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Clustering of complex datasets

Milestone Presentation

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Service-centric Networking | Tu Berlin | May 11th, 2016

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Complex Datasets

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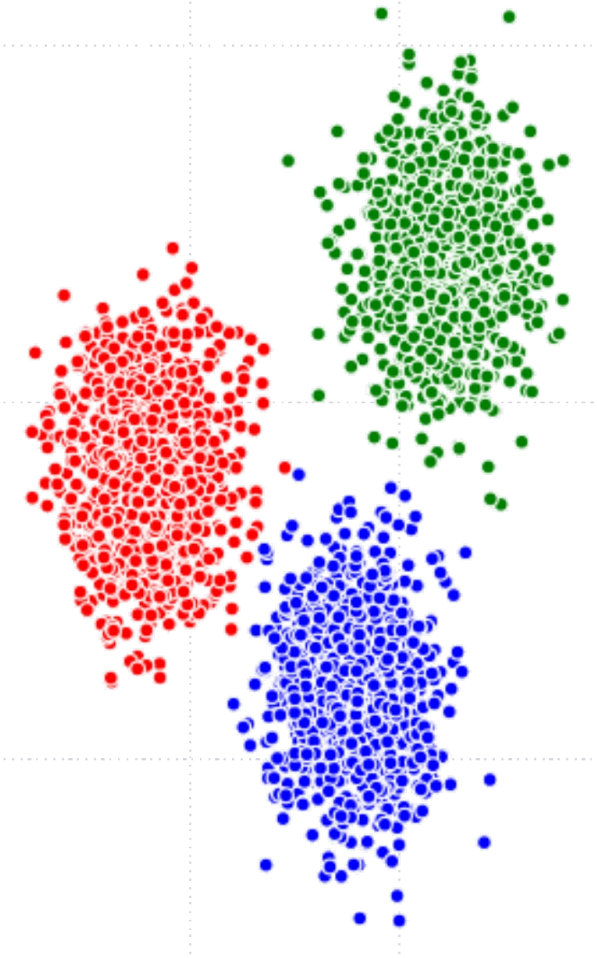
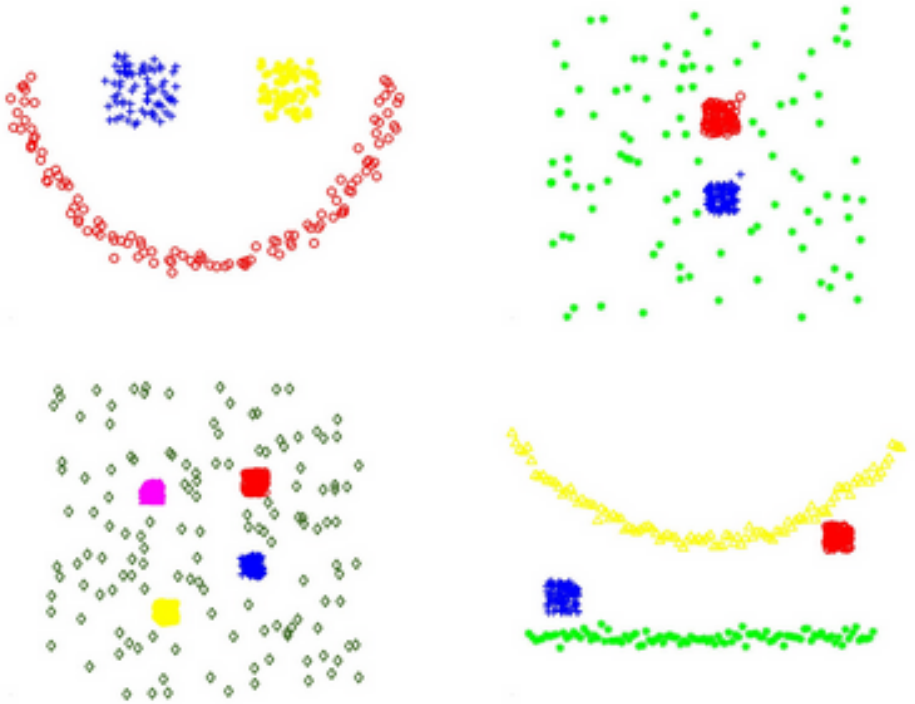


Normal Dataset



Complex Datasets

Clustering

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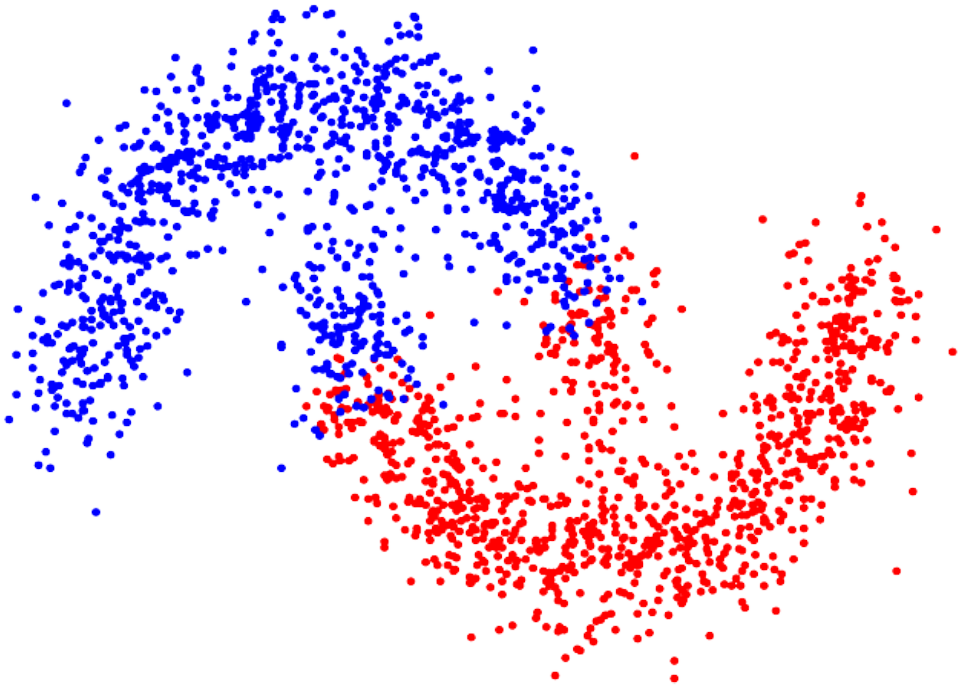
Grouping a set of objects in a way that similar objects are in the same cluster.

Types:

- Connectivity Based (Hierarchical)
- Centroid Based (kMeans)
- Density Based (OPTICS)
- Self-Tuning Spectral Clustering



Kmeans Clustering

Self-tuning Spectral Clustering[2]

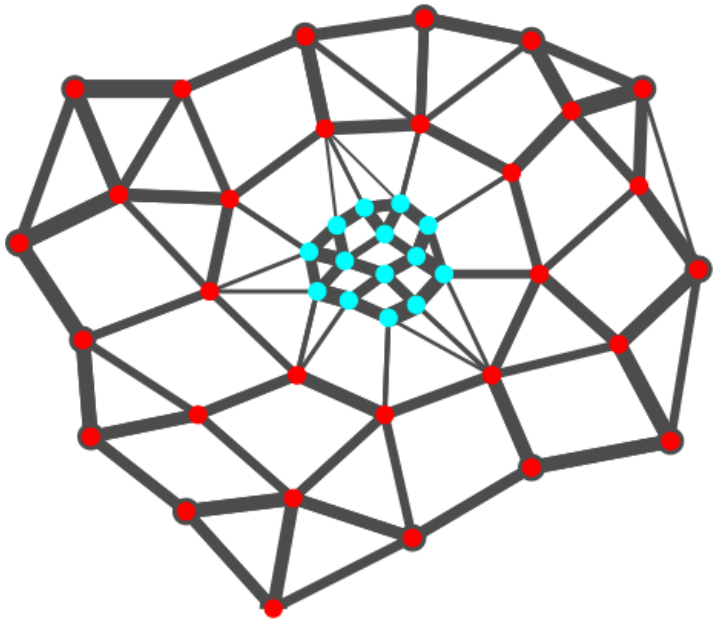
Requires:

- Max number of Clusters

Builds the affinity matrix based on the relations between objects in the dataset.

Operate a dimensionality reduction based the eigenvectors of the matrix.

Exploits the eigenvectors structure to determine the optimal number of clusters.



Self-tuning Spectral Clustering[2] - contd

Building of the Affinity Matrix:

$$\hat{A}_{ij} = e^{\left(\frac{-d^2(s_i, s_j)}{\sigma_i \sigma_j}\right)}$$

$$\sigma_i = d(s_i, s_K), K = 7$$

Self-tuning Spectral Clustering[2] - contd

Implementations already available in: C++ and Matlab

Objective:

- Investigate the construction of the affinity matrix
- Comparison with OPTICS
- Performance Analysis

OPTICS [1]

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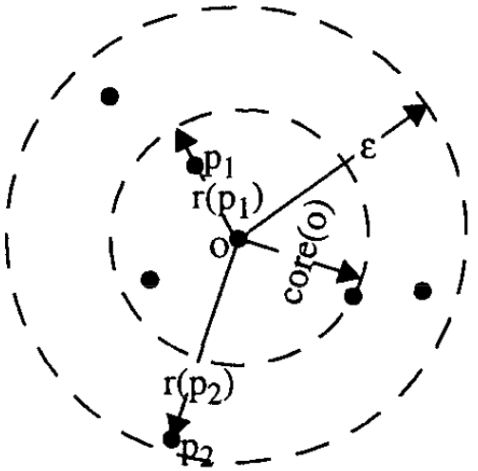
Density Based

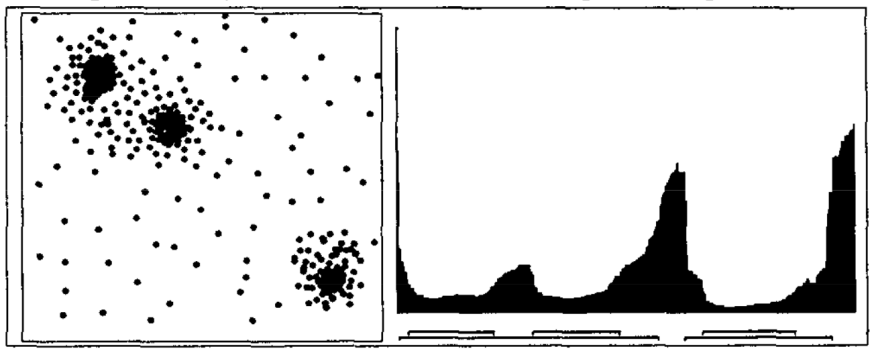
Requires:

- Min # Points in a Cluster (MinPts),
- Max Neighborhood radius (ε),
- Degree of Steepness (ξ).

Produces Reachability Plot

Automatic cluster extraction from the plot





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OPTICS[1] - contd

Implementations already available in: Java, Python, R and Matlab.

Objective:

- Comparison of the different Implementations
- Focus on the automatic cluster extraction
- Performance Analysis

Problem:

- Not all implementations extract automatically the clusters

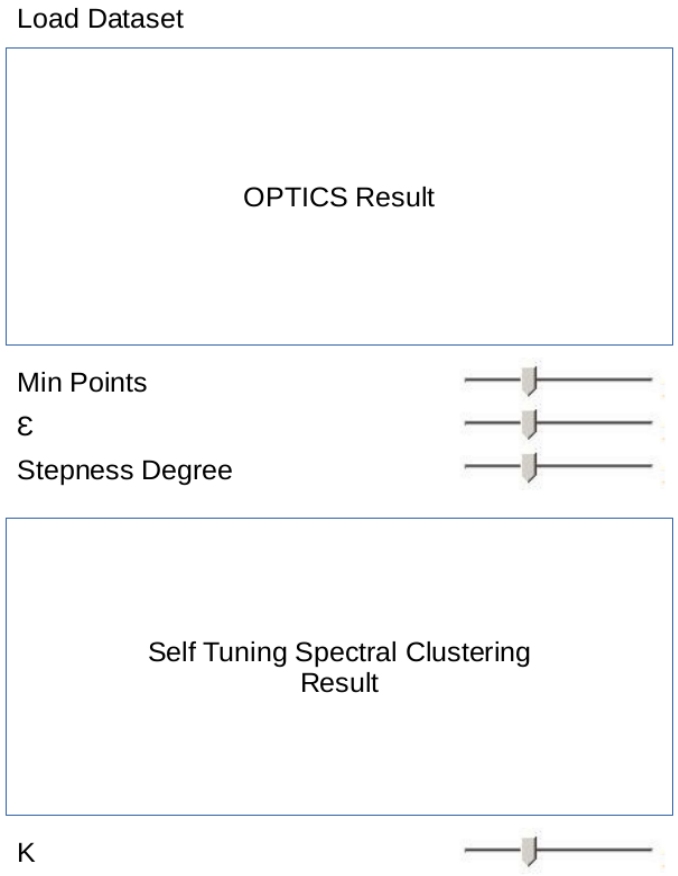
Visualization Tool

Website to run the experiments and visualize the results.

Possibility to set the parameters and see the result in real time.

Plot with the Javascript library D3.js

Backend in Python to execute the different algorithms.



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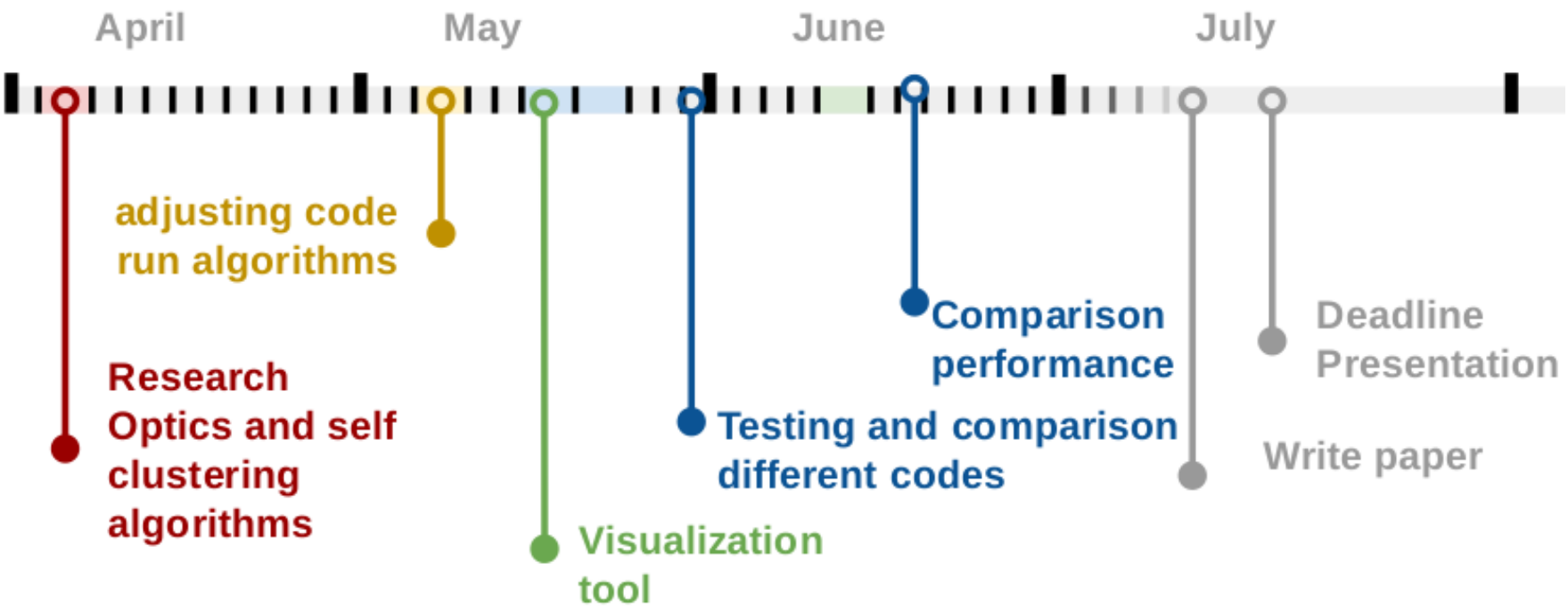
ORGANIZATION

Timeline


April
May
June
July
adjusting code
run algorithms
Research
Optics and self
clustering
algorithms
Visualization
tool
Testing and comparison
different codes
Comparison
performance
Deadline
Presentation
Write paper

Tools

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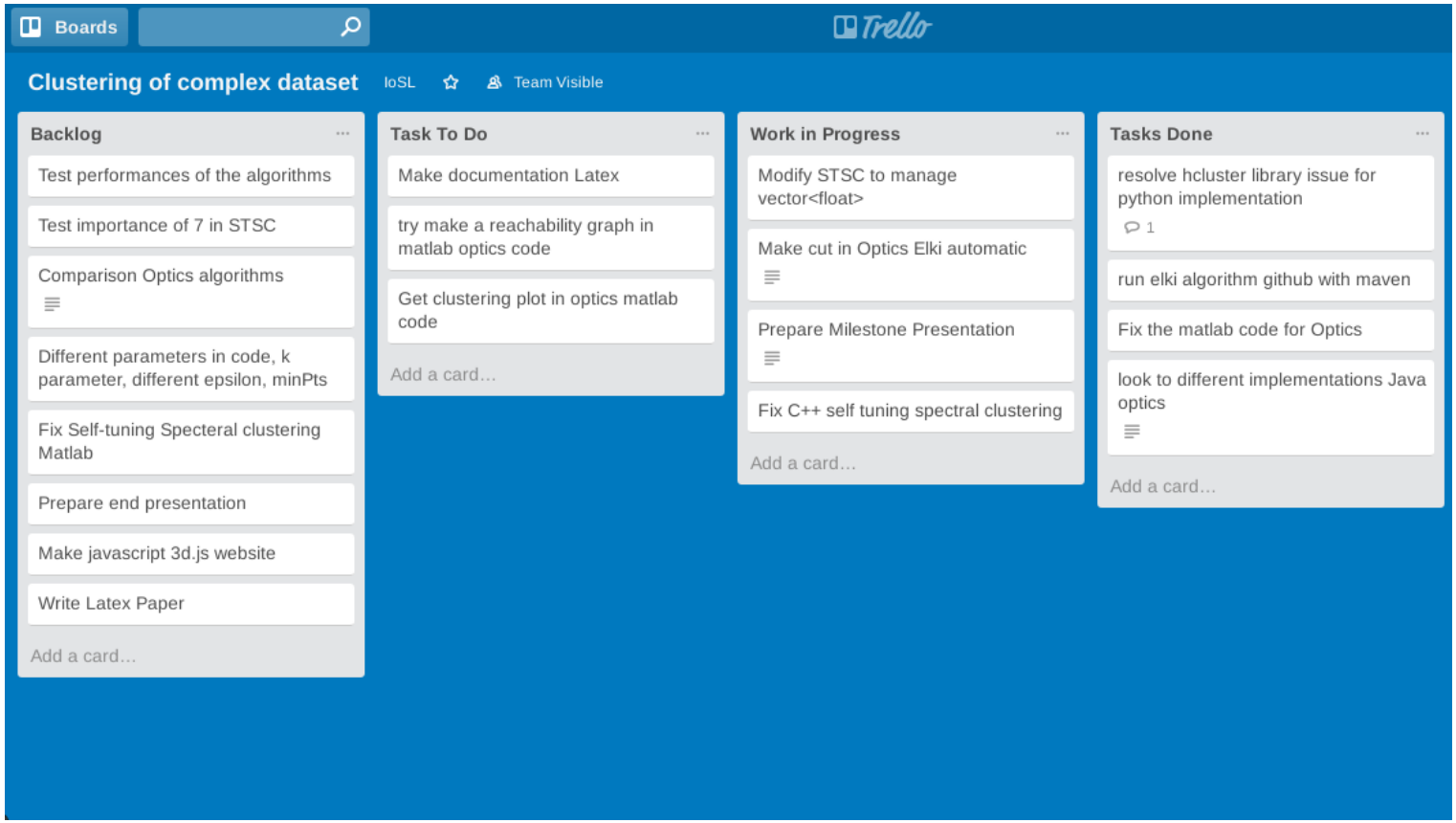
Trello



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Tools

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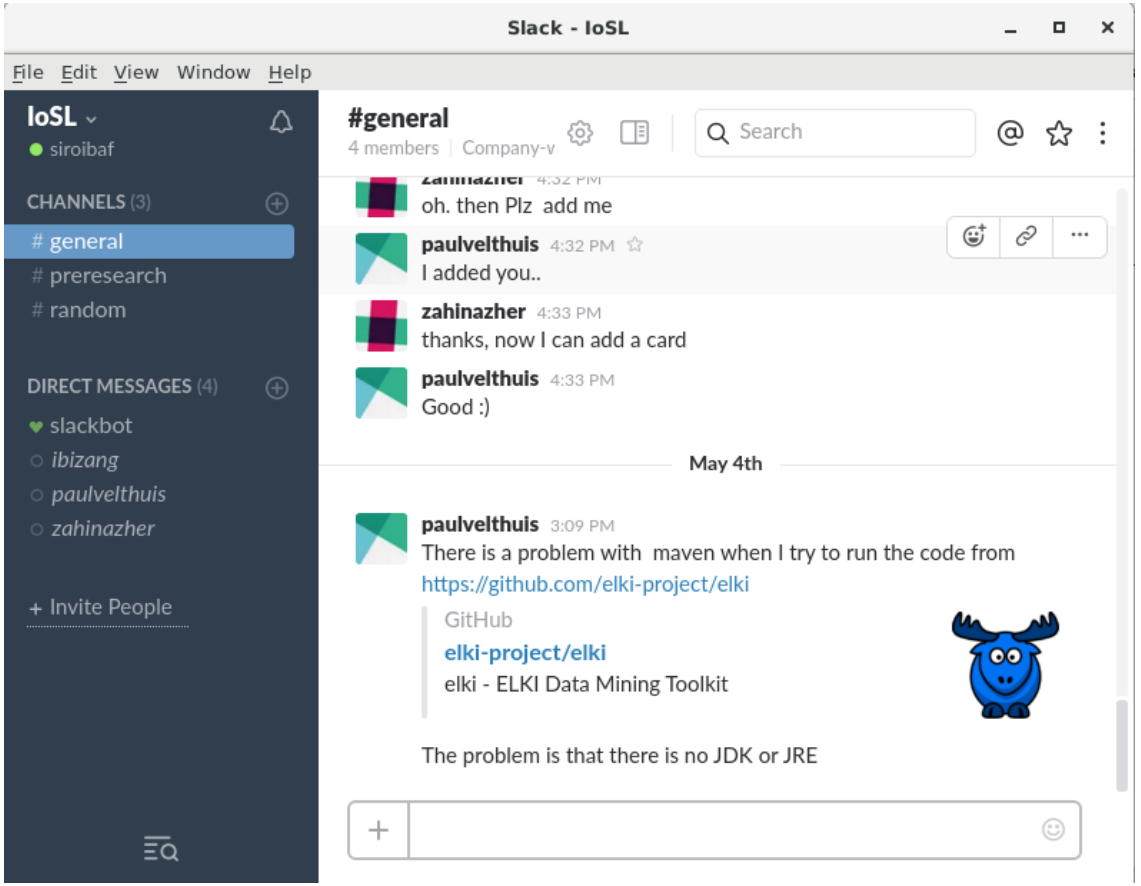
Trello

Slack



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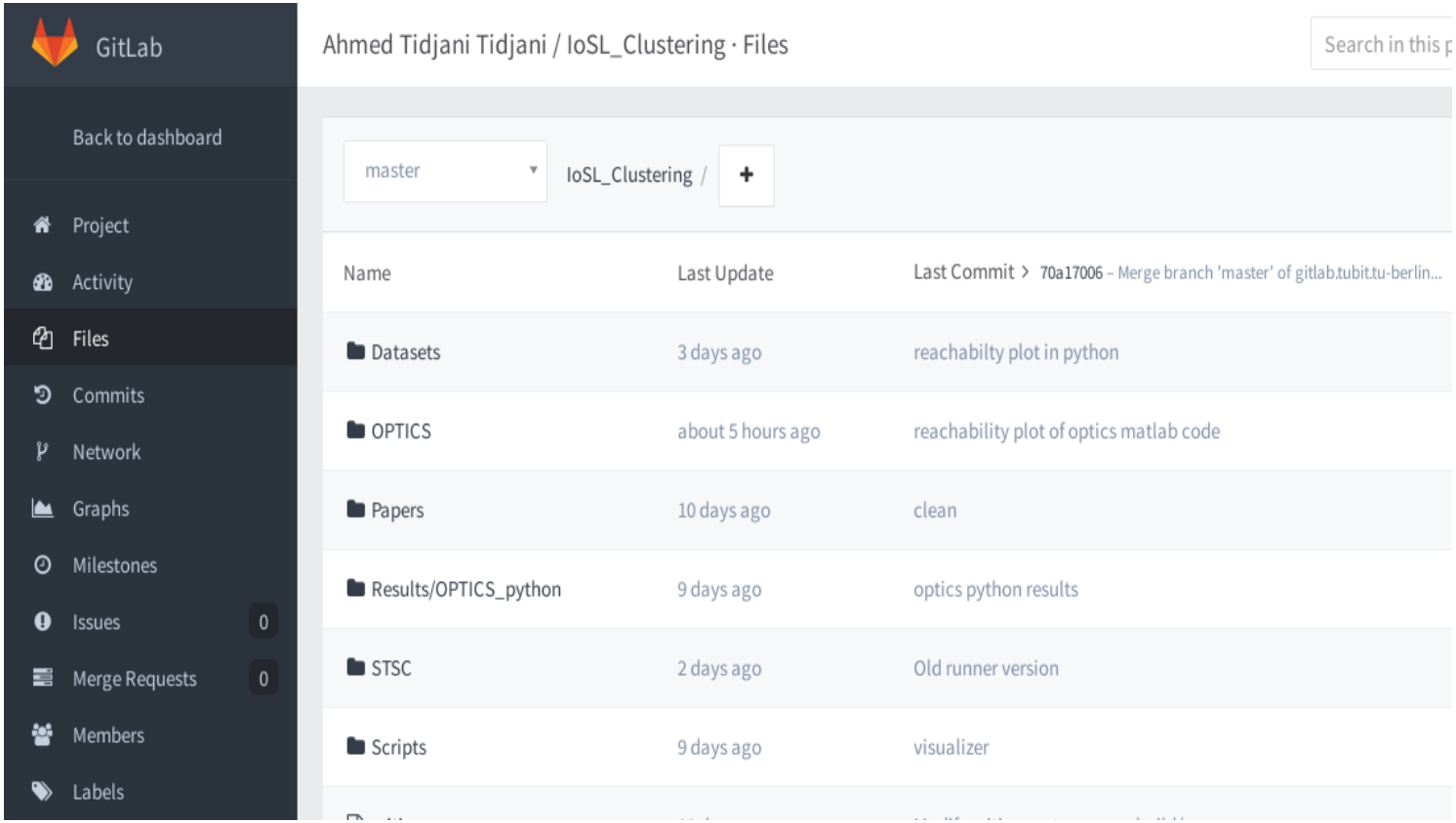
GitLab (Wiki)



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THANK YOU FOR YOUR ATTENTION
QUESTIONS?

References

[1] Ankerst, M., Breunig, M. M., Kriegel, H. P., & Sander, J. (1999, June). OPTICS: ordering points to identify the clustering structure. In ACM Sigmod Record (Vol. 28, No. 2, pp. 49-60). ACM.

[2] Zelnik-Manor, L., & Perona, P. (2004). Self-tuning spectral clustering. InAdvances in neural information processing systems (pp. 1601-1608).