

# BrunoFBessa\_5881890\_P9\_results

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## 0.1 SFI5904 - Complex Networks

Project 9: Communities in complex networks First Semester of 2021

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Generate networks with 2 or 3 communities, using libraries and also the software for synthetic geographic networks with initial nodes positions following modular distribution.

Apply at least 2 methods for community detection, including accessibility and compare the results qualitatively using visualizations of the networks with communities identified with different colors.

## 0.2 Results

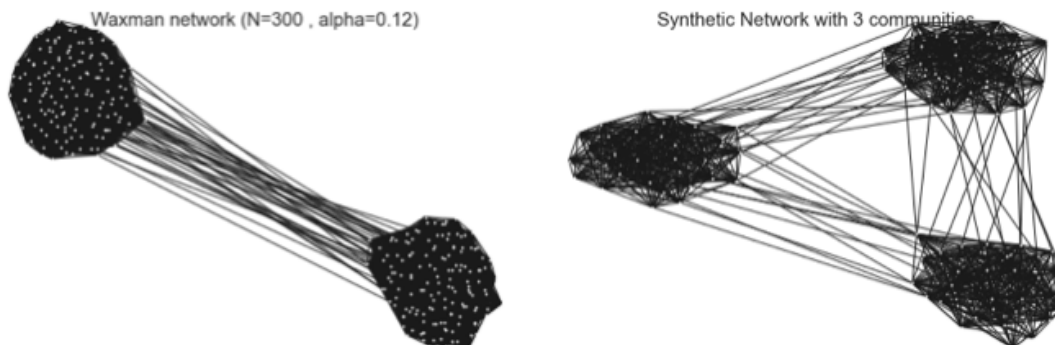
For this project we used two ways to generate communities: \* Waxman topology with initial positions separated during the addition of the nodes \* NetworkX method for generating synthetic communities (random\_partition\_graph)

The methods to detect communities were \* use nodes accessibility [1] to spot the communities \* the Louvain Method [2]

In the Louvain method, first small communities are found by optimizing modularity locally on all nodes, then each community is grouped into one node and the first step is repeated.

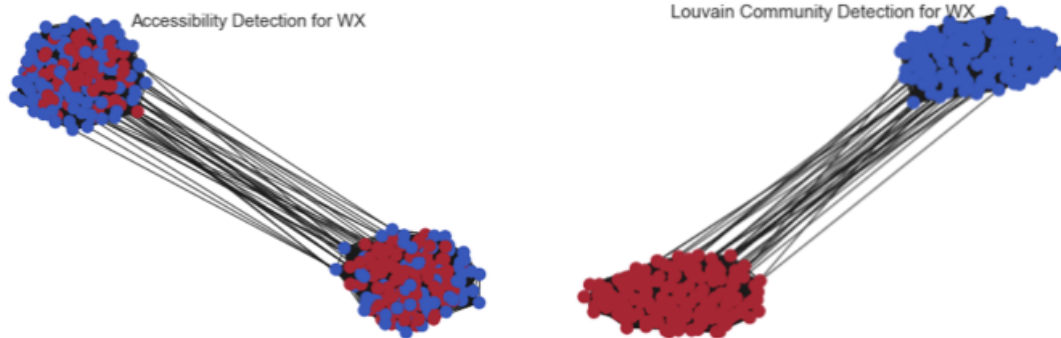
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[3]: display.Image("images/results_a.png")
```

[3]:



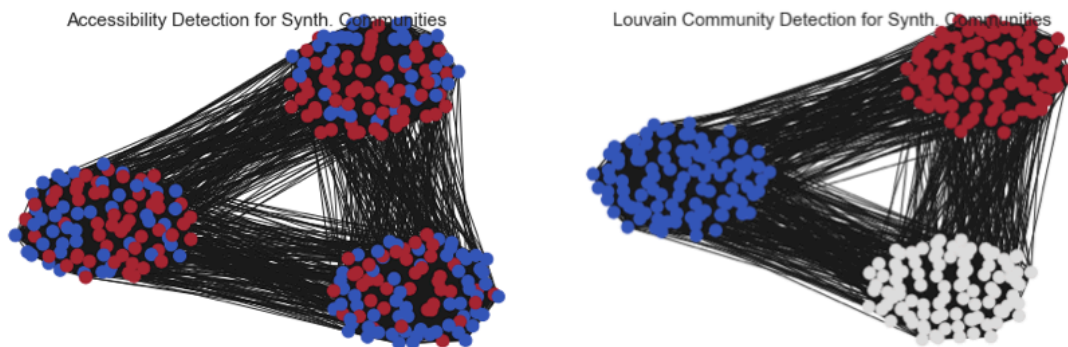
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[4]: display.Image("images/results_b_2.png")
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[4]:



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[5]: display.Image("images/results_b_3.png")
```

[5]:



### 0.3 Conclusion

The accessibility value was shown to be good to detect central nodes inside a cluster of nodes (community). The Louvain Method had superior performance differentiating one cluster to the other.

### 0.4 References

[1] Travençolo, B. A., Viana, M. P., Costa, L. F., Border detection in complex networks, New Journal of Physics, March, 2009

[2] Fortunato, S., Hric, D., Community detection in networks: A user guide, Physics Reports, September, 2016