Community Detection in Multilayer Graph
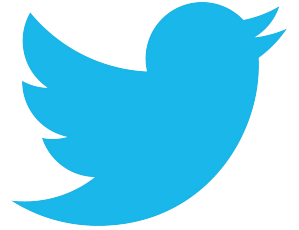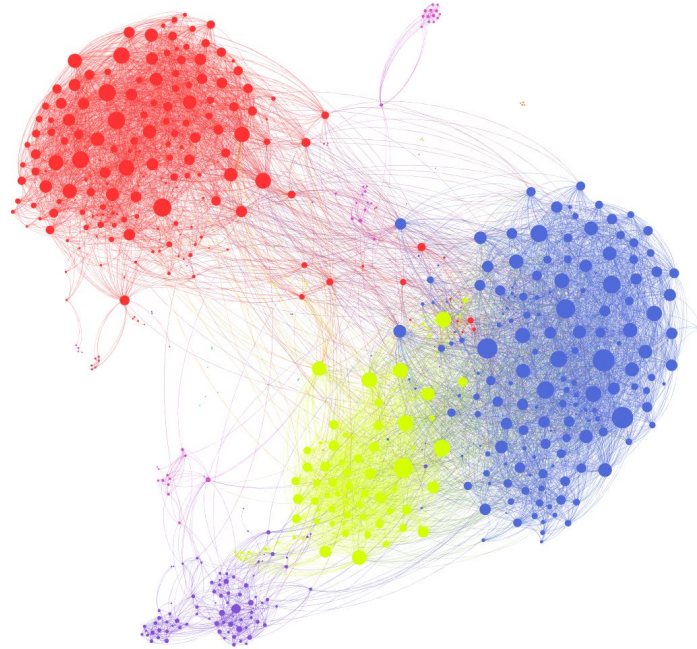
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Research Question

Research Papers

1. Dong, Xiaowen, et al. "Clustering on multi-layer graphs via subspace analysis on Grassmann manifolds." IEEE Transactions on signal processing 62.4 (2013): 905-918.
2. Kim, Jungeun, and Jae-Gil Lee. "Community detection in multi-layer graphs: A survey." ACM SIGMOD Record 44.3 (2015): 37-48.
3. Zhang, Pan. "Evaluating accuracy of community detection using the relative normalized mutual information." Journal of Statistical Mechanics: Theory and Experiment 2015.11 (2015): P11006.

Proposed Solution

1. Calculate Laplacian matrix and extracted the subspace from each graph
2. For each graph, use the Laplacian matrix and subspace matrix to calculate the distance matrix and sum them.
3. Find the important feature in aggregated Laplacian matrix by using eigenvalue and eigenvector
4. Use k-means for clustering

Evaluation Methodology

- **Density**

  The higher value of density, the more likelihood it presents a good community with strong connections.
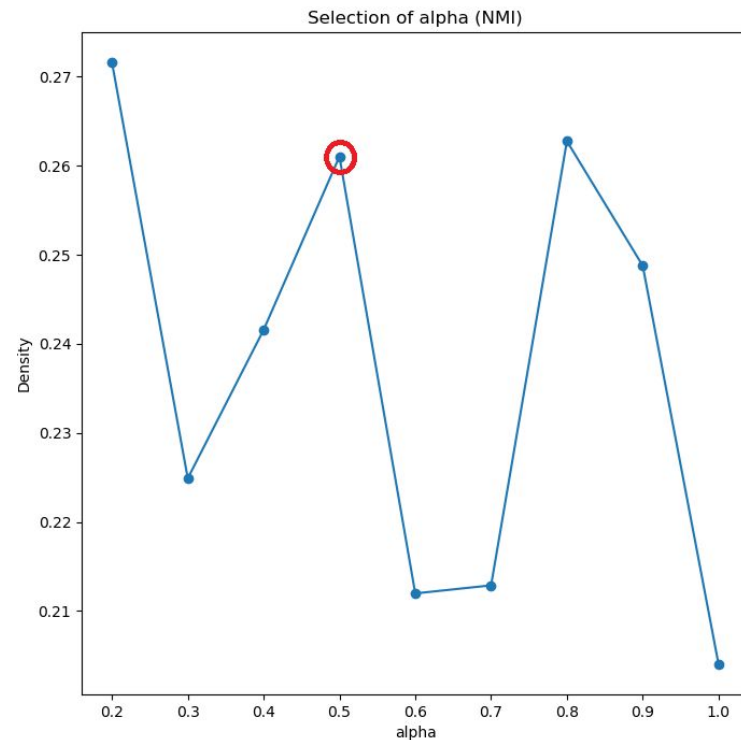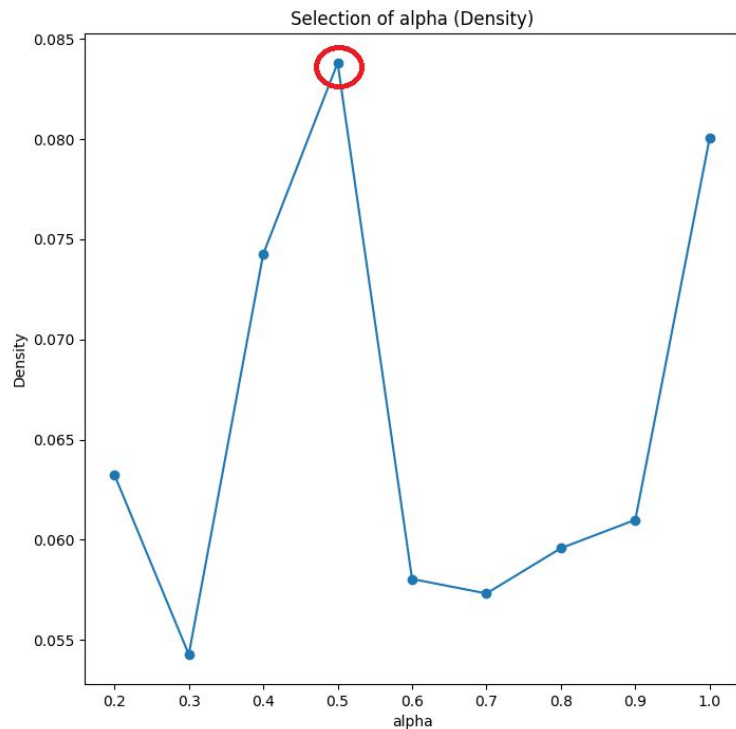
- **Normalized Mutual Information (NMI)**

  Scale the results between 0 (no mutual information) and 1 (perfect correlation).

- **Purity**

  The accuracy comparing to ground truth.

Results(1/2)

Results(2/2)

Metrices	Lunch	Facebook	Work	Leisure	Coauthor	Multilayers
Purity	0.4909	0.2909	0.4727	0.4727	0.4	0.3474
NMI	0.40782	0.2371	0.3602	0.3836	0.3053	0.2896

- The algorithm enforces the solution of the layer 'Facebook' which is relatively lower quality
- Provide complementary but not contradictory information

Thank you