

Keynote Talk: Control and Machine Learning

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ABSTRACT

In this lecture, we will discuss recent results from our group that explore the relationship between control theory and machine learning, specifically supervised learning and universal approximation. We will take a novel approach by considering the simultaneous control of systems of Residual Neural Networks (ResNets). Each item to be classified corresponds to a different initial datum for the ResNet's Cauchy problem, resulting in an ensemble of solutions to be guided to their respective targets using the same control. We will introduce a nonlinear and constructive method that demonstrates the attainability of this ambitious goal, while also estimating the complexity of the control strategies. This achievement is uncommon in classical dynamical systems in mechanics, and it is largely due to the highly nonlinear nature of the activation function that governs the ResNet dynamics.

This perspective opens up new possibilities for developing hybrid mechanics-data driven modeling methodologies. Throughout the lecture, we will also address some challenging open problems in this area, providing an overview of the exciting potential for further research and development.

How to Cite

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