Week 07

Community structure

Thursday, October 7

INFO 5613: Network Science

Brian Keegan
brian.keegan@colorado.edu

University of Colorado Boulder

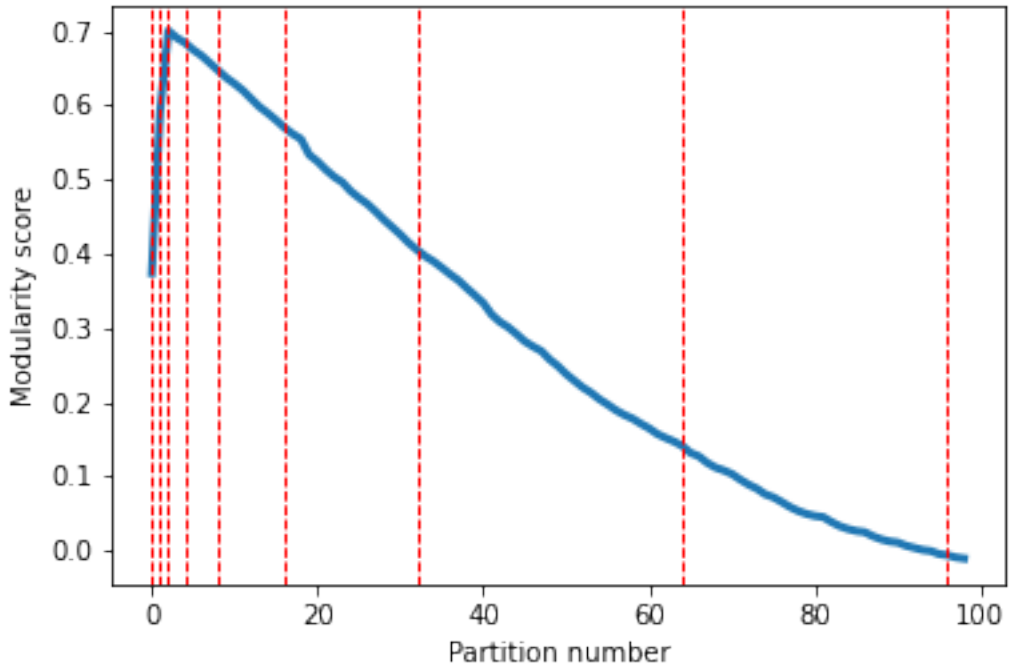
Agenda

- The presence of dense/cohesive interpersonal relations indicates a social group

- **Cliques/clans/cores** – different definitions of cohesive sub-groups in a network
- **Community detection** – algorithms for identifying sub-groups in a network
- **Block models** – a class of network models for generating or identifying subgroups

- Module Assignment 2: write a special call for network perspective on X in your research area
  - Due October 15
- Final assignment

Modularity


Modularity score
Partition number
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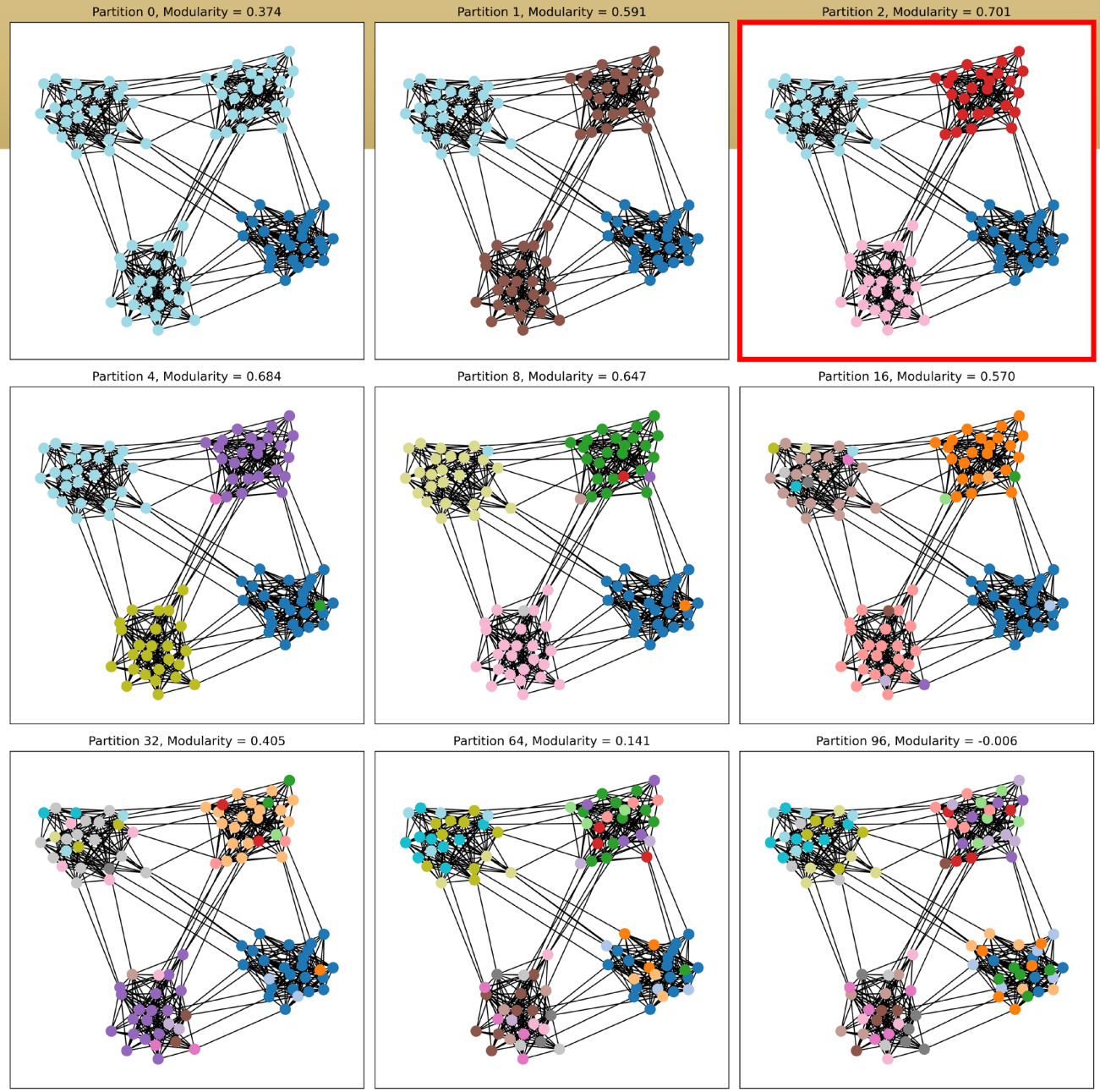
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0
20
40
60
80
100


Partition 0, Modularity = 0.374
Partition 1, Modularity = 0.591
Partition 2, Modularity = 0.701
Partition 4, Modularity = 0.684
Partition 8, Modularity = 0.647
Partition 16, Modularity = 0.570
Partition 32, Modularity = 0.405
Partition 64, Modularity = 0.141
Partition 96, Modularity = -0.006

Discussion

- Readings
  - Friedkin, N. E. (2004). Social cohesion. Annual Review of Sociology, 30(1):409–425
  - Fortunato, S. and Hric, D. (2016). Community detection in networks: A user guide. Physics Reports, 659

- What are examples of cohesive sub-groups in the networks relevant to your research? Drawing from Friedkin 2004, what mechanisms could cause some nodes to form dense sets of ties among themselves versus the rest of the network? Conversely, what mechanisms could undermine the formation of cohesive sub-groups in your network? Are pro-cohesion or anti-cohesion mechanisms more susceptible to influence, engineering, etc.?
- Fortunato & Hric's (2016) discussion of "structure versus metadata" emphasizes that labels may bear only a weak correspondence to the patterns of links among nodes. What are some examples from your research area where node-level meta-data should have a stronger influence on network structure including the formation of cohesive sub-groups and some counter-examples of node-level meta-data that should have a weak influence?
- Community detection in networks is a good example of "unsupervised learning" where the structure in the data lends itself to identifying emergent patterns. Ignoring the mathematical formalisms, unsupervised learning has a strong correspondence with many qualitative methods that depend on induction and triangulation for meaning-making. You have network data where you expect there to be meaningful cohesive subgroups, so you run community detection algorithms to identify these groups. What would be your next steps for validating and interpreting the resulting groups?

Discussion

Subgroup examples & mechanisms

- Membership & turnover in music groups → touring, recording, proximity can reinforce
- Political parties and caucuses → policy agendas, consumption, influence/conformity
- Fandoms around productions → participation, shared goal/interest
- Religious groups → attendance, engagement
- Multiple clique membership → interpersonal influences, coordination, dispute resolution
- Online collaborations → topics/projects
- Expat communities → similarity/affinity, demographics, conformity/uniformity
- Online support → interpersonal solidarity vs. aggressive commenters
- Online conspiracies → consequence, interactivity/feedback

Interpreting detected sub-groups

- Visualizing groups for overlaps and interfaces
- Different methods produce different groups → prioritizing/evaluating definitions?
- Orient to key players and their groups assignments

Node meta-data and network structure

Module Assignment 2

Proposal for network perspectives on X

- Convening conversations are an important genre of scholarly writing
- Write up a (minimum) 1,000-word proposal on network perspectives for your research domain
- Outline
  - Motivate a gap in understanding and identify relevant network perspectives to explore it
  - Identify and summarize related work showcasing boundaries and opportunities
  - For a panel format, assemble your dream team of panelists and what each would speak about
  - For a workshop format, outline the activities that would happen among attendees
  - For a special issue format, enumerate themes you contributors could write on
  - Include logistics of deadlines, timelines, *etc*.
- Look to journals and conferences in your disciplines for examples
- Due Friday, October 15

Final assignment

What to do?

- Choose your own adventure!

Next class

Readings

- Week 7 – Community Structure: cohesion, cores/cliques/clans, community detection

- Readings
  - Friedkin, N. E. (2004). Social cohesion. *Annual Review of Sociology*, 30(1):409–425
  - Fortunato, S. and Hric, D. (2016). Community detection in networks. *Physics Reports*, 659:1–44