Network Science Center Research

Network Structure and Algorithms

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The project described here will bring together researchers from both the mathematical and computer science disciplines in order to apply their quantitative background while addressing issues related to the structure of real-world networks as well as algorithms for operating on those networks. The broad goals of the research are to:

1. Work towards developing taxonomy of networks that can be used to:

a. Classify a real-world network or category of networks in order to help guide algorithmic choices when operating on the network(s).

b. Determine the right random graph model to use in studying a given real-world situation.

2. Develop and test algorithms that can be used to better operate on and in real-world networks, to include:

a. Operating on a dynamic network, possibly with only imperfect information about the complete state of the network.

b. Overlaying two or more related networks to determine knowledge that cannot be determined from a single network.

Approach:

One of the goals of this research is to work towards developing taxonomy of networks that can be used to classify a real-world situation. Various aspects of this hard problem have been addressed in the literature from a variety of perspectives. We intend to further this work by pulling together existing results from a common graph theoretic perspective, deriving new results about the global structure of a graph, and also deriving results that help further the understanding of network metrics. A long term goal of this research is the ability to find the underlying structure of a large graph to either predict emergent behavior or influence the future behavior of the network based on core characteristics defined by the underlying global structure.

Impact:

This research has the potential to increase our understanding of social networks from a mathematical standpoint. Our aim is to develop the theoretical underpinnings of the networks we study, which will in turn generalize to other social network settings. Many of these are directly relevant to problems faced by the Army, DoD, and the nation.