CourseNetworking and community: Linking online discussion networks and course success

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Forum community data

Instructors in online and face-to-face classes use forums to support and extend class discussion[1]. Here we use the accumulated forum posts from a semester-long class to build a collaboration network and look for grade benefits for students who are more central in this network.

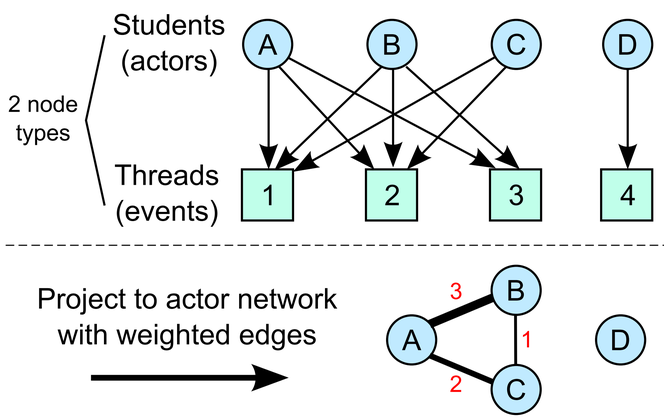
- Calculus-based physics I, ~156 students
- Face-to-face lecture/lab/recitation with active learning in lecture
- CourseNetworking forum software supports threaded discussions and "liking" posts
- Data includes time/date, post content, # likes

Connecting a forum network

Networks need nodes and edges--commonly, students and their reported interactions. Studies quantifying online interactions vary on approaches:
* Pre/post surveys, like an in-class network [2,3]
* Link from each commentor to previous post[4]
* Unspecified methods[5]

Few use information about how students interact in the forum. Here, we fold that information into the network and look for correlations between network position and final course grades.

Affiliation network model[6]



In the actor projection, students are connected when they post in common threads.

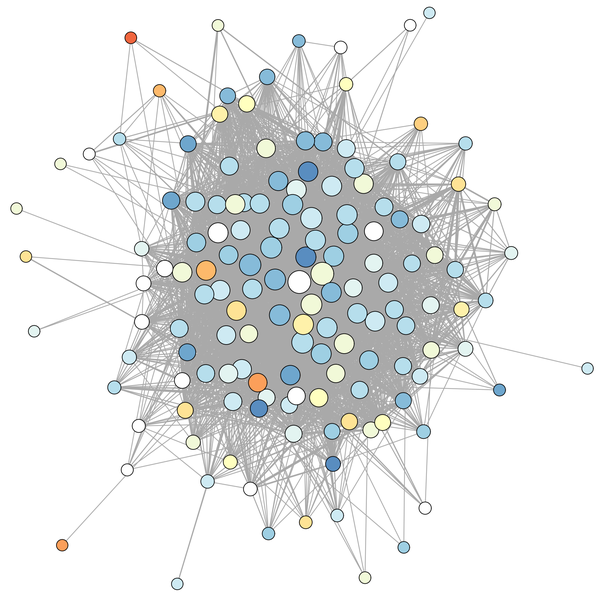


Figure 1: Actor projection of the forum network. Thicker lines between students indicate more threads in common. Students on the periphery posted in one or two low-activity threads.

Nodes are sized by degree (number of connections) and shaded by course grade, from high (blue) to low (red). White nodes show missing grades (faculty, staff, or drops).

Table: Descriptive statistics for actor projection, with average posts and replies from original affiliation network

Measure	Value	Notes
N_{nodes}	156	
N_{edges}	3814	
Density	0.158	(actual edges)/(possible edges)
Clustering coefficient	0.64	fraction of closed triplets
Average degree	53.0	"collaborators" per student
Average posts/student	20.8	new threads + replies
Average replies/thread	2.5	

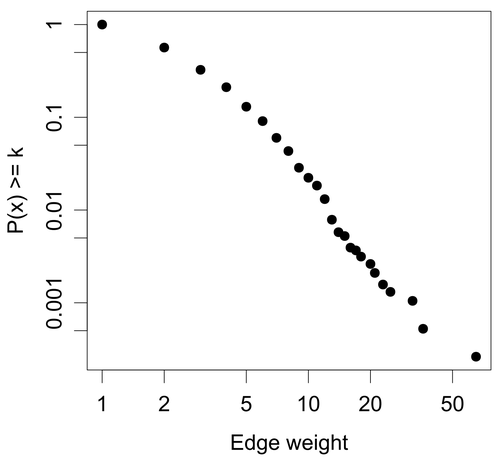


Figure 2: Cumulative distribution function of edge weights (log-log axes). The y-axis shows the probability that an edge has a weight of at least *k*, where *k* is the x-axis value. Low-weight edges are much more common, with 90% of edges having weight 5 or less.

Correlations with grades

Forum activity correlates with homework effort (see Gavrin & Lindell poster at this conference). Does student centrality in the actor projection network correlate with final course grade?
Measures considered:
- PageRank[7], accounts for number of connections and the influence of those connections
- Target entropy (TE, [8]): high TE nodes have many connections and receive information from a variety of sources
- Hide[8]: high-hide nodes are hard to "find" in the network, sparse connections in low-activity threads
- Small positive correlations for PageRank (0.18, [7]) and target entropy (0.29, [8]) with final grade
- Small negative correlation between hide (-0.27, [8]) and final grade

Notes and future work

Most students participated in threads with many other people, rather than following a few friends (higher degree than typical in-class networks).

SNA of forums is occurring more in education, but models for connecting these networks are still under development. The affiliation approach used here follows analysis of scientific co-authorship networks [6], but is more densely connected.

To improve correlations with final grades, the next step is to examine post content, separating student interactions into different types[8].

References

1. J. R. Howard, *Discussion in the college classroom: Getting your students engaged and participating in person and online* (Jossey-Bass, 2015).
2. H. Cho, G. Gay, B. Davidson, A. Ingraffea, *Computers & Educ.* *49*, 309–329 (2007).
3. H.-L. Yang, J.-H. Tang, *JALN* **7**, 93–107 (2003).
4. R. Aviv, Z. Erlich, G. Ravid, A. Geva, *JALN* **7**, 1–23 (2003).
5. S. Dawson, *Ed. Tech. & Society* **11**, 224–238 (2008).
6. M. E. J. Newman, *Phys. Rev. E* **64**, 16131 (2001).
7. S. Brin, L. Page, in Seventh International World-Wide Web Conference (WWW 1998) (http://ilpubs.stanford.edu:8090/361/).
8. J. Bruun, E. Brewe, *PRST-PER* **9**, 20109 (2013).