Outline

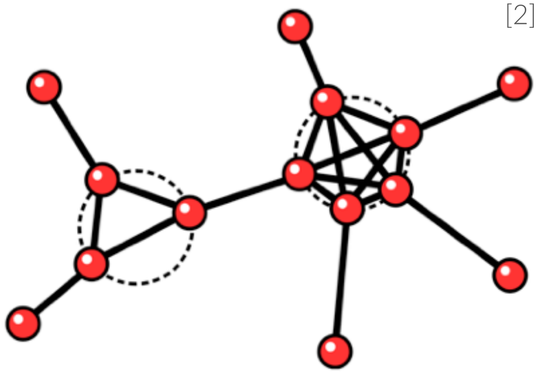
1. Why models and the challenge of clustering
2. A geometric approach to clustering
3. Euclid and hyperbolic geometry
4. A hyperbolic solution to clustering
5. Rethinking interactions: the case of directed graphs
6. **Rethinking interactions: the case of modular structure**

Modeling clustering

Trickier because clustering consists in three-node interactions while our mathematical tools rely on pairwise interactions either explicitly or implicitly.

Most models therefore assume

- an underlying tree-like structure
- that the networks are dense



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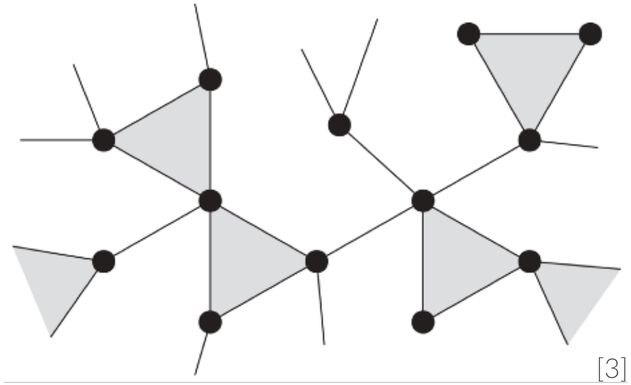

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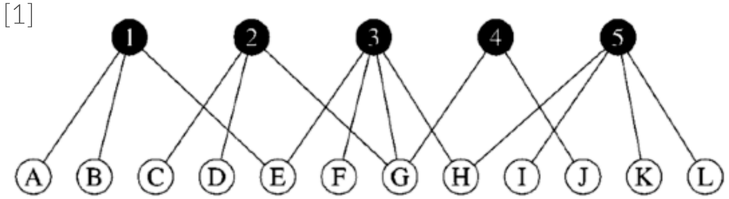

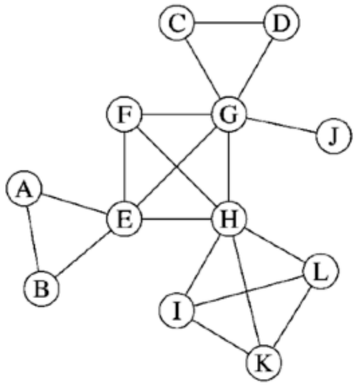

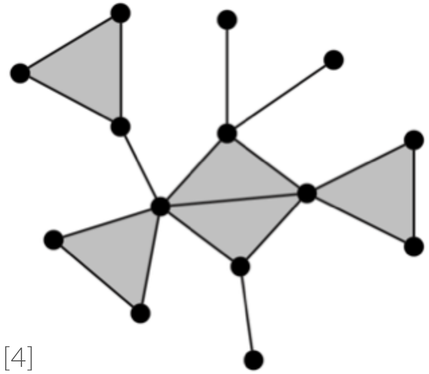

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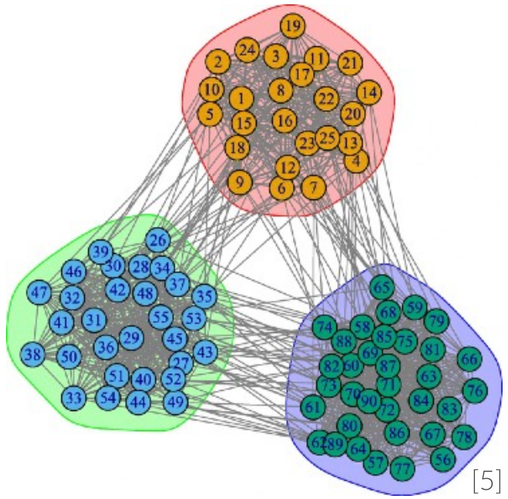

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[1] Phys. Rev. E 68, 026121 (2003)
[2] Phys. Rev. E 80, 036107 (2009)
[3] Phys. Rev. Lett. 103, 058701 (2009)
[4] Phys. Rev. E 82, 066118 (2010)
[5] Appl. Netw. Sci. 4, 122 (2019)