# Visualization of Hierarchical Communities in Large Scale Complex Networks

Real-world large scale complex networks exhibit community structures. Nodes with similar connections tend to be part of one community with more edges within the community than the edges to other communities. In literature several community detection techniques have been proposed, including the Louvain method [1], OSLOM [2] and AH-KSC [3, 4]. These techniques provide hierarchical community information for large scale networks. However, there is no visualization tool which allows to illustrate the hierarchical communities at different levels of granularity.

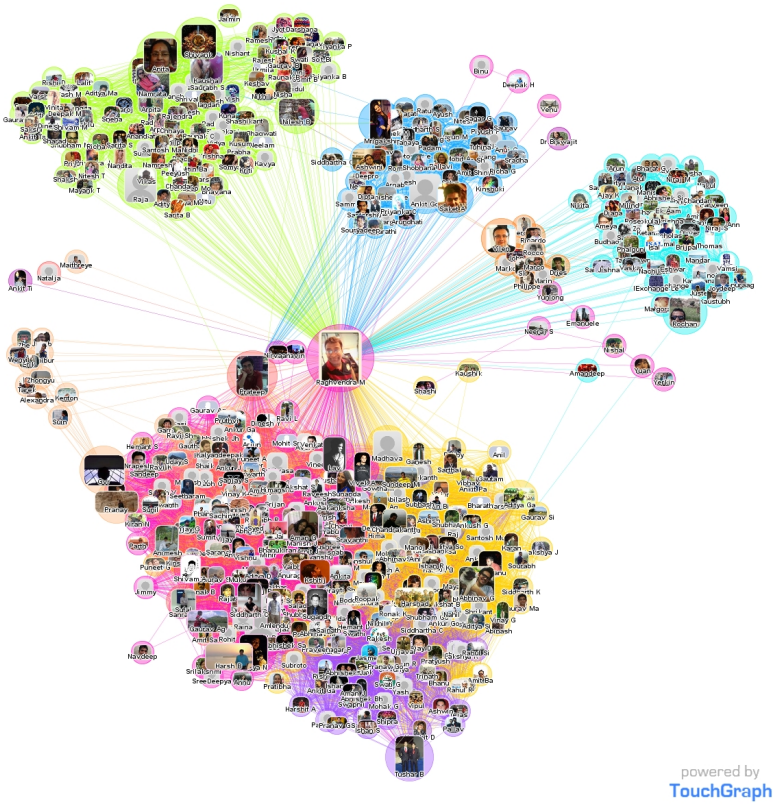



Figure 1: Flat clustering visualization, i.e. only one level of hierarchy, related to my facebook graph.

OSLOM [2] allows visualization of 2 layers of hierarchy at a given time using the software Gephi [5]. The goal of this master thesis is to build an online tool which behaves similar to Google Maps i.e. by means of a scroll bar we can zoom in and zoom out at the layers of hierarchy and displays appropriate communities in the large scale networks. The challenge lies in the design of the user interface and displaying communities, which merge at higher level of hierarchy, close to each other at lower levels. We plan to experiment on visualization of different large scale networks available at [6].

- Requirements: Basic knowledge of Networks and R .
- Tool to Learn: Shiny [7].
- Type of work: Literature: 25%, Implementation: 50%, Experiments and Results: 25%
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- Promoter: Prof. Johan Suykens
- Number of students: 1.
- Suitable Master: WIT (mathematical engineering), AI (artificial intelligence).

# References


[1] V. Blondel, J. Guillaume, R. Lambiotte and L. Lefebvre, *Fast unfolding of communities in large networks.*, Journal of Statistical Mechanics: Theory and Experiment, 10:P10008, 2008.

[2] A. Lanchichinetti, F. Radicchi, J. Ramasco, and S. Fortunato, *Finding statistically significant communities in networks*, PLOS ONE, 6(e18961), 2011.

[3] R. Mall, R. Langone and J. A. K. Suykens, *Agglomerative Hierarchical Kernel Spectral Clustering for Large Scale Networks*, In Proc. of European Symposium on Artificial Neural Networks (ESANN), Brugges, Belgium, April, 2014.

[4] R. Mall, R. Langone and J. A. K. Suykens, *Multilevel Hierarchical Kernel Spectral Clustering for Real-Life Large Scale Complex Networks*, PLOS One, e99966, 9(6), pp. 1-18, 2014.

[5] `http://gephi.github.io/`

[6] `https://snap.stanford.edu/data/`

[7] `http://shiny.rstudio.com/`