CNeuro2022 Lecture Abstracts

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Abstract 1 – Basic Lecture:

Neural Networks from Biological and Artificial Perspectives

Neurons in the brain are governed by the laws of physics, whereas artificial neurons follow the rules of math. I will present a survey of some of the most common frameworks for modeling neurons. The biological models will be compared and contrasted with artificial models of machine learning. In particular, we will look at how nonlinearities arise from intrinsic dynamics and how recurrence differs between artificial and biological networks. Learning will also be discussed.

Abstract 2 – Advanced Lecture:

Theoretical Analysis of Neural Network Models

Artificial neural networks in recent years have enjoyed huge success after reaching impressive performance on benchmark tasks such as image recognition, speech and natural language processing. Yet a comprehensive theory of why they work so well is still missing. Unsolved problems include the role of architecture and inductive bias, how optimization works in the non-convex setting, and why networks can have almost no training error but still not overfit. I will cover recent work that addresses all of these problems. In particular, I will focus on how function spaces associated with neural networks can explain how network architecture builds in useful biases to enhance learning. Much of this work is motivated by biological principles, and while the lecture will focus on artificial networks and math, we will see that biology employs these same mathematical tricks in brains.