

Outline

1. Why models and the challenge of clustering
2. A geometric approach to clustering
3. Euclid and hyperbolic geometry
4. A hyperbolic solution to clustering
5. Rethinking interactions: the case of directed graphs
6. Rethinking interactions: the case of modular structure

Network models

Why?

- ▷ Mathematical representation → **analytical** results and predictions.
- ▷ Identify the **mechanisms** behind a set of topological properties.
- ▷ **Disentangle** the effect of various topological properties (e.g. assortative mixing vs. clustering on the percolation threshold [1]).
- ▷ Identify significant patterns of connection in real networks (i.e. **null models**).
- ▷ Perform in silico controlled experiments (e.g. **simulation** of epidemic spreading).
- ▷ ...

[1] Phys. Rev. E 80, 020901 (2009)

[2] SIAM Rev. 60, 315 (2018)

[3] Phys. Rev. Lett. 89, 208701 (2002)

[4] Phys. Rev. X 9, 011023 (2019)

[5] Soc. Networks 5, 109 (1983)

[6] Appl. Netw. Sci. 4, 122 (2019)

[7] Nature 393, 440 (1998)

[8] SIAM Rev. 45, 167 (2003)