



NETWORK ANALYSIS IN PYTHON I

Case study!

Data

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



Graph properties

```
In [1]: import networkx as nx
```

```
In [2]: G = nx.erdos_renyi_graph(n=20, p=0.2)
```

```
In [3]: len(G.edges())
```

```
Out[3]: 29
```

```
In [4]: len(G.nodes())
```

```
Out[4]: 20
```



Graph properties

```
In [5]: nx.degree centrality(G)
```

```
Out[5]:
```

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

```
In [6]: nx.betweenness centrality(G)
```

```
Out[6]:
```

```
{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



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Case study part II: Visualization



nxviz API

```
In [1]: import networkx as nx
```

```
In [2]: import nxviz as nv
```

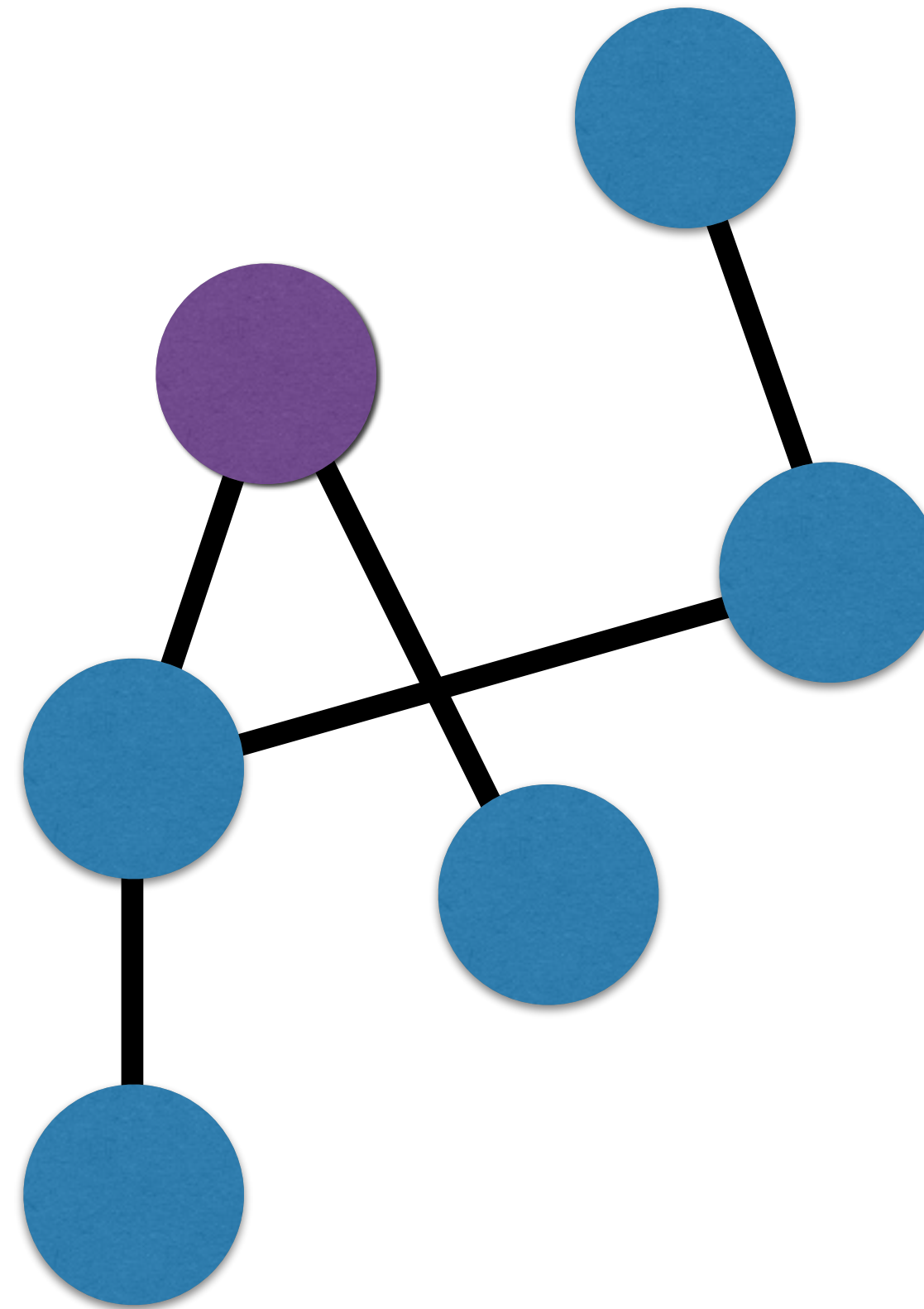
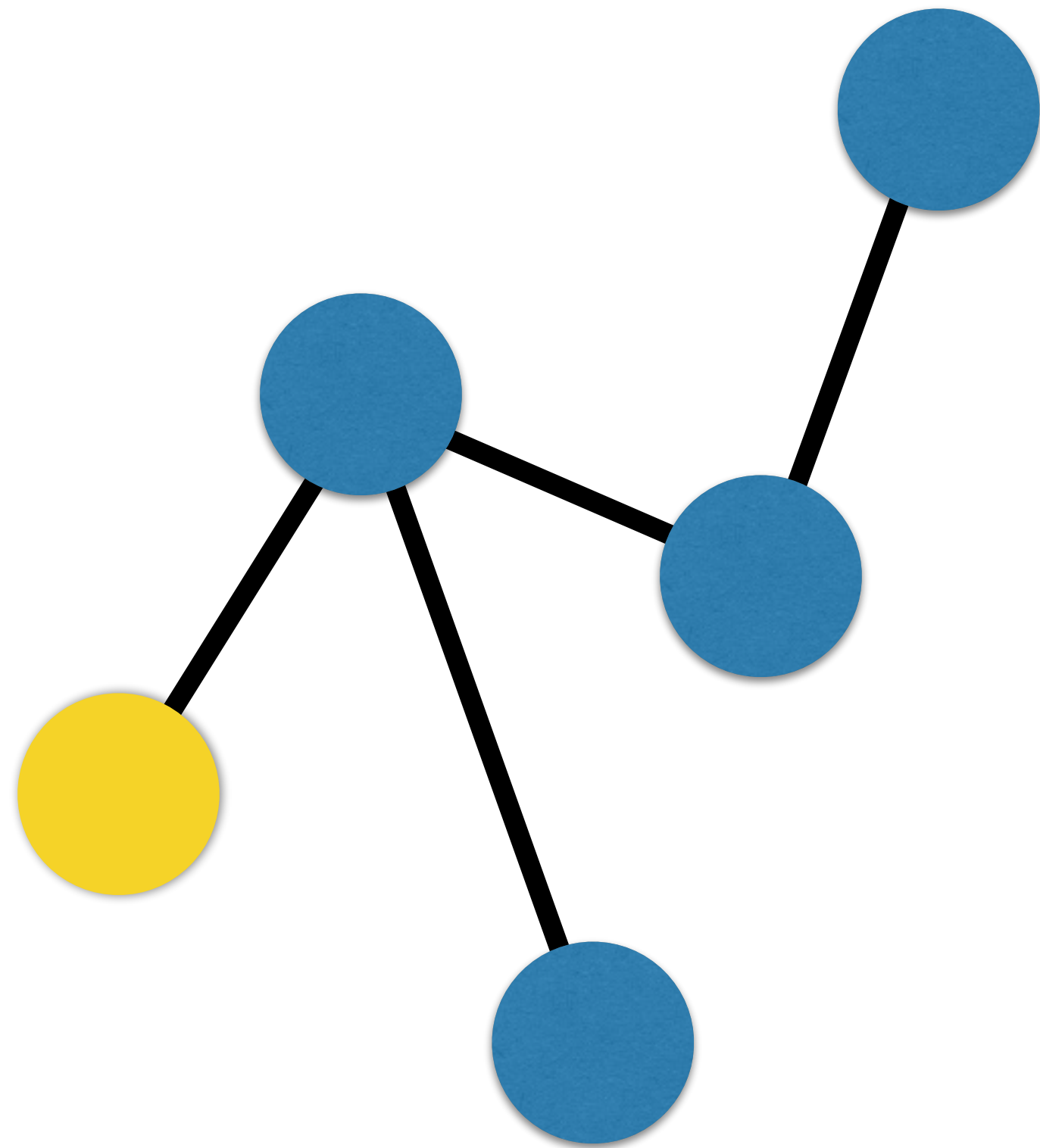
```
In [2]: G = nx.erdos_renyi_graph(n=20, p=0.3)
```

```
In [3]: circ = nv.CircosPlot(G, node_color='key',  
                             node_group='key')
```

```
In [4]: circ.draw()
```




Connected component subgraphs





NetworkX API

```
In [1]: import networkx as nx
```

```
In [2]: G = nx.erdos_renyi_graph(n=100, p=0.03)
```

```
In [3]: nx.connected_component_subgraphs(G)
```

```
Out[3]: <generator object connected_component_subgraphs at 0x10cb2c990>
```

```
In [4]: list(nx.connected_component_subgraphs(G))
```

```
Out[4]:
```

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

```
In [5]: for g in list(nx.connected_component_subgraphs(G)):
```

```
...:     print(len(g.nodes()))
```

```
...:
```

```
Out[5]: 99
```

```
...: 1
```



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Case study part III: Cliques

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

```
In [1]: import networkx as nx
```

```
In [2]: G = nx.erdos_renyi_graph(n=100, p=0.15)
```

```
In [3]: nx.find_cliques(G)
```

```
Out[3]: <generator object find_cliques at 0x10ca8bca8>
```

```
In [4]: for clique in nx.find_cliques(G):  
...:     print(len(clique))
```



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Case study part IV: Final tasks



Final tasks

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



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Final thoughts

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 a case study
- How to use the NetworkX and nxviz packages
- How to write network algorithms
- Practical applications of network analysis



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**See you in the
next course!**