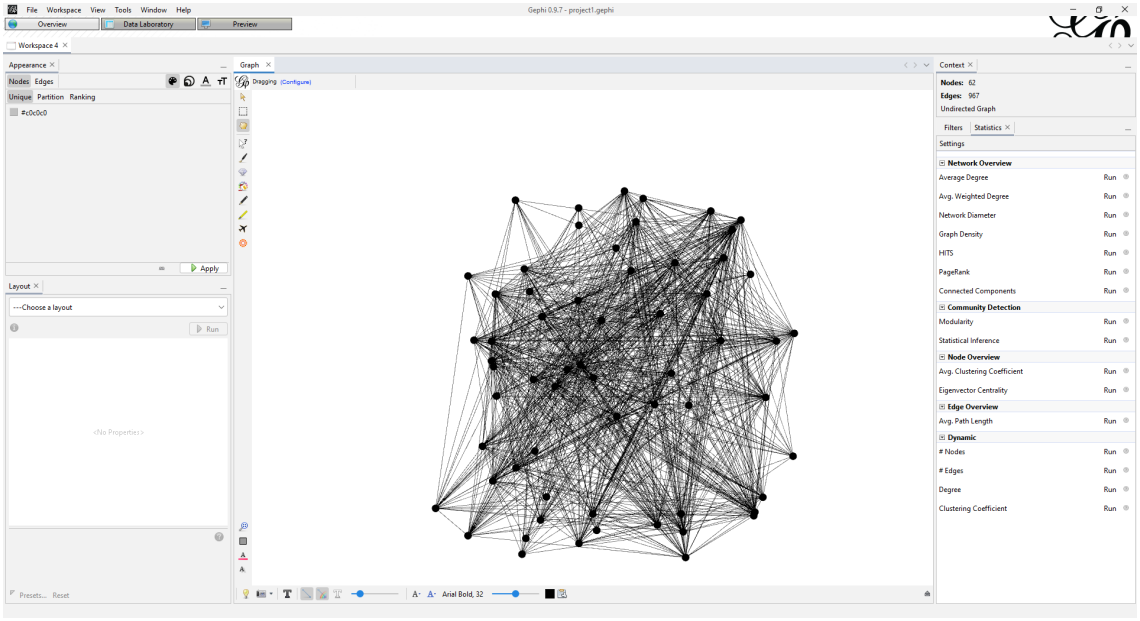

Figure 1: Gephi software interface.

We will proceed with answering the each Homework's question in the following sections. For the sake of completeness we will provide definitions of the metrics, if

needed, using as a reference the course's slides.

1.1 Measure the degrees of all nodes and resize the nodes according to their in-degree.

The degree (in or out) of a network is the number of edges incident on a node. From the statistics tab we used the *Average Degree* calculation which resulted in an Average Degree of 31.194. Since the graph is undirected, the in-degree is equal to the Degree. The output is found in Figure 2.

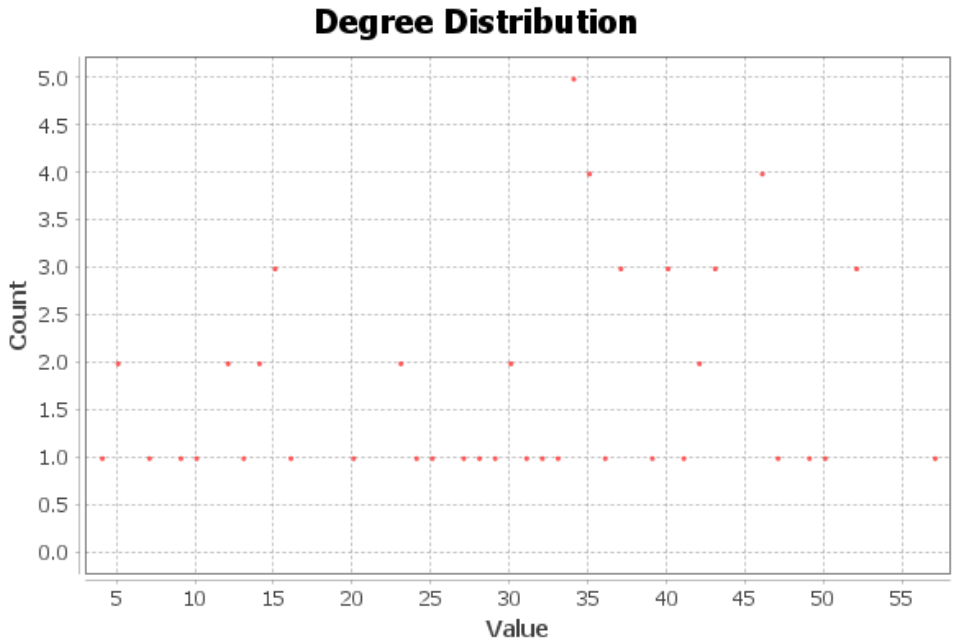

Figure 2: Degree distribution.

In order to resize the nodes according to the degree, the Appearance tab is used. By selecting the *size* icon and under Nodes/Ranking, the Degree is set between 10 and 50. Finally, for this step the results are presented using the Fruchterman Reingold Layout with default values. The output may be found in Figure 3

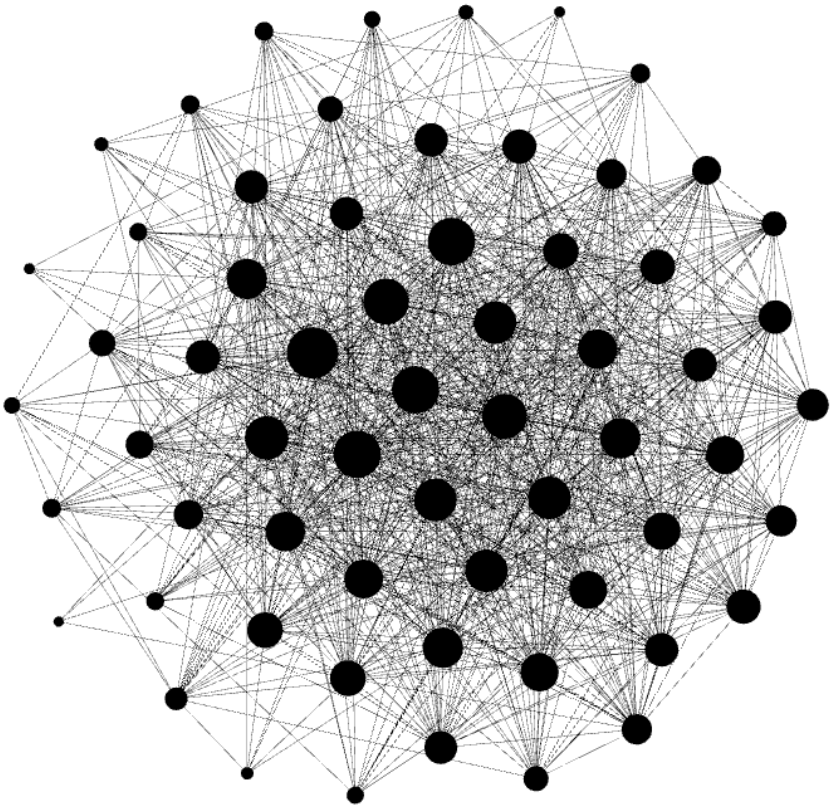

Figure 3: Rezied Nodes according to their Degree.

1.2 Find the network's diameter, the individual with the largest betweenness centrality and the communities existing in the network.

The diameter of a network is the distance between the two most distant nodes in the network. Similar to the previous approach we selected the *Network Diameter* option (in the statistics tab) which resulted in a **Diameter of 3**. The individual with the largest betweenness centrality can be found from the *Data Laboratory tab* by ordering the individuals using the betweenness centrality column. A sample of the data may be found in Table 1.

Id	Label	betweeness_centrality
1150672795	Hua Liu	118.905898
100001462903816	Tea Linwei Shao	60.920643
100003088796617	Han Zhang	52.699929
100000733574190	Tisa Fu	44.099923
1316072780	Yenan Liang	42.805893

Table 1: `Top 5 id/users ordered by betweeness centrality.`

Regarding the communities, Gephi offers the option to find them using the *Modularity* option. Using the default values we found that there are 4 communities. The corresponding graph can be found in Figure 4.

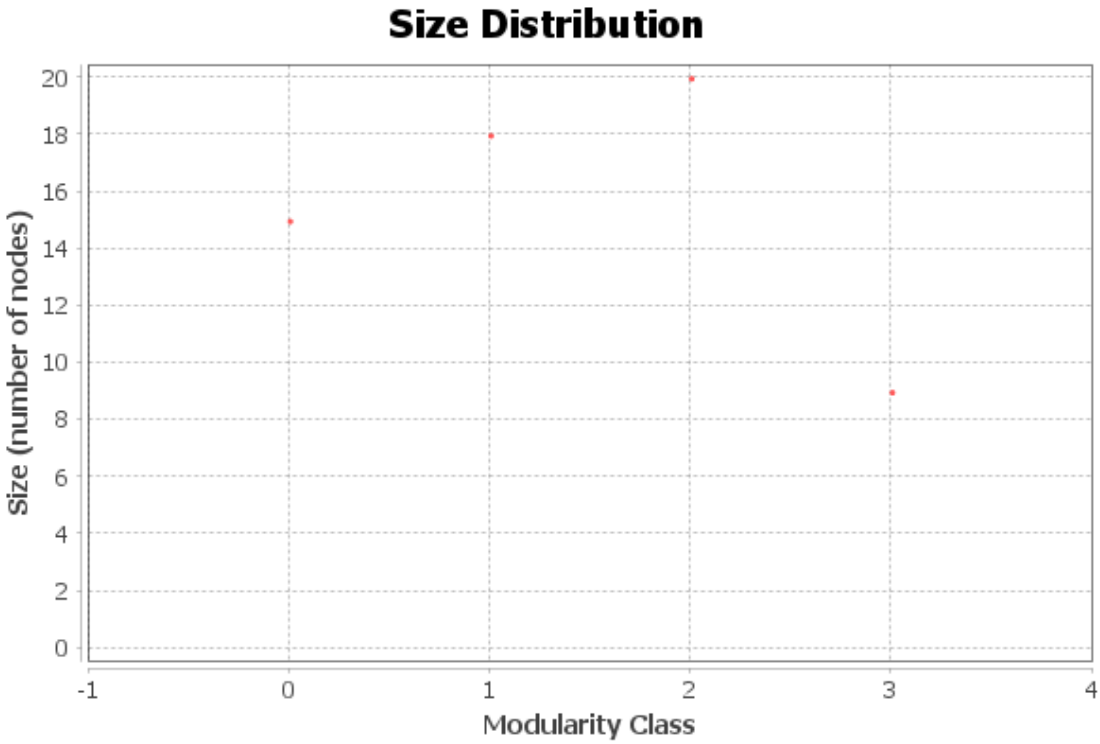

Figure 4: Community Size Distribution.

1.3 Color the nodes according to the communities you discovered.

Using the *Appearance* tab we colored the nodes according to the communities we discovered. The result is presented in Figure 6. In order to better visually enhance the graph, the node's size represent the node's degree, and each node has the label placed at the center. In this step the position of the nodes was randomly chosen.

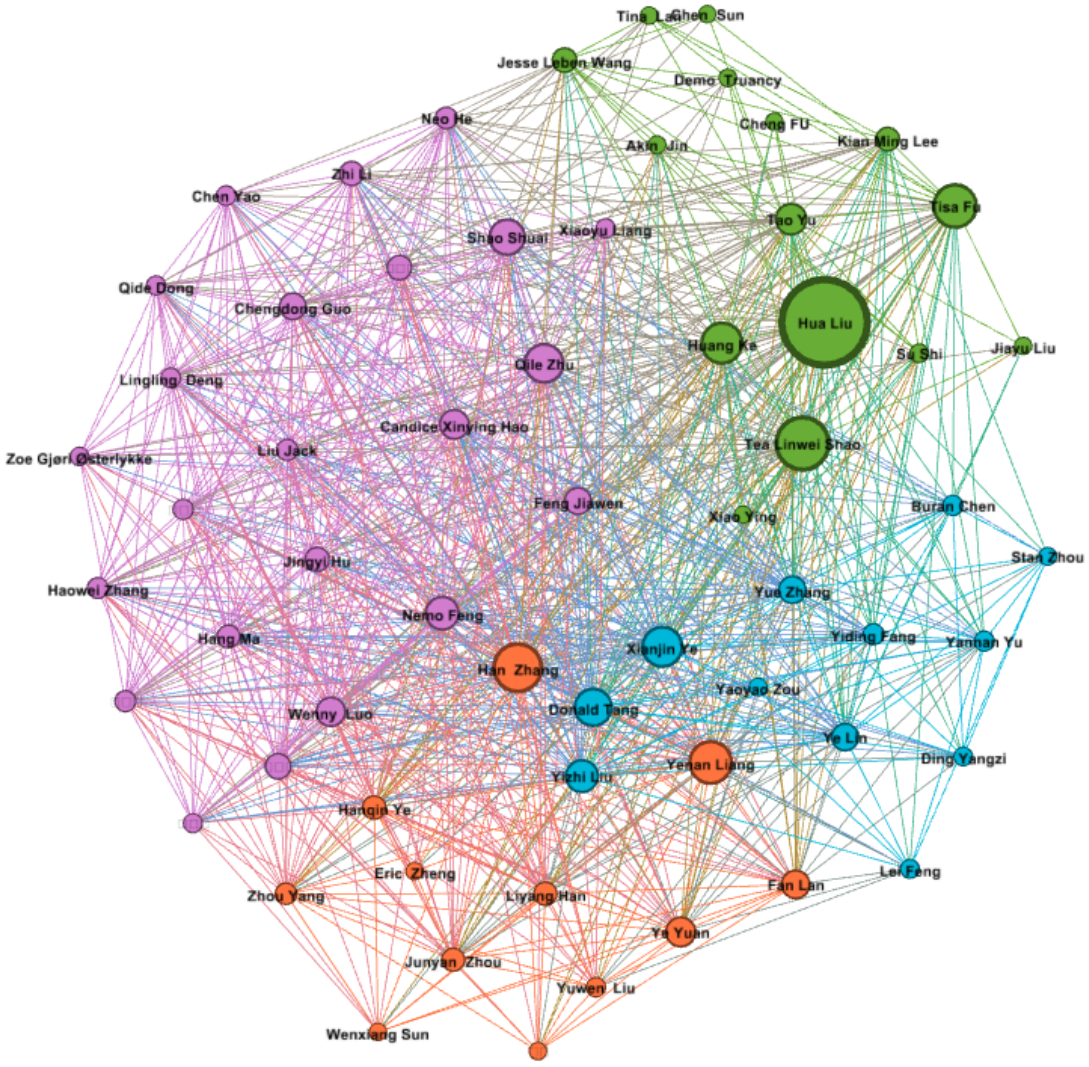

Figure 5: Network colored based on the community.

1.4 Select an individual in the network as your best friend and apply different colors to the edges of:

- this node
- the nodes in its ego network with depth 1
- the nodes in its ego network with depth 2
- the remaining nodes

Apply a layout than enhances the visualization of your network (ForceAtlas, Fruchterman Reingold, Yifan Hu and their variations are excellent choices).

We selected the individual: *Tea Linwei Shao* with the id *100001462903816*. The Degree along with the PageRank values of the individual are presented in Table 2.

Id	Label	Degree	PageRank
100001462903816	Tea Linwei Shao	52	0.025956

Table 2: `Degree and Pagerank of "Best Friend".`

Before proceeding the, previously applied, community colors were removed in order to apply the colors for the various nodes. Initially only the selected Node was painted, with a blue color, as shown in Figure 6.

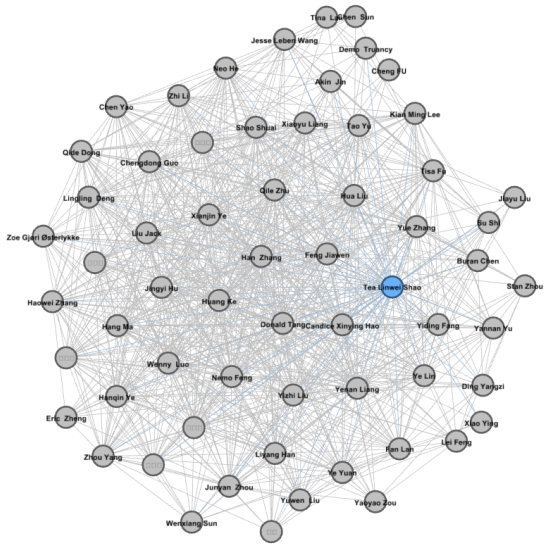

Figure 6: Only node painted.

Using the *Filters* tab, under topology, the Ego network allows the selection of nodes, based on a user's filter. Moreover, using the Heat Map filter, the user can paint specific nodes, that are currently selected. By filtering each of the question's nodes (depth 1, 2), in reverse order, the corresponding nodes wee painted. However, since the maximum depth for this specific node is 2, there is no color for the nodes labeles as the "remaining nodes" ($depth \geq 3$). Finally, in order to achieve a better visual result, the Yifan Hu Layout was used with 500 Optimal Distance and the rest of the parameters kept to default values. We experimentedThe output is presented in Figure 7.

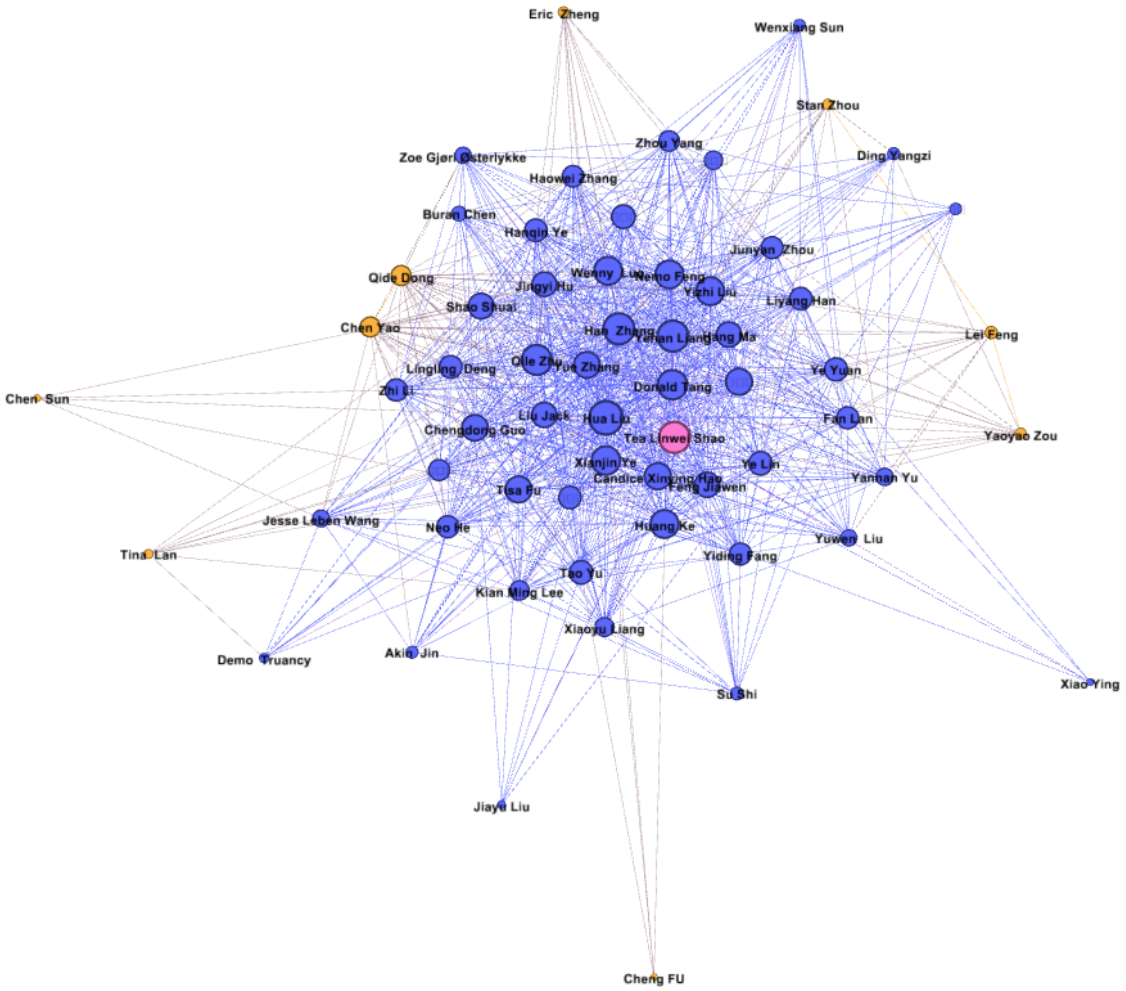

Figure 7: Nodes painted according to the distance from the "*best friend*" node.

As a final step, the *SigmaExporter* plugin was used in order to export the `Sigma.js` template, which can be found in the submitted `.zip` file. This was achieved through

File→Export→Sigma.js template...