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Stochastic dynamics of biological information

This talk focusses on new mathematical challenges that arise in the context of biological problems. The first concerns the motion of eyes during reading. We have recently proposed a model for such eye movements which assumes that information is gathered from words in parallel in the word stream. The model has an intrinsic memory that expands with time. This expanding memory of the incoming words, as well as the “forcing” of the “reading system” by sequences of words of differing difficulties and with serial correlations pose great mathematical challenges. Another context in which information is gathered from an environment occurs in swarm intelligence problems. For example, ant colonies communicate with each other directly as well as through environment signals (such as the magnitude of food resources). In many colonies, there is non-hierarchical control in which ants perform different different tasks, and switch tasks as well. We will discuss the deterministic/stochastic dynamics of such task allocation in terms of birth-death processes, and discuss the challenges involved in incorporating the spatial domain in such problems.