ON TWO FUNDAMENTAL PROBLEMS IN STATISTICAL AND FUNCTIONAL MODELING OF COMPLEX NETWORKS

Abstract

by

Hyunju Kim

In the first part of the thesis we solve a fundamental problem that researchers face when modeling networked systems based on limited data, in particular degree-based data. Applications include all problem areas where network topology generators are needed, for e.g., the construction and enumeration of structural isomers of alkenes in chemistry, the construction and sampling of unbiased contact graphs for modeling the spread of diseases in human interaction networks, peer-to-peer communication networks and construction and enumeration of small functional building blocks of biological interaction networks.

In the second part of this thesis we provide a mechanism for the emergence of functional modules in neuronal networks, which could provide part of the explanation for why the primate cortex is segregated into functional areas and lobes (vision, sound, motor functions, etc.).