Network Analysis 101: Basics

Overview

What is a network?

A network is a set of nodes and edges:

Reading and Viewing

https://en.wikipedia.org/wiki/Network_science

https://visiblenetworklabs.com/guides/network-science-101/

Exploring Complex Networks

Additional Material The Structure and Function of Complex Networks

.

.

Networks in the Real World

Networks are everywhere, such as:

- Information, ie: the Web
- Social, ie: Twitter, Facebook
- Biological, ie: Ecosystems, Neuronal, Metabolism

https://www.youtube.com/watch?v=yAtsm5xkb5c

Basic Network Analysis: Analytic

Centrality

The basic analytic statistics on networks are measures that have their focus on nodes and their "importance" in the network.

The technical term for this is called centrality and thus these are centrality measures.

https://en.wikipedia.org/wiki/Centrality

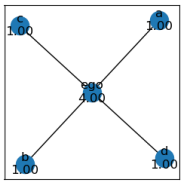
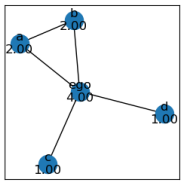
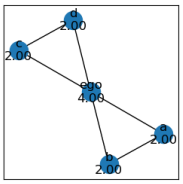
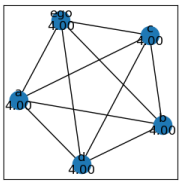
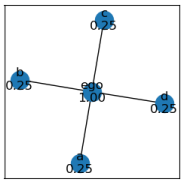
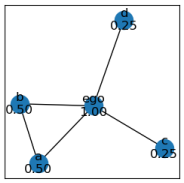
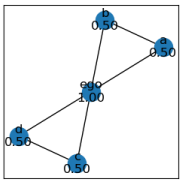
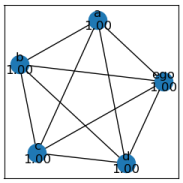
https://www.youtube.com/watch?v=NgUj8DEH5Tc

Degree

The degree of a node is the number of connected edges	The most basic centrality statistics is called degree centrality
$d(i) =$ number of edges connected to node i	$C_i^D = \frac{d(i)}{n-1}$

A related wholistic measure is density.

More Examples Here are more networks, which will be used in later measures also as the above network is pretty simple.

	Star	Clique	Bridge	Complete
Degree				
Degree Centrality				

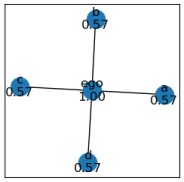
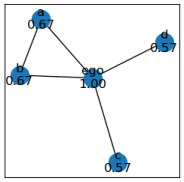
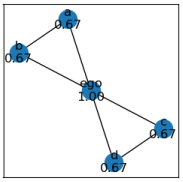
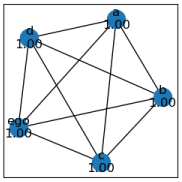
Closeness Closeness is a measure that means to capture a notion of proximity of a node to all other nodes.

So, if *ego* is 1 step away from all other nodes (ie: the center in a star network) the sum would be $n-1$. Since generally we want measures $0 \leq c \leq 1$, let us consider this to be the maximum of 1 and thus closeness would be defined as:

$$Cent_i^C = \frac{n-1}{\sum l(i,j)}$$

$n-1$	$\sum l(i,j)$
3	3

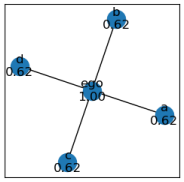
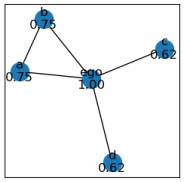
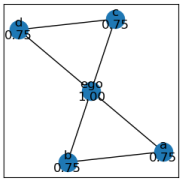
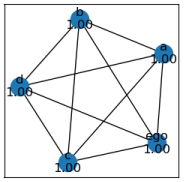
More Examples

	Star	Clique	Bridge	Complete
Closeness Centrality				

References https://www.youtube.com/watch?v=89mxOdwPfxA&t=810

Decay

More Examples

	Star	Clique	Bridge	Complete
Decay Centrality				

Betweenness .

Basic Network Analysis: Synthetic

The basic synthetic, or wholistic, statistics on networks are measures meant to give information to the overall structure of the network.

Density

.

Clusters

.