

# ECE6970/SYSEN5420 - Network Systems and Games

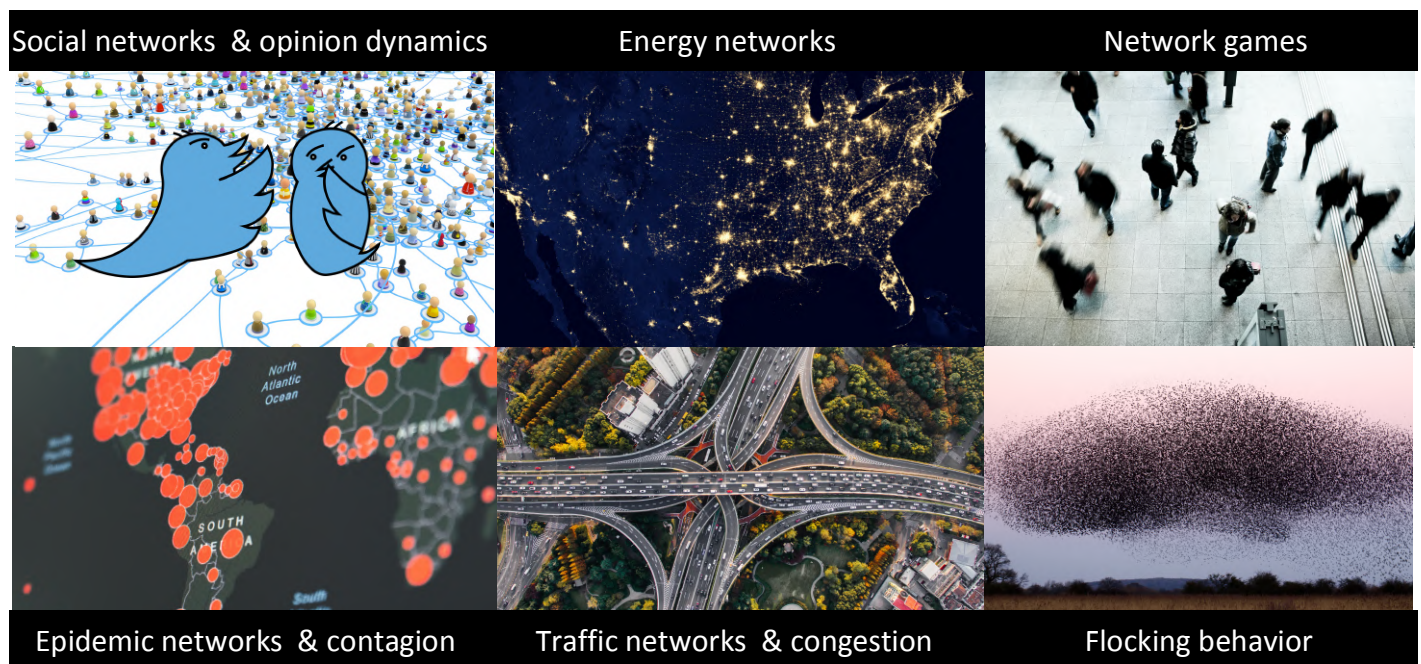
Fall 2020

Instructor: Francesca Parise, fp264@cornell.edu

TR 11.30am-12.40pm, 3 Credits

Network systems pervade our society in both social and technological contexts. On the one hand, social networks play a central role in the transmission of information or viruses with fundamental consequences for product marketing, technology adoption, voting decisions, spread of false news and epidemiology. On the other hand, network topology fundamentally affects the performance and resilience properties of large-scale multi-agent systems, such as the power grid, the internet of things, traffic and robotic networks.

In this class you will learn the necessary mathematical and modeling tools needed to describe and understand these network systems. Questions of interest will be how the network structure impacts the dynamics of network systems, how network properties can be exploited to maximize system performance or resilience and how one can address these questions while also accounting for strategic human behavior.



## Topics covered

- the theory of graphs (with emphasis on algebraic and spectral graph theory);
- network properties and centrality measures, with application to web-search algorithms;
- distributed averaging algorithms (consensus) with applications to social influence, wireless sensor networks, robotic coordination, optimal sensor placement, flocking behavior;
- epidemic models and network contagion;
- models of strategic behavior (game theory) with application to traffic and power networks;
- network games and targeted interventions with application to marketing and economic systems.

## Pre-requisites

The course is designed for students with a good background in linear algebra and differential equations. Students should be comfortable with some mathematical rigor and mathematical proofs. Beyond those concepts, the course will be self-contained. In case of doubt, please contact the instructor.