Connections in Dynamical Systems and Machine Learning

Mason Legere [1]

In the past decade, advances in Machine Learning, specifically in Deep Neural Networks (DNN), have led to tremendous breakthroughs in many applications, such as in image recognition, medical imaging, natural language processing and autonomous vehicles. Historically, favourable architecture designs of DNNs and improved optimization algorithms for training these networks have largely been based on heuristics requiring domain expertise or experiments on a case-by-case basis. Recent efforts from the applied mathematics and statistics community have been made to better understand the theoretical foundations and generalizations of these DNNs and as well as improvements in accelerated methods in optimization. In this talk, I will introduce connections between dynamical systems and architecture designs of DNNs, and as well as acceleration methods in optimization. Specifically, I will discuss relationships between ResNet and numerical discretizations of an associated continuous dynamical systems. Moreover, I will give a survey of the relationships between Nesterov Acceleration from convex optimization to discretizations and Bregman Lagrangian dynamics.

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[1] UNBC Mathematics and Statistics, University of Northern British Columbia, Prince George, B.C., V2N4Z9, Canada (mlegere@unbc.ca).