

Review of Graphs and Networks: networks and their representation, the adjacency matrix, weighted networks, directed networks, hypergraphs, bipartite networks, trees, planar networks, degree, paths, components, independent paths, connectivity, and cut sets, the graph laplacian, random walks

Measures and metrics: degree centrality, eigenvector centrality, katz centrality, pagerank, hubs and authorities, closeness centrality, betweenness centrality, groups of vertices, transitivity, reciprocity, signed edges and structural balance, similarity, homophily and assortative mixing

The structure of complex networks - Clustering - Motifs - Community structures -. Graph spectra. The large-scale structure of networks: components, shortest paths and the small-world effect, degree distributions, power laws and scale-free networks, distributions of other centrality measures, clustering coefficients, assortative mixing

Network Models: Random graphs: Erdős–Rényi, Barabási–Albert, Watts–Strogatz, Exponential random (ERGM), Hyperbolic (HGN), Hierarchical, Stochastic block model
Dynamics: Boolean network, agent based, Epidemic/SIR

TEXTBOOKS/ REFERENCES:

1. *Douglas West, "Introduction to Graph Theory", Second Edition, PHI Learning Private Limited, 2011.*
2. *Guido Caldarelli, "Scale-Free Networks", Oxford University Press, 2007.*
3. *Alain Barrat, Marc Barthelemy and Alessandro Vespignani, "Dynamical processes on Complex networks", Cambridge University Press, 2008.*
4. *Reuven Cohen and Shlomo Havlin, "Complex Networks: Structure, Robustness and Function", Cambridge University Press, 2010.*
5. *M.E.J. Newman, "Networks: An Introduction", Oxford University Press, 2010.*