MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF MATHEMATICS

Applied Math Colloquium

Monday, March 9, 2020

4:15pm   Room : 2 - 190

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"A mathematical perspective of machine learning"

Abstract

The heart of modern machine learning is the approximation of high dimensional functions. Traditional approaches, such as approximation by piecewise polynomials, wavelets, or other linear combinations of fixed basis functions, suffer from the curse of dimensionality. We will discuss representations and approximations that overcome this difficulty, as well as gradient flows that can be used to find the optimal approximation. We will see that at the continuous level, machine learning can be formulated as a series of reasonably nice variational and PDE-like problems. Modern machine learning models/algorithms, such as the random feature and shallow/deep neural network models, can be viewed as special discretizations of such continuous problems. At the theoretical level, we will present a framework that is suited for analyzing machine learning models and algorithms in high dimension, and present results that are free of the curse of dimensionality. Finally, we will discuss the fundamental reasons that are responsible for the success of modern machine learning, as well as the subtleties and mysteries that still remain to be understood.