The Prisoners Dilemma: The Emergence of Cooperation

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September 18, Room: 9204

Abstract: The tension between opportunistic behavior and cooperation is a central features of many human (and animal) interactions. Understanding when people can overcome the incentives for opportunistic behavior and cooperate with each other is of importance for many sciences, from Economics to Biology. The literature on infinitely repeated games shows how repeated interaction can yield cooperation. We will discuss some of the fundamental theoretical findings of this literature, experimental results with human subjects and the application of dynamics to address the issue of multiplicity of equilibria in infinitely repeated games.

Regulatory Networks

Konstantin Mischaikow
Rutgers University

October 16, Room:4102

Abstract: Consider a regulatory network presented as a directed graph with annotated edges that indicate if the first node is up-regulating or down-regulating the second node. What kind of dynamics can this network generate? While this may seem to be an inadequately posed question it arises fairly often in biological contexts. Our motivation for addressing it arises from gene regulatory networks where we assume that the nodes represent genes and act as switches. However, we do not assume that we know the appropriate parameter values let alone the nonlinear reactions that govern the switches. Nevertheless, as I will describe in this talk, for moderate sized networks we can give a mathematically justifiable, computationally tractable, description of the global dynamics over all possible parameter values. We call the output of our approach a Database of Dynamic Signatures in that we produce potentially large, but queriable, combinatorial descriptions of the global dynamics that are valid over explicitly defined regions of parameter space.

The lectures will cover three topics. (1) The mathematical theory, based to a large extent on the ideas of C. Conley, used to decompose and identify the dynamics, (2) The computational techniques and challenges. (3) A few idealized examples and a few biologically based examples.

Dynamics of the visual cortex

Lai-Sang Young
CIMS and NYU

November 20, Room 9204

Abstract: In the first session, I will introduce some relevant concepts in theoretical neuroscience, and take some time to familiarize the audience with the dynamics of a population of integrate-and-fire neurons. This is strictly introductory material; no prior exposure to neuroscience is assumed.

In the second session, I will report on some ongoing computational modeling work. We seek to model the monkey visual cortex, which is very similar to our own, as a large and complex dynamical system. In this talk, I will focus on how visual signals are passed from the lateral geniculate nuclei (LGN) to the input layer of the primary visual cortex (V1). I will discuss what anatomical information can be gleaned from biology, how it is used to build a mathematical model, the experimental data used for validation, the analysis of dynamical mechanisms, and finally, what we have learned from this modeling work so far. This is joint work with Robert Shapley (Center for Neural Science, NYU) and Logan Chariker (PhD student, Courant).