Network Analysis

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Outline

Introduction and background

Creating Graphs in NetworkX

Data loading and visualization

Centrality

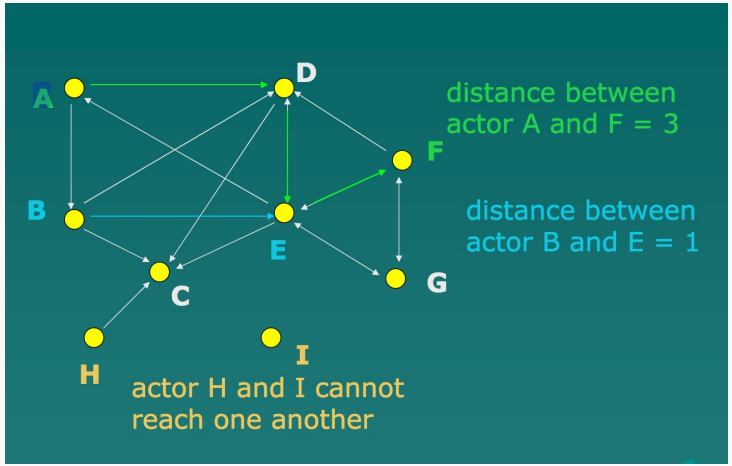
Cliques, triangles and triadic closure

Community detection and statistical inference

What is Network?

A pattern of interconnection among a set of things.

A collection of points joined by lines



Network can be thought of as :

a complicated data structure,

a complex system,

a way of exploring data.

The basics of network theory

Networks, a.k.a. graphs, are an immensely useful modeling tool to model complex relational problems.

Networks are comprised of two main entities: Nodes and Edges

Nodes: commonly represented as circles. In the academic literature, nodes are also known as "vertices".

Node/vertex: the entity of analysis which has a relationship.

Node is used in the network context.
Vertex is used in the graph theory context.
Both terms are often used interchangeably.

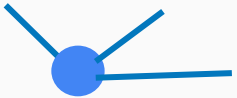
The basics of network theory

Link/edge/relationship: the connections between the nodes.

Edges: commonly represented as lines between circles.Edges denote relationships between the nodes.

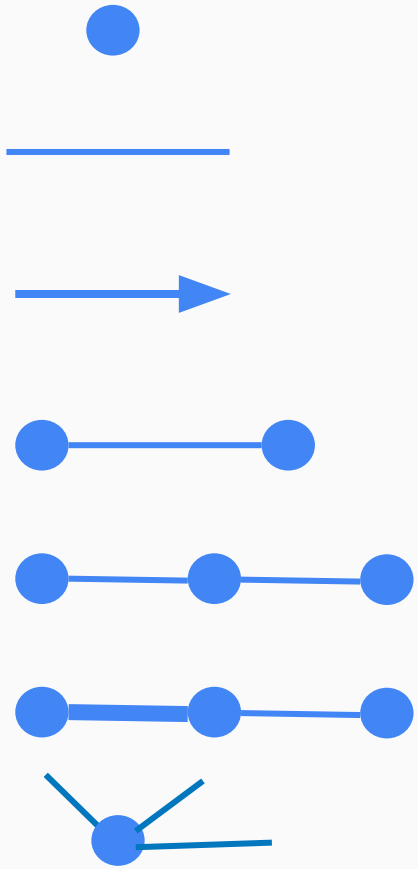
Attributes: Both nodes and edges can store attributes, which contain additional data about that object.

Weight: a common attribute of edges use to indicate strength or value of a relationship. 

Degree: number of edges or connections a node has. 

Basics

- Node/Vertex
- Edge
- Directed
- Connectivity
- Path
- Weight
- Degree



What is Social Network and Social Network Analysis?

Social Network: a network where the “things” are people and “interconnections” are social interactions.

Social Network Analysis (SNA): the application of graph and network theory to investigate social structures.

The basics of network theory

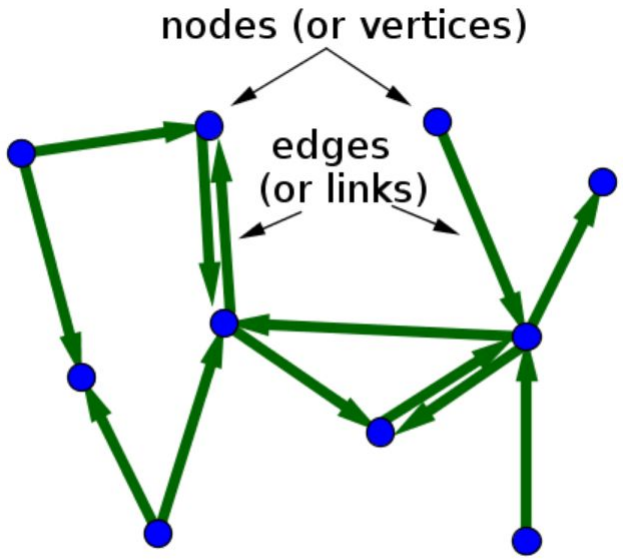
In a network, if two nodes are joined together by an edge, then they are neighbors of one another.

Type of network :

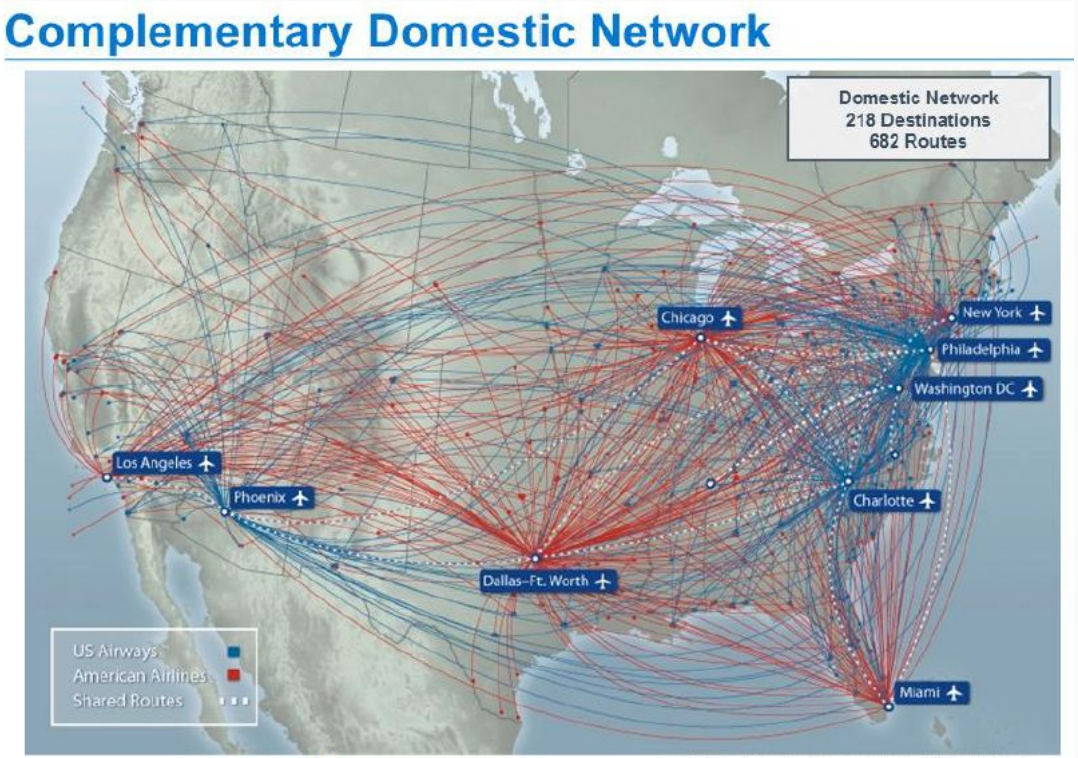
- ➔ directed
- ➔ undirected

Example of Network : Directed Network

Air traffic network: Airports are nodes, flights between airports are the edges.

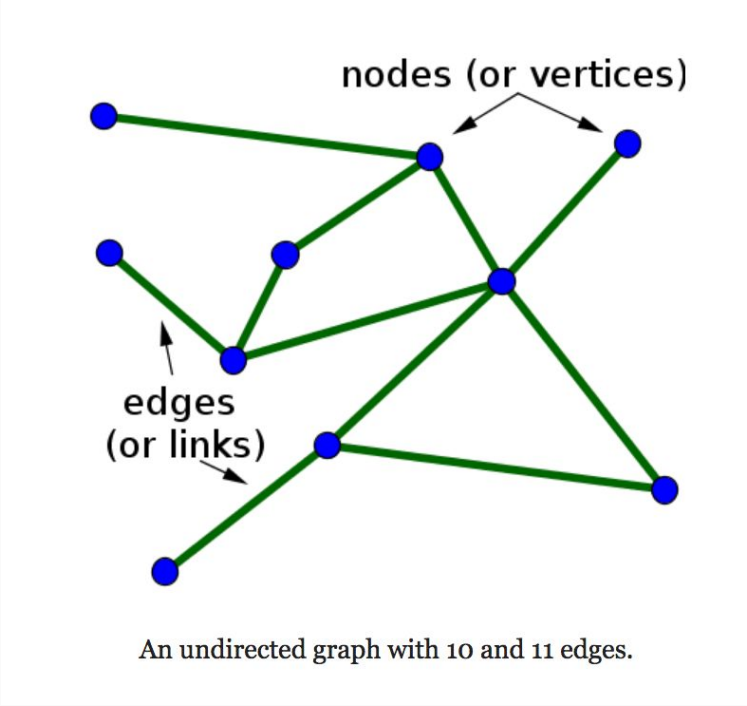


A directed graph with 10 vertices (or nodes) and 13 edges.

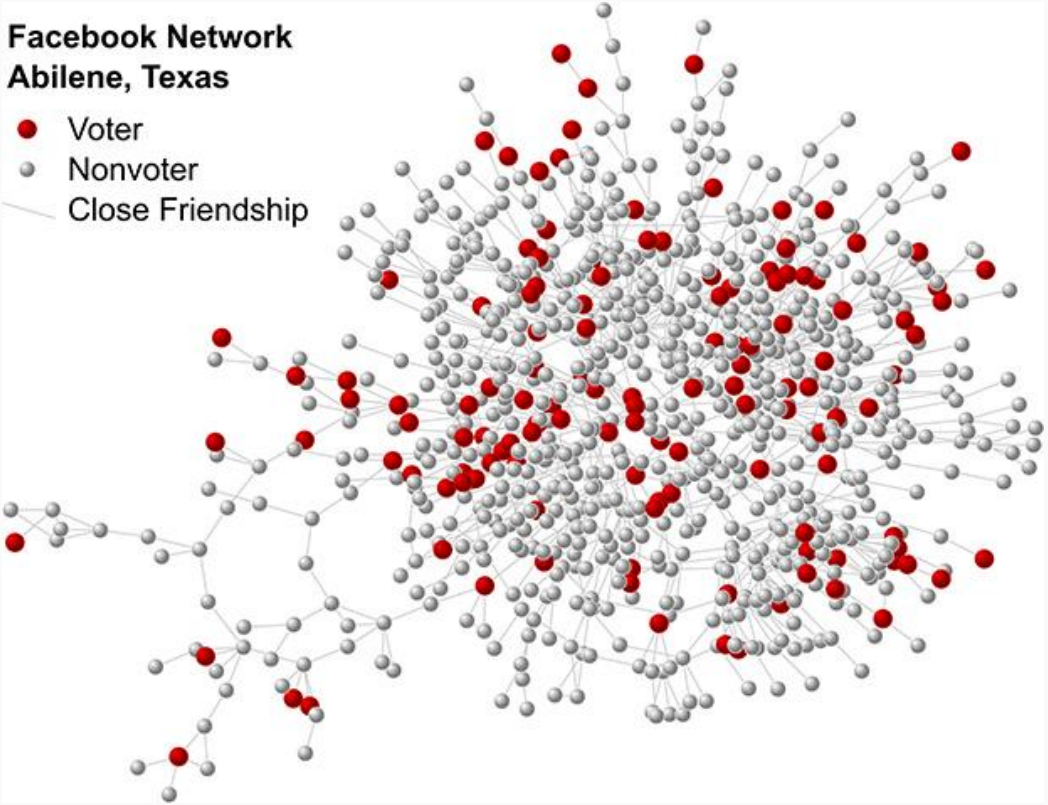


Sample of Network : Undirected network

Facebook's network: Individuals are nodes, edges are drawn between individuals who are FB friends with one another.



An undirected graph with 10 and 11 edges.



Social Network Analysis : What for?

- ➔ Businesses use SNA to analyze and improve communication flow in their organization, or with their networks or partners and customers.
- ➔ Marketing. Social Networks are the most important way to obtain valuable information in marketing, like communities, or influencers.
- ➔ Crime detection. Law enforcement agencies(and the army) use SNA to identify criminal and terrorist networks from traces of communication that they collect; and then identify key players in these networks.
- ➔ Relationships and reputation.Social Network sites like Facebook use basic elements of SNA to identify and recommend potential friends based on friends-of-friends.

Intro to NetworkX

NetworkX is a Python language software package for the creation, manipulation, and study of the structure, dynamics, and functions of complex networks.

With NetworkX you can:

- load and store networks in standard and nonstandard data formats,
- generate many types of random and classic networks,
- analyze network structure,
- build network models,
- design new network algorithms,
- draw networks, and much more.

Credits

https://github.com/ericmjl/Network-Analysis-Made-Simple

YouTube video from Rob Chew, Peter Baumgartner | Network Analysis Tutorial with NetworkX

Sarah Guido, Celia La - Twitter Network Analysis with NetworkX - PyCon 2015

Social Network Analysis by Giorgos Cheliotis