Abstract

The theory of performance optimization has wide applications in many engineering and social fields and problems, including computer and communication networks, automation, transportation, manufacturing, robotics, logistics, financial systems, and social networks. Learning refers to the study and construction of algorithms that implement the optimization theory based on observation and available data. They provide the fundamental principles behind the great success of AlphaGo. In this course, we introduce the basic principles and results in stochastic learning and optimization of dynamic systems based on the Markov model; topics include Markov decision processes, states and policies, dynamic programming, Hamilton-Jacob-Bellman (HJB) optimality equations, reinforcement learning, search trees, learning and search algorithms, etc. Other topics such as neural networks, policy gradient (perturbation analysis) will be briefly discussed. Examples such as AlphaGo will be given to enhance the understanding.

Prerequisites: basic probability and matrix calculation; stochastic processes a plus.

Reading books:

