Glossary

Adaptive networks: networks that change by themselves over time (e.g., a fungus)

Centrality: importance of a given element (e.g., degree centrality based on the number of friends).

Clustering: measure of how well neighbors of a node are connected.

Compartmental model: specification of a process by defining categories and transitions between them

Complete graph: network in which each person is connected to all others (denoted K_n for *n* nodes)

Complex network: no accepted definition… used as a synonymous for 'real-world' or 'big' sometimes

Cycle: network displayed as a circle, each node connected to one on the right and on the left (C_n)

Degree: number of edges connected to a given node (e.g., I have three friends = my degree is 3)

Degree distribution: specified by p(*x*), the fraction of nodes having degree *x*.

Directed: edge that goes only from one node to another (the flow goes only one way)

Distance: smallest number of edges needed to go from one node to the other.

Eccentricity: maximum distance from one node to all others.

Edge: relationship between two nodes (e.g., friendship tie between 2 persons, road between 2 cities)

Flow: quantities being carried on edges (e.g., financial flows, flows of information...)

Fuzzy cognitive maps: map based on fuzzy logic; can be built by consulting expert or doing reviews

Motifs: a pattern (small network) that appears at a different frequency than expected in a network.

Node: element of a network (e.g., one person, one city…)

Power-law: degree distribution of the type $p(x) = \text{constant} * x^{-\alpha}$, where α is called the exponent

Preferential attachment: when a node joins the network, it connects based on preferences

Rewiring: change extremity of an edge (e.g., instead of being friend with A, become friend with B)

Scale-free: network having a power-law degree distribution

Small-world: network with high clustering and low average distance

Social network: network in which the nodes are people, and the edges represent social ties

Susceptible-Infected: typical example of a compartmental model with 2 categories and 1 transition

Undirected: edges are assumed to be reciprocal (flows can go both ways)

Watts-Strogatz: model of small-world based on a regular lattice with few random rewiring

Recommended readings

[Measures and properties] MEJ Newman: the structure and function of complex networks.
www-personal.umich.edu/~mejn/courses/2004/cscs535/review.pdf
Also a video: http://videolectures.net/eccs07_newman_sdc/

[Properties] PJ Giabbanelli, JG Peters: complex networks and epidemics (TSI)
Motifs S Maslov: role model for modules (Nature Physics)
Clustering J Samaraki et al.: Generalizations of the clustering coefficient (Phys Rev E)
Small-world DJ Watts, SH Strogatz: collective dynamics of small-world networks (Nature)
Power-laws L Li et al.: Towards a theory of scale-free graphs (Internet Mathematics)

[Models] **Small-world** F Comellas et al.: Deterministic small-world communication networks (IPL)
Scale-free L Barriere et al.: Deterministic hierarchical networks (preprint catalunya)
Fractals PJ Giabbanelli: the small-world property in networks (ACS)
Properties PJ Giabbanelli et al.: average path length of deterministic… (CompleNet 2010)

[Processes] PJ Giabbanelli: Impact of complex network properties on routing (CCNet 2010)
PJ Giabbanelli et al.: Modeling the influence of social networks (Under review)
C Piccardi, R Casagrandi: Inefficient epidemic spreading in scale-free (Phys Rev E)
P Crepey et al.: Epidemic variability in complex networks (Phys Rev E)

Bibliography

On power-law distributions:
http://cscs.umich.edu/~crshalizi/notebooks/power-laws.html

On complex networks:
http://cscs.umich.edu/~crshalizi/notabene/complex-networks.html

On applications to health:
DT Finegood, L Johnston, PJ Giabbanelli et al.: Complexity and Systems Theory (Oxford online)

Research groups

Interdisciplinary Center for Network Science & Application (iCeNSA, Notre-Dame)
Barabasi Lab (Northeastern university)
Center for the Study of Complex Systems (University of Michigan)
Computational Analysis of Social and Organizational Systems (CASOS, Carnegie Mellon).
Center for Nonlinear Studies (Los Alamos National Laboratory)
Santa Fe Institute. Has a summer school (3 weeks); no tuition fees.
New England Complex Systems Institute (NECSI)
Center for Complex Networks and Systems Research (CNetS), University of Indiana.
Computational Epidemiology Research Laboratory (CERL), University of North Texas.
Matthieu Latapy's team in Paris, the IXXI in Lyon, and the Lisc in Clermont-Ferrand. See also Cx-Nets.
Centre for research in social simulation (cress), University of Surrey
Centre of Excellence in Computational Complex Systems Research (COSY, Finland)
Statistical Mechanics and Complexity (SMC), Università "La Sapienza" (Rome)
ARC Complex Open Systems Research Network