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Syllabus

Network Science Module

Lecture 1

- Overview of the course; introduction to networks

[20/02/2024] [[slides](#)]

reading material: Sec. 0.1-0.6 ([Menczer, Fortunato, and Davis 2020](#)) Sec. 1.1, 1.2 ([Easley and Kleinberg 2010](#))

Lecture 2

- Graph theory: basic definitions; density and sparsity; subnetworks; degree; directed networks; weighted networks; multilayer and temporal networks; network representations; drawing networks; paths and distances; connectedness and components; small world phenomena, clustering coefficient.

[23/02/2024] [[slides](#)]

reading material: Chapter 1-2 ([Menczer, Fortunato, and Davis 2020](#)) Sec. 2.1, 2.2, 2.3 ([Easley and Kleinberg 2010](#))

Lecture 3

- Strong and weak ties; triadic closure; the strength of weak ties; tie strength and network structure in large-scale data; tie strength, social Media, and passive Engagement; closure, structural holes, and social capital.

[27/02/2024] [[slides](#)]

reading material: Sec. 3.1-3.5 ([Easley and Kleinberg 2010](#))

Lecture 4

- Homophily; assortativity; mechanisms underlying homophily: selection and social influence; affiliation; tracking link formation in online data; a spatial model of segregation;

[01/03/2024] [[slides](#)]

reading material: Sec. 2.1 ([Menczer, Fortunato, and Davis 2020](#)) Sec. 4.1-4.5 ([Easley and Kleinberg 2010](#))

Lecture 5

- Exercises; basics on network analysis with Python; introduction to NetworkX

[04/03/2024] [[slides](#)] [[slides on NetworkX](#)]

Lecture 6

- Hubs; centralities; degree centrality; eigenvector centrality; closeness centrality; betweenness centrality; friendship paradox; robustness; core decomposition

[08/03/2024] [[slides](#)]

reading material: Chapter 3 ([Menczer, Fortunato, and Davis 2020](#))

Lecture 7

- More on centralities; exercises

[12/03/2024] [[slides](#)]

Lecture 8

- Network models; random networks, small-world networks, the configuration model, preferential attachment

[15/03/2024] [[slides](#)]

reading material: Chapter 5 ([Menczer, Fortunato, and Davis 2020](#))

References

Easley, D., and J. Kleinberg. 2010. *Networks, Crowds, and Markets: Reasoning about a Highly Connected World*. Cambridge University Press. <https://books.google.it/books?id=atfCl2agdi8C>.

Menczer, F., S. Fortunato, and C. A. Davis. 2020. *A First Course in Network Science*. Cambridge University Press. <https://books.google.it/books?id=q1abxgEACAAJ>.