Case study!

NETWORK ANALYSIS IN PYTHON (PART 1)

Eric Ma

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: 0.019493177387914230,
 1: 0.06091617933723196,
 2: 0.12768031189083820,
 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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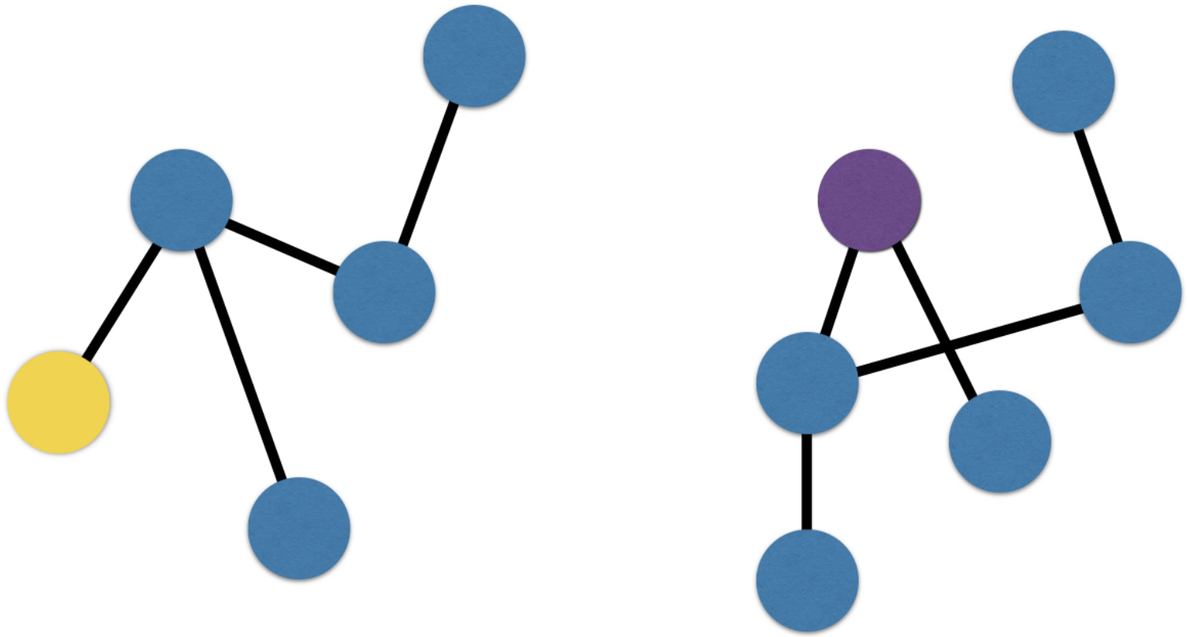
nxviz API

```
import networkx as nx
import nxviz as nv
G = nx.erdos_renyi_graph(n=20, p=0.3)

circ = nv.CircosPlot(G, node_color='key', node_group='key')

circ.draw()
```

Connected component subgraphs



NetworkX API

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

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

```
list(nx.connected_component_subgraphs(G))
```

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

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

```
99
1
```

Let's practice!

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Case study part III: Cliques

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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**
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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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