

INSALATE DI MATEMATICA

presents

29/11/2023

ANNA GALLO

Scuola IMT Alti Studi Lucca

Strong, weak or no balance? Testing structural hypotheses in real heterogeneous networks



Abstract:

The abundance of data about social, economic and political relationships allows social theories to be tested against empirical evidence and human behaviour to be analyzed just as any other natural phenomenon. Here we focus on balance theory, stating that actors in signed, social networks tend to avoid the formation of cycles with an odd number of negative links. This statement, however, can be supported statistically only after a comparison with a null model. Since the existing benchmarks do not account for actors' heterogeneity, here we extend the Exponential Random Graphs framework to signed networks with both global (homogeneous) and local (heterogeneous) constraints and employ them to assess the significance of unbalanced patterns in several real-world networks. We find that the nature and level of balance in social networks crucially depends on the null model employed: while homogeneous benchmarks favour the weak balance theory, according to which only triangles with one negative link should be under-represented, heterogeneous benchmarks favour the strong balance theory, according to which also triangles with all negative links should be under-represented. Biological networks, instead, display almost inverted patterns and strong frustration under any benchmark, confirming that structural balance inherently distinguishes social networks from other signed networks.

Keywords: Probability theory · Graph theory · Null models · Statistical mechanics · Entropy · Balance theory

Dipartimento di Matematica e
Applicazioni

Università degli Studi di Milano-Bicocca

U5-3014

03:30 pm (CET)



*"Obvious" is the most dangerous word in mathematics.
(Eric Temple Bell)*