International Association of CRIME ANALYSTS

GHENT UNIVERSITY

Analysis of Criminal Networks in Python

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About me

- Background in Data Science
- PhD candidate at UGent Crime Lab, Ghent University (Belgium)
- Research topics:
  - Social aspects of criminal behavior
  - Criminal networks
  - Formal models of co-offending
- Tools:
  - Computational modeling
  - Social network analysis
  - Agent-based modeling

Objectives

- Building a network from police data
- Visualization of networks
- Combining different types of networks
- Bipartite networks
- Data and networks manipulation

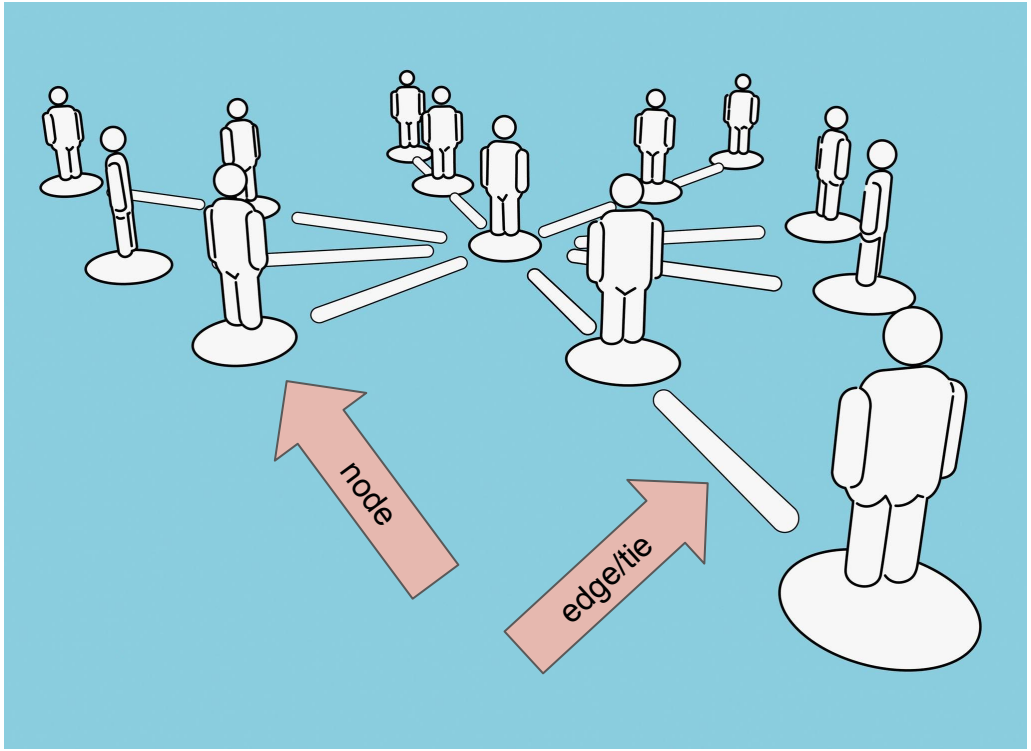
Why Python?

- Open source
- Larger community
- Variety of tasks
- However, learning curve

About the data

Data is anonymized and cannot be shared due to the sensitive nature of the data

What is a network?



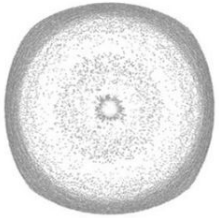
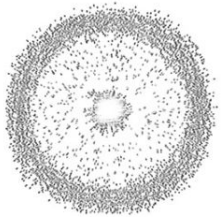
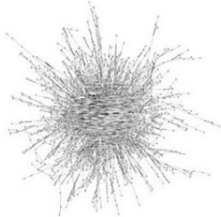
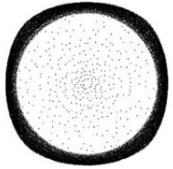
Network is a representation of connections between entities.

In this webinar:

- Nodes = offenders
- Edges = co-offenses

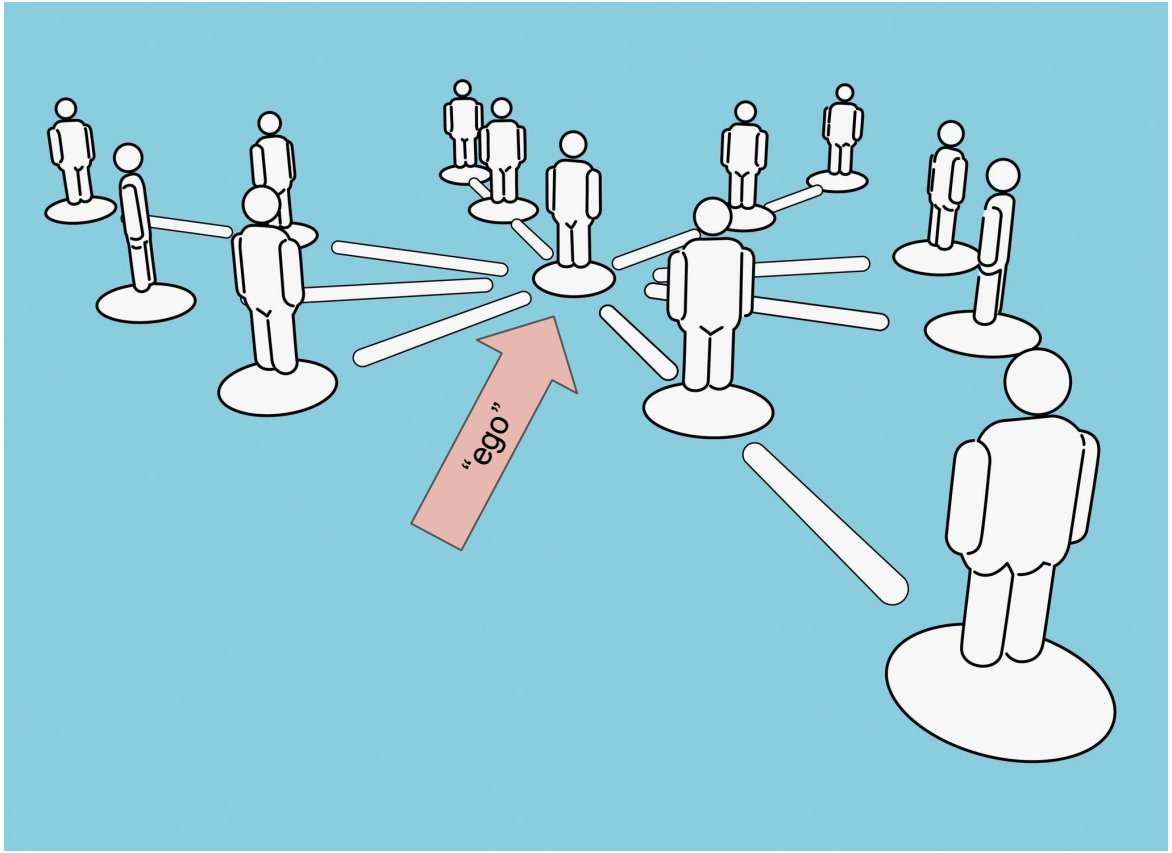
Co-offending network from Bruges

Table 3
Descriptive statistics of the network.

Measure	Original network G	Network without isolated nodes G_e	Giant component G_g	Isolated nodes
				
N	33,815	16,652	4978	17,229
$\langle k \rangle$	2.21	4.50	8.79	0
$\langle cc \rangle$	0.24	0.48	0.58	0
D	–	–	19	–
$\langle l \rangle$	–	–	6.93	–
V_i				
Min.	0	0	0	0
Max.	2.75	2.75	2.75	0.40
Mean	0.04	0.05	0.10	0.01
Median	0	0	0	0

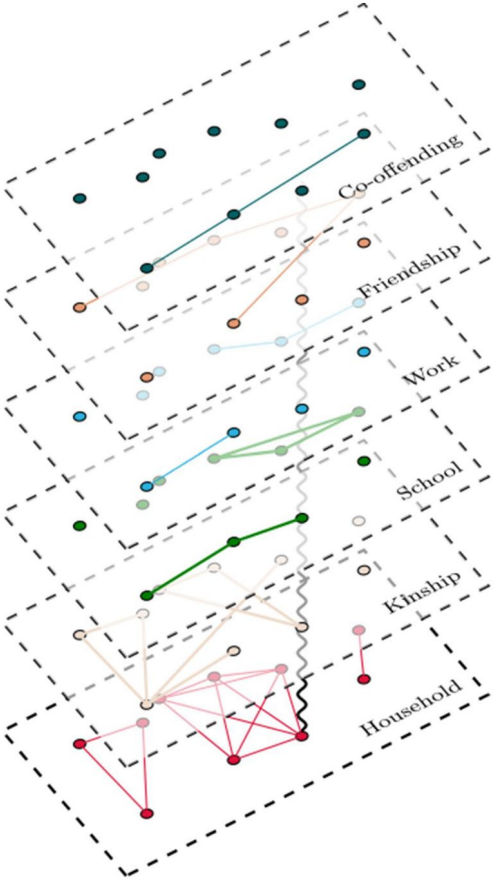
Geeraert, J., Rocha, L. E. C., & Vandeviver, C. (2024). The impact of violent behavior on co-offender selection: Evidence of behavioral homophily. *Journal of Criminal Justice*, *94*, 102259. https://doi.org/10.1016/j.jcrimjus.2024.102259

Ego-centric networks



Multilayer networks

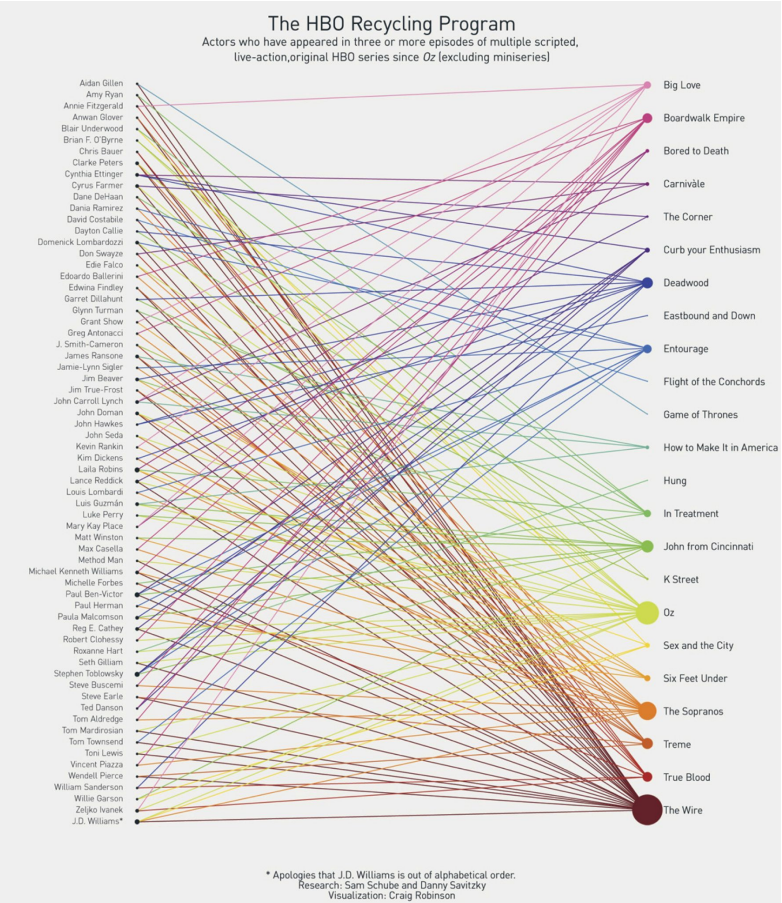
Fig. 1 The multiplex network structure for the organized crime model



“Different types of edges”

Calderoni, F., Campedelli, G. M., Szekely, A., Paolucci, M., & Andrighetto, G. (2022). Recruitment into Organized Crime: An Agent-Based Approach Testing the Impact of Different Policies. *Journal of Quantitative Criminology*, *38*(1), 197–237. https://doi.org/10.1007/s10940-020-09489-z

Bipartite networks



"Different types of nodes"

Where to learn?

- Python programming:
  - DataCamp https://www.datacamp.com/
  - DataQuest https://www.dataquest.io/
- Coursera:
  - https://www.coursera.org/learn/social-network-analysis
  - https://www.coursera.org/learn/social-network-analysis2
  - https://www.coursera.org/learn/social-economic-networks
- Udemy https://www.udemy.com/

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Thank you!

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