Introduction to Networks

INTRODUCTION TO NETWORK ANALYSIS IN PYTHON



Eric Ma

Data Carpentry instructor and author of nxviz package

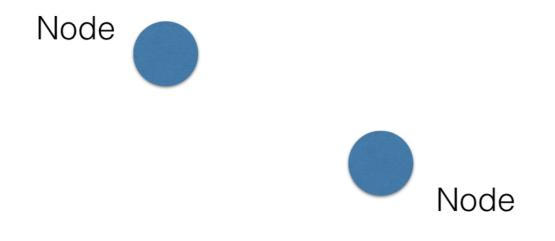


Networks!

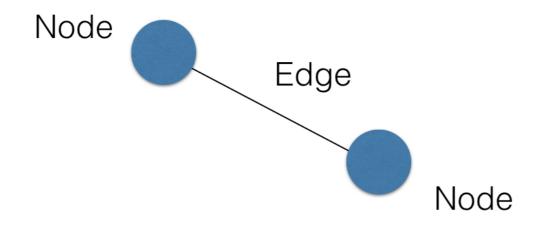
- Examples:
 - Social
 - Transportation
- Model relationships between entities

Networks!

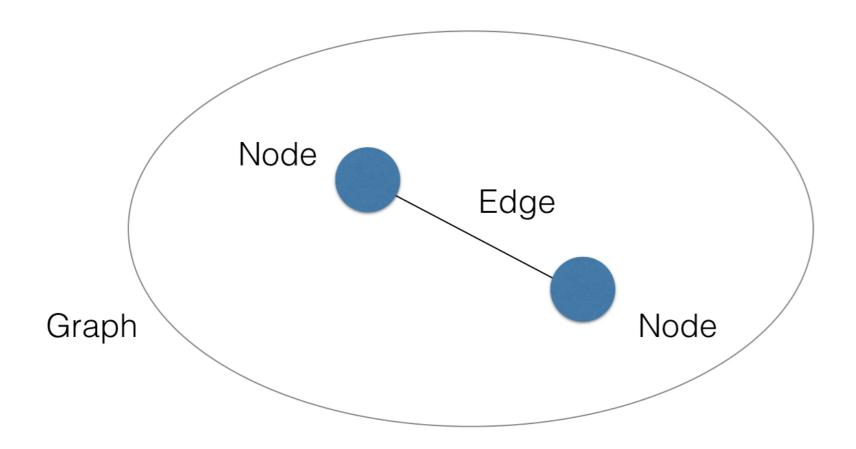
- Insights:
- Important entities: influencers in social network
- Pathfinding: most efficient transport path
- Clustering: finding communities

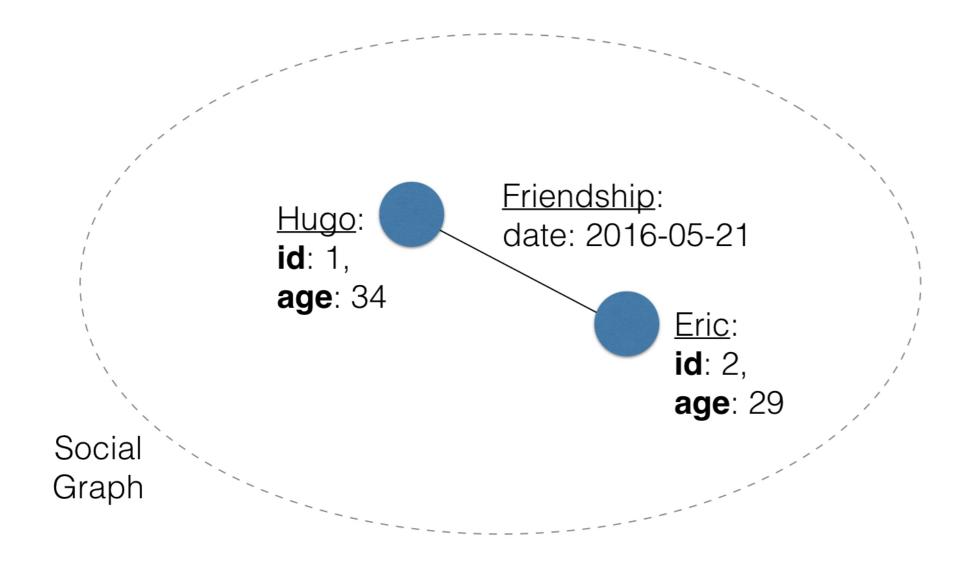














NetworkX API Basics

```
import networkx as nx
G = nx.Graph()
G.add_nodes_from([1, 2, 3])
G.nodes()
[1, 2, 3]
G.add_edge(1, 2)
G.edges()
```



[(1, 2)]

NetworkX API Basics

```
G.node[1]['label'] = 'blue'
G.nodes(data=True)
```

```
[(1, {'label': 'blue'}), (2, {}), (3, {})]
```

NetworkX API Basics

```
nx.draw(G)
import matplotlib.pyplot as plt
plt.show()
```





Let's practice!

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Types of graphs

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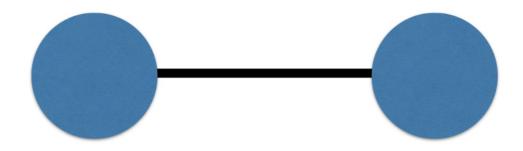
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Undirected graphs

Facebook social graph



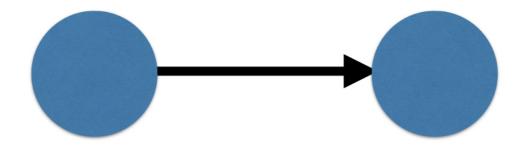
Undirected graphs

```
import networkx as nx
G = nx.Graph()
type(G)
```

networkx.classes.graph.Graph

Directed graphs

• Directed: Twitter social graph



Directed graphs

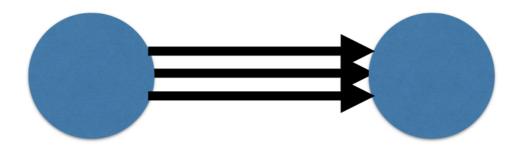
```
D = nx.DiGraph()
type(D)
```

networkx.classes.digraph.DiGraph



Types of graphs

• Multi(Di)Graph: Trip records between bike sharing stations



Multi-edge (Directed) graphs

```
M = nx.MultiGraph()
type(M)
```

networkx.classes.multigraph.MultiGraph

```
MD = nx.MultiDiGraph()
type(MD)
```

networkx.classes.multidigraph.MultiDiGraph



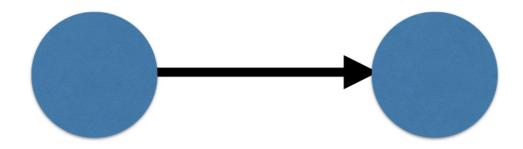
Weights on graphs

Edges can contain weights



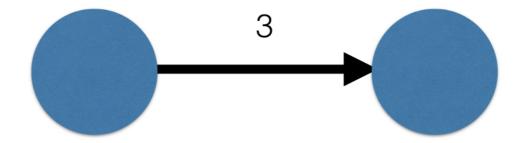
Weights on graphs

• Edges can contain weights



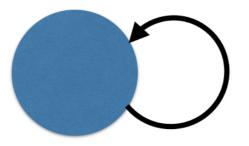
Weights on graphs

• Edges can contain weights



Self-loops

Nodes that are connected to themselves



Let's practice!

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Network visualization

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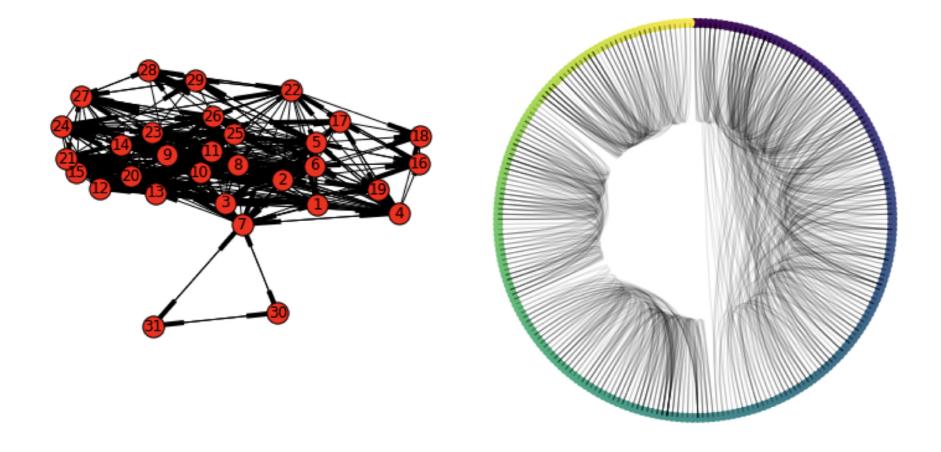


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Irrational vs. Rational visualizations



Visualizing networks

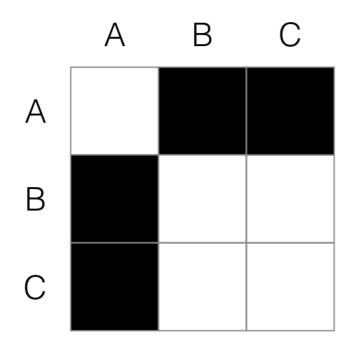
- Matrix plots
- Arc plots
- Circos plots

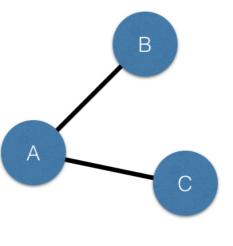


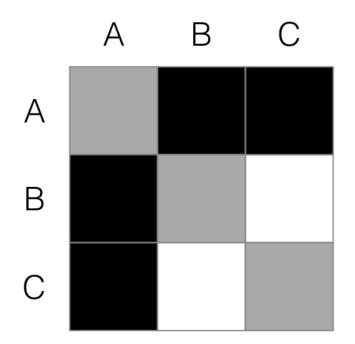
Visualizing networks

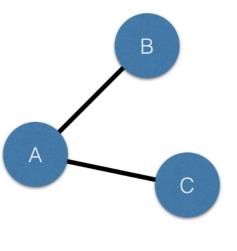
- Matrix plots
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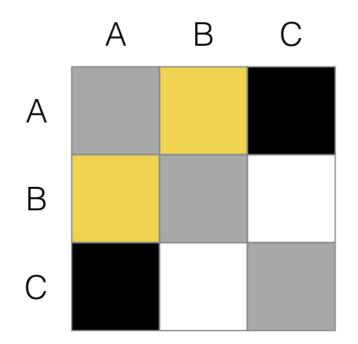


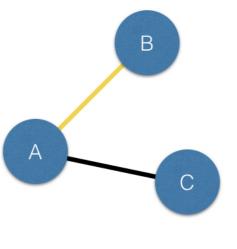


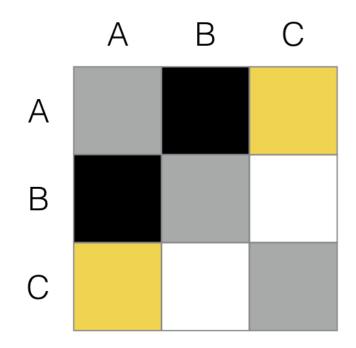


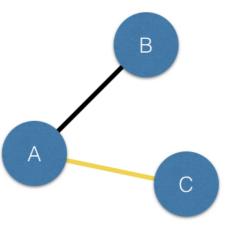




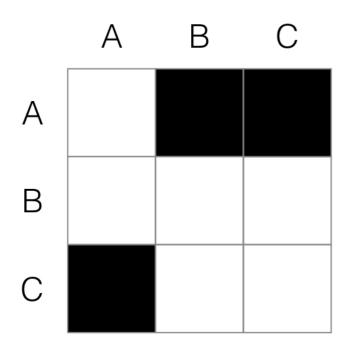


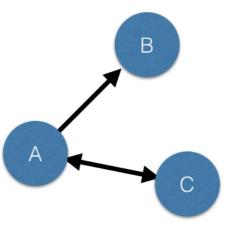






Directed matrices



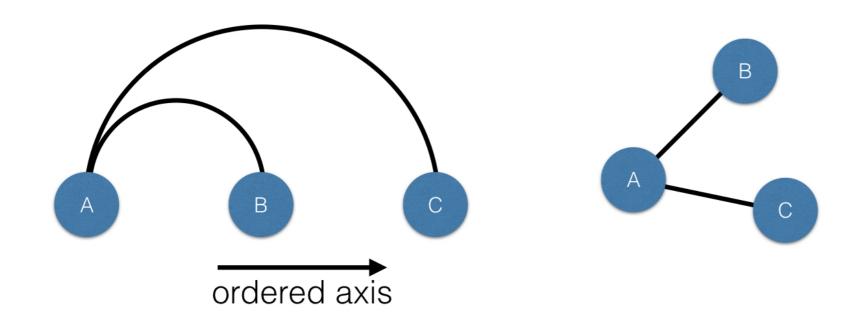


Visualizing networks

- Matrix Plots
- Arc Plots
- Circos Plots



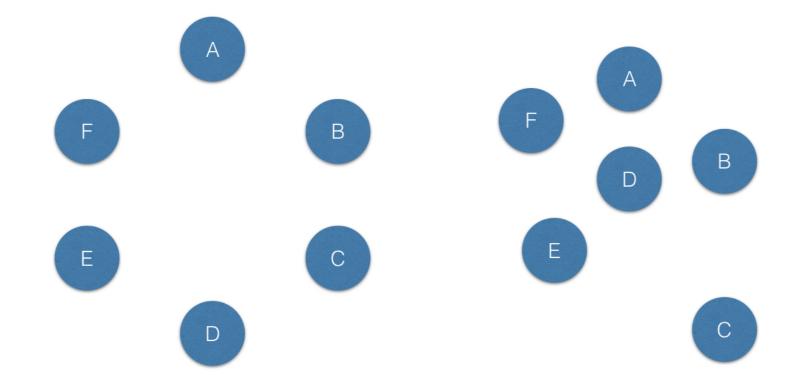
Arc plot



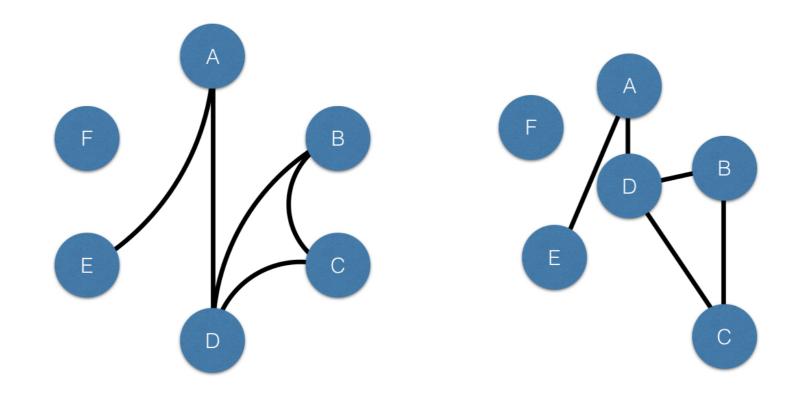
Visualizing networks

- Matrix Plots
- Arc Plots
- Circos Plots

Circos plot



Circos plot



nxviz API

```
import nxviz as nv
import matplotlib.pyplot as plt
ap = nv.ArcPlot(G)
ap.draw()
plt.show()
```

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