

Networks

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Network Science

Today we are going to discuss the definitions of terms used to describe graphs.

- ▶ A *graph* $G = (V, E)$ is a set of *vertices* (or *nodes*) V and a set of *edges* (or *links*) E between vertices.
- ▶ *Social Networks* can be modeled with graphs.
- ▶ This material is from Chapter 20 in the Second Edition of the book.

Why you should study Network Science?

- ▶ To have a basic understanding of how people understand Social Media Networks, such a Facebook or Twitter.
- ▶ To understand the basics of *graphs* so that when we get to discussing Neural Networks the ideas of graphs are already familiar. We will be using graph computation to fit NNs.
- ▶ To be aware of graph databases and how a graph can be used to store and access data. See Neo4j.

Definitions

- ▶ Edges can be *directed* or *undirected*.
- ▶ Edges may be *weighted*.

Definitions

- ▶ A *path* is a non-self-intersecting sequence of edges that connect vertices.
- ▶ The shortest path is called the *geodesic*.
- ▶ A graph is *connected* if there is a path between all pairs of vertices.
- ▶ The *diameter* of a graph is the length of the longest geodesic.
- ▶ The *eccentricity* of a vertex in a graph is the length of the longest geodesic starting at that vertex.

Definitions

- ▶ Graphs **do not** have coordinates.
- ▶ There is no obvious measure of *centrality*.

Definitions

- ▶ *Degree of centrality*: The more connections a nodes has the higher its rank.
- ▶ *Betweenness centrality*: The more paths that go through a node gives that node a higher rank.
- ▶ *Eigenvector centrality*: This is what is used in Google's PageRank algorithm. The idea used for Google Search.

Definitions

- ▶ *Triadic closure* is used to examine clusters in a network.

History

- ▶ *Random graphs*
- ▶ *Phase transition*
- ▶ *Six degrees of Kevin Bacon*

PageRank

- ▶ Google's PageRank
- ▶ Markov Process
- ▶ Used eigenvector centrality

Thank you

- ▶ Thank you to Jeff Helmsley for introducing these ideas to me.
- ▶ Check out his book *Going Viral*