

Case study!

INTRODUCTION TO NETWORK ANALYSIS IN PYTHON



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Data Carpentry instructor and author of
nxviz package

Data

- Github user collaboration network
- Nodes: users
- Edges: collaboration on same GitHub repository
- Goals:
 - Analyze structure
 - Visualize
 - Build simple recommendation system

Graph properties

```
import networkx as nx  
G = nx.erdos_renyi_graph(n=20, p=0.2)  
len(G.edges())
```

29

```
len(G.nodes())
```

20

Graph properties

```
nx.degree_centrality(G)
```

```
{0: 0.15789473684210525,  
 1: 0.15789473684210525,  
 2: 0.15789473684210525,  
 3: 0.10526315789473684, ...}
```

```
nx.betweenness_centrality(G)
```

```
{0: 0.01949317738791423,  
 1: 0.060916179337231965,  
 2: 0.1276803118908382,  
 3: 0.03313840155945419, ...}
```

Data

- Number of nodes
- Number of edges
- Degree centrality distribution
- Betweenness centrality distribution

Let's practice!

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Case study part II: Visualization

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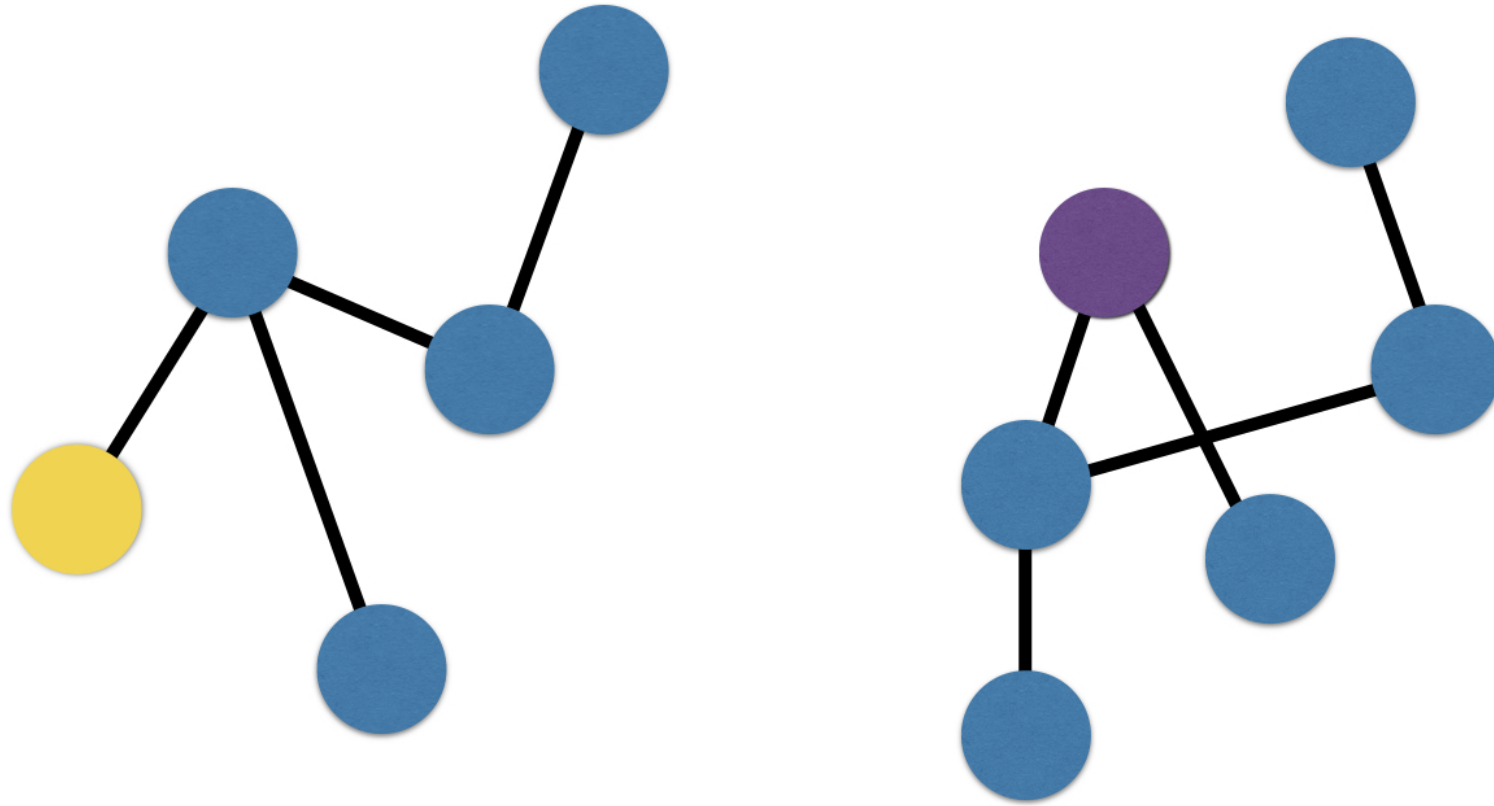
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nxviz API

```
import networkx as nx
import nxviz as nv
G = nx.erdos_renyi_graph(n=20, p=0.3)
circ = nv.circos(G, node_color_by='key', sort_by='key')
```


Connected component graphs



NetworkX API

```
import networkx as nx
G = nx.erdos_renyi_graph(n=100, p=0.03)
nx.connected_components(G)
```

```
<generator object connected_component_subgraphs at 0x10cb2c990>
```

```
list(nx.connected_components(G))
```

```
[<networkx.classes.graph.Graph at 0x10ca24588>,
 <networkx.classes.graph.Graph at 0x10ca244e0>]
```

```
for g in list(nx.connected_components(G)):
    print(len(g.nodes()))
```

```
99
1
```

Let's practice!

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Finding cliques (I)

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Cliques

- Definition:
 - Groups of nodes
 - Fully connected
- Simplest clique: edge
- Simplest complex clique: triangle

Maximal cliques

- Definition:
 - A clique
 - Cannot be extended by adding a node

Finding cliques

```
import networkx as nx
G = nx.erdos_renyi_graph(n=100, p=0.15)
nx.find_cliques(G)
```

```
<generator object find_cliques at 0x10ca8bca8>
```

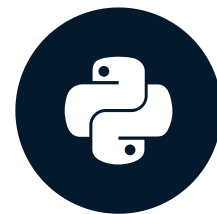
```
for clique in nx.find_cliques(G):
    print(len(clique))
```

Let's practice!

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Case Study Part IV: Final Tasks

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Final tasks

- Find important users
- Find largest communities of collaborators
- Build a collaboration recommendation system

Final tasks

- Find important users
- Find largest communities of collaborators
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Final tasks

- Find important users
- **Find largest communities of collaborators**
- Build a collaboration recommendation system

Final tasks

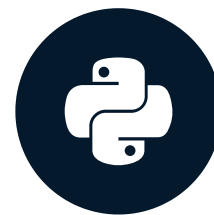
- Find important users
- Find largest communities of collaborators
- **Build a collaboration recommendation system**

Let's practice!

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Final thoughts

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What You've Learned

- The basics of networks and network analysis
- How to find important nodes
- How to identify communities of nodes
- How to apply these concepts in case studies
- How to use the NetworkX and nxviz packages
- How to write network algorithms

Let's practice!

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