Week 05

Local-level metrics

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INFO 5613: Network Science

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Agenda

- The “neighborhood” around nodes encodes important information about network structure

- **Clustering** – how many of a node’s neighbors are neighbors themselves?
- **Triad census** – how many of each triad type exists in a network?
- **Degree assortativity** – do well-connected nodes connect to other well-connected nodes?
- **Friendship paradox** – your friends (probably) have more friends than you do… implications?

- What are other examples of class size paradoxes and what are their implications?
- What behaviors are well-captured by some triad classes?
- Are social networks likely to be distinct on metrics other than clustering and assortativity?

Next class

- Readings
  - Feld, S. L. (1991). Why your friends have more friends than you do. *American Journal of Sociology*, 96(6)
  - Milo, R., Shen-Orr, S., Itzkovitz, S., Kashtan, N., Chklovskii, D., and Alon, U. (2002). Network motifs: Simple building blocks of complex networks. *Science*, 298(5594)
  - Newman, M. E. J. and Park, J. (2003). Why social networks are different from other types of networks. *Physical Review E*, 68(3):036122
    - Just skim through equations, focus on prose and “Section V: Examples”

Discussion

Class size paradoxes and implications

- Thought experiments into explaining the friendship paradox
- If I am my friend's friend, why don't I have more ties than them?
- Feld (1980, pg. 1468): "Distribution of [FoF] includes the same individuals over and over"
- "People with lots of friends are more likely to number among your friends in the first place."
- Role of the paradox in echo chambers and implications for polarization, misinformation, *etc*.?
- Skill/newcomer incongruity: everyone else is better + self-sorting to be around similar others
- Collaborations: collaborators are likely more "successful" than you
- Do online networks' recommenders flatten or exaggerate the paradox?
- Risk perceptions in a pandemic

Stories well-captured by motifs

- Transitivity: closing gaps in networks
- Motifs as solutions to constraints for information processing, energy flow, *etc*.
- Motifs as Lego blocks, circuits, gravitational pulls, unstable configurations
- Do triadic motifs vary with position in the network or are they universal?
- Similarities across diverse complex systems implies possibility of common solutions?
- Criminal networks pressured to structure themselves to avoid detection
- Motifs are “uncolored”, but more configurations possible with attributes on nodes

Social structure: clustering + assortativity?

- Socialness → community, cooperation → distinctive structures
- Can human experience and relationships be captured by single ties?
- Friendship paradox as a mechanism through human social+political history?
- Family trees and relationships → local ties more important that global structure
- Wikipedia game: degree correlations may be weak ties

Next class

Next week: network-level structure

- Degree distributions and scale-free networks, small worlds, core-periphery, and components

- Readings
  - Borgatti, S. P. and Everett, M. G. (2000). Models of core/periphery structures. *Social Networks*, 21(4):375–395
  - Uzzi, B., Amaral, L. A., and Reed-Tsochas, F. (2007). Small-world networks and management science research: A review. *European Management Review*, 4(2):77–91
  - Barabási, A.-L. (2009). Scale-free networks: A decade and beyond. *Science*, 325(5939):412–413