Summary

1. Presented a generalization of the $\mathbb{S}^1$ model to directed networks.
2. Proposed a general approach to control reciprocity in any random network model.
3. Showed that the interplay between in/out-degree, reciprocity and clustering in directed networks can be accurately captured by a geometric approach.

Further details

- Allard, Serrano & Boguñá, *Geometric description of clustering in directed networks*, Nat. Phys. (in press), arXiv:2302.09055
- https://github.com/networkgeometry/directed-geometric-networks

Ongoing work / open questions

- How to infer the angular positions as well. Does this information improve the accuracy of the model?
- Can we disentangle the effect of ν, β and the correlation between in- and out-degrees on the accuracy of the model?
- Why are some real networks not fitted well by the model?
- What about vertex-wise reciprocity? Is it uniform/heterogeneous? Is the model accurate?

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**