UCSB

Numerical Scouts
Research Presentation

Optimizing Neural Networks via Koopman Operator Theory

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Akshunna (picture left, Harvard University applied physics research fellow) and William (pictured right, UCSB dynamical neuroscience PhD student) will present their recent arxiv paper which can be found here.

Abstract: Koopman operator theory, a powerful framework for discovering the underlying dynamics of nonlinear dynamical systems, was recently shown to be intimately connected with neural network training. As Koopman operator theory is a linear theory, a successful implementation of using it to evolve network weights and biases offers the promise of accelerated training. In this talk, we present our recent first steps in this endeavor. We show that Koopman operator theoretic methods allow for accurate predictions of weights and biases of feedforward, fully connected deep networks over a non-trivial range of training time. During this time window, we find that our approach is >10x faster than various gradient descent based methods (e.g. Adam, Adadelta), in line with our complexity analysis. We end by highlighting open questions in this exciting intersection between dynamical systems and neural network theory.

Biographies: Aksh graduated NYU with degrees in Mathematics and Physics, and joined the Dept. of Physics at MIT as a Research Assistant in Fall 2018, and joined SEAS at Harvard University as a Research Fellow in Spring 2020. His core research interests are driven by Dynamical Systems and Information theory - their applications have led him to successful projects in Quantum Information, Fluid Mechanics and Machine Learning Optimization.

Will graduated NYU with degrees in Math and Physics, and joined UCSB's Dynamical Neuroscience PhD program as a Chancellor's Fellow in 2018. In addition to working in Prof. Michael Goard's systems neuroscience lab, where he is studying the stability of (or lack thereof) of neural representations in the hippocampus, he is also interested in Koopman operator theory, and its connection to the renormalization group and machine learning.

Location and Time

Zoom @ 3:00pm - 4:00pm (Pacific Time), please RSVP at the email address below and a zoom link will be sent between 2:30pm and 3pm.

Contact

Website
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