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)