A Non-autonomous Equation Discovery Method for Time Signal Classification

Abstract: The connection between deep neural networks and ordinary differential equations (ODEs), as known as Neural ODE, is an active field of research in machine learning. In this talk, we view the hidden states of a neural network as a continuous object governed by a dynamical system. The underlying vector field of hidden variables is written using a dictionary representation which is identified by fitting on the dataset. Within this framework, we develop models for time-series classification. We train the parameters in the models by minimizing a loss, which is defined using the solution to the governing ODE. We solve the optimization problem using a gradient-based method where the gradients are computed via the adjoint method from optimal control theory. Through various experiments on synthetic and real-world datasets, we demonstrate the performance of the proposed models. We also interpret the learned models by visualizing the phase plots of the underlying vector field and solution trajectories. At the end, we introduce the extension of the model for unsupervised learning tasks like dimension reduction method.

This seminar is easily accessible to persons with disabilities. For more information or for assistance, please contact the Mathematics Department at 743-3500.