Social Network Basics

CS315 – Web Search and Data Mining

What is a social network?

A set of relationships between entities

Social Network Analysis

* [Social network analysis] is grounded in the observation that social actors are interdependent and that the links among them have important consequences for every individual [and for all of the individuals together]. ...

* [Relationships] provide individuals with opportunities and, at the same time, potential constraints on their behavior. ...

Social network analysis involves theorizing, model building and empirical research focused on uncovering the patterning of links among actors. It is concerned also with uncovering the antecedents and consequences of recurrent patterns. [Linton C. Freeman, UC-Irvine]
Examples of Social Networks

- Nodes are high-school students.
- Boys are red, Girls are blue…
- What is the meaning of a bidirectional edge?

Definition:
A path is a sequence of nodes \( (v_1, ..., v_k) \) such that for any adjacent pair \( v_i \) and \( v_{i+1} \), there’s a directed edge \( e_{i,i+1} \) between them.

Paths

Path \( (v_1, v_2, v_8, v_3, v_7) \)

Definition: The length of a path is the number of edges it contains.

Path length

Path \( (v_1, v_2, v_6, v_5, v_7) \) has length 4.

Distance

The distance between \( v_i \) and \( v_j \) is 3.

Definition: The distance between nodes \( v_i \) and \( v_j \) is the length of the shortest path connecting them.
Famous distances

Kevin Bacon number

nodes = \{actors\}
edges = if two actors star in same film

Kevin Bacon number = distance between actor and Bacon

The Kevin Bacon Game

Invented by Albright College students in 1994: Craig Fass, Brian Turtle, Mike Ginelly

Goal: Connect any actor to Kevin Bacon, by linking actors who have acted in the same movie,

Oracle of Bacon website uses Internet Movie Database (IMDB.com) to find shortest link between any two actors:

http://oracleofbacon.org/
Paul Erdős number

- nodes = {mathematicians}
- edges = if 2 mathematicians co-author a paper

Erdős number = distance between mathematician and Erdős

- Erdős wrote 1500+ papers with 507 co-authors.
- Number of links required to connect scholars to Erdős, via co-authorship of papers.
- What type of graph do you expect?
- Jerry Grossman (Oakland Univ.) website allows mathematicians to compute their Erdős numbers: http://www.oakland.edu/enp/

Connecting path lengths, among mathematicians only:
- avg = 4.65
- max = 13

Jerry Grossman (Oakland Univ.)

Proud people!
Famous distances

Erdős number of ... = 4

Famous distances

Erdős number of ... = 3

Famous distances

Erdős number of ...

YOU = Bill Gates

if you publish with me!

Diameter

Definition: The diameter of a graph is the maximum shortest-path distance between any two nodes.

The diameter is 3.