



THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

SEMINAR ON DATA SCIENCE

Local Elasticity: A Phenomenological Approach Toward Understanding Deep Learning

By

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Abstract

Motivated by the iterative nature of training neural networks, we ask: If the weights of a neural network are updated using the induced gradient on an image of a tiger, how does this update impact the prediction of the neural network at another image (say, an image of another tiger, a cat, or a plane)? To address this question, I will introduce a phenomenon termed local elasticity. Roughly speaking, our experiments show that modern deep neural networks are locally elastic in the sense that the change in prediction is likely to be most significant at another tiger and least significant at a plane, at late stages of the training process. I will illustrate some implications of local elasticity by relating it to the neural tangent kernel and improving on the generalization bound for uniform stability. Moreover, I will introduce a phenomenological model for simulating neural networks, which suggests that local elasticity may result from feature sharing between semantically related images and the hierarchical representations of high-level features. Finally, I will offer a local-elasticity-focused agenda for future research toward a theoretical foundation for deep learning. This talk will be based on the following three papers:

<https://arxiv.org/abs/1910.06943>

<https://arxiv.org/abs/2010.11775>

<https://arxiv.org/abs/2010.13988>

Biography:

Weijie Su is an Assistant Professor in the Wharton Statistics Department and in the Department of Computer and Information Science, at the University of Pennsylvania. He is a co-director of Penn Research in Machine Learning. Prior to joining Penn, he received his Ph.D. from Stanford University in 2016 and his bachelor's degree from Peking University in 2011. His research interests span machine learning, optimization, privacy-preserving data analysis, high-dimensional statistics, and deep learning theory. He is a recipient of the Stanford Theodore Anderson Dissertation Award in 2016, an NSF CAREER Award in 2019, and an Alfred Sloan Research Fellowship in 2020.

Date : 20 November 2020 (Friday)

Time : 10:30am – 11:50am

Zoom Meeting : <https://hkust.zoom.us/j/5616960008> (Passcode: math6380p)

All are Welcome!