

abstract

COMPUTER SCIENCE/DISCRETE MATH I

Topic:

Speaker:

Affiliation:

Date:

Time/Room:

Biological networks have so many possible states that exhaustive sampling is impossible. Successful analysis thus depends on simplifying hypotheses, but experiments on many systems hint that complicated, higher order interactions among large groups of elements play an important role. We show that vertebrate retina uses combinatorial coding scheme, in which activity patterns of groups of neurons carry different information than the sum of its components. Further we show that weak correlations between pairs of neurons coexist with strongly collective behavior in the responses of ten or more neurons. Surprisingly, we find that this collective behavior is described quantitatively by models that capture the observed pairwise correlations but assume no higher order interactions. These maximum entropy models are equivalent to Ising models, and predict that larger networks are completely dominated by correlation effects. This suggests that the neural code can have associative or error--correcting properties, and we provide preliminary evidence for such behavior.