

Assortative Mixing in a Large Scientific Collaboration Network

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[Abstract] In a real-world society, individuals often exhibit strong preferences to communicate or take actions with others, rather than being just an isolated outlier. It's not always been well-confirmed that people tend to connect with someone who has similar or dissimilar attributes. Recent studies have shown that both of assortative and disassortative mixing patterns are widely existing in many social networks. Although some researchers have been observed that the scientific collaboration network (SCN) also demonstrates an assortative mixing pattern in different disciplines, our study examines a large scientific collaboration network in the field of physics and explores the mixing pattern among collaborators in the SCN.

In this study, we build a scientific collaboration network according to the common publishing relationship with the journal papers of APS (American Physical Society) from 1985 to 2009. The whole network includes 105742 authors, 897271 collaboration relations, and 486 components. The most giant connected component (GCC) owns 98.83% authors and 99.88% collaboration relations. In addition, by means of techniques of complex networks, we measure the node degree assortativity, average degree connectivity and the degree mixing of GCC. Meanwhile, a random network of the same size, weight and similar degree distribution is generated and experimented as a contrast group. The main results are as follows: A) The global assortativity coefficient is around 0.128. It is rather smaller than 0.363, the same assortativity coefficient using the ArXiv: a cond-mat repository of preprints in the previous research (2001, M. E. J. Newman). On the other hand, nodes in different degree groups have shown diverse features of assortativity. B) With a relatively small increase of nodes' degree, the average nearest neighbors' degree arises more significant. C) The high frequency of degree mixing happened among degree below 50. D) In contrast, the controlled random network exhibits an obvious lower assortativity even though the same size and degree distribution with the real SCN. Partial results are presented in Figure 1 below.

Our research has shown that the extent of assortative mixing behaviors of authors may diversify from the different physics fields, or the different number of collaborators. The authors who have few collaborators have a tendency to connect the authors who have a relatively higher number of collaborators. The collective behavior in the scientific community shows a more purposeful motivation rather than randomly choice. The future work will focus on grasping the mechanism hidden in these patterns.

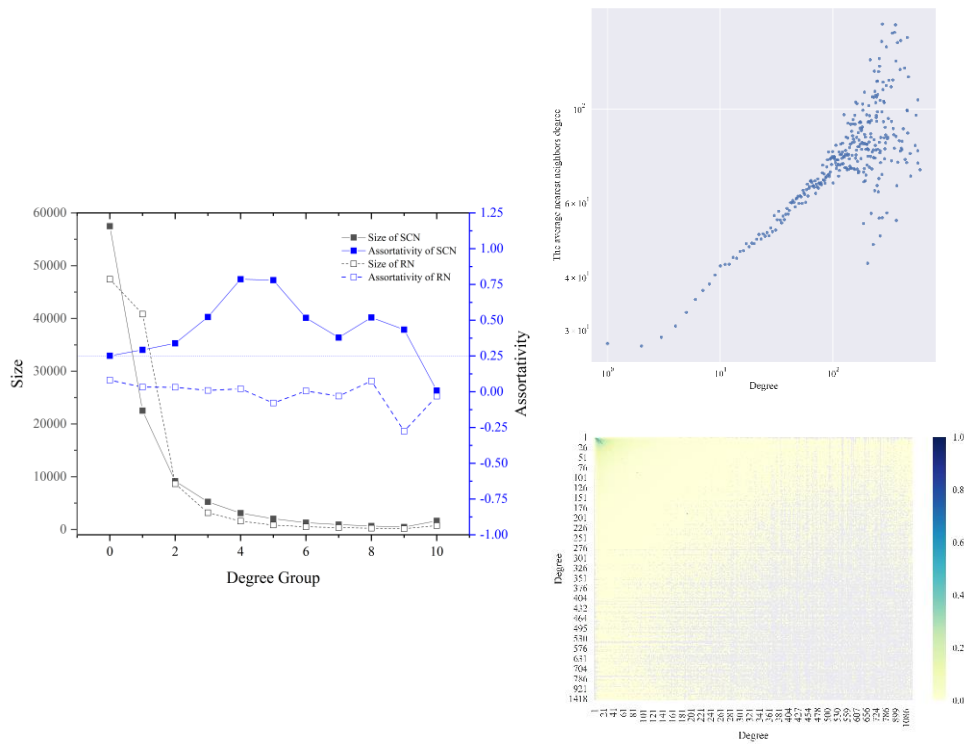


Figure. 1 Assortative mixing in a large scientific collaboration network.