

Complex and Social Networks: Research project proposal

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This project is based on the research paper: [\[Su et al., 2021\]](#) Note: the two articles mentioned in this section are attached.

1. Domain, background

cooperation, evolutionary game theory, asymmetric relationships in networks, directed graphs

2. Aims of the research

- (a) [donation game from the initial part of the article] Recreate the results analysing how the fraction of oriented edges impact the critical cost/benefit. We will recreate the results for all networks used in the paper (Random regular, ER, SW, BA).
- (b) Explore different diffusion processes (mentioned as further work in the paper). Our proposal is to use a different network for the diffusion process than the underlying network used for the donation game model.

3. Hypotheses to be tested

The critical cost/benefit of the considered networks will differ (grater or lower) if the diffusion network has "role models" (ethical celebrities) i.e. it is a scale free network. This is not relevant for the BA graphs.

4. Theoretical framework

Game theory, network science and graph theory (more specifically random graphs/networks).

5. Methods

Modelling graphs with computer programming, statistical analysis of the results and mathematical analytical results.

Bibliography

[Su et al., 2021] Su, Q., Allen, B., and Plotkin, J. B. (2021). Evolution of cooperation with asymmetric social interactions. *Proceedings of the National Academy of Sciences*, 119(1).

[Link](#) to the article, we recommend also reading the supplement.