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THE WEIZMANN INSTITUTE OF SCIENCE  
FACULTY OF MATHEMATICS AND COMPUTER SCIENCE

Faculty Seminar

Room 1 ,Ziskind Building  
on Tuesday, Jan 07, 2020at 11:00

**NOTE THE UNUSUAL DAY AND ROOM**

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Traces of Class/Cross-Class Structure Pervade Deep Learning Spectra

Abstract:

Numerous researchers recently applied empirical spectral analysis to the study of modern deep learning classifiers, observing spectral outliers and small but distinct bumps often seen beyond the edge of a "main bulk". This talk presents an important formal class/cross-class structure and shows how it lies at the origin of these visually striking patterns. The structure is shown to permeate the spectra of deepnet features, backpropagated errors, gradients, weights, Fisher Information matrix and Hessian, whether these are considered in the context of an individual layer or the concatenation of them all. The significance of the structure is illustrated by (i) demonstrating empirically that the feature class means separate gradually from the bulk as function of depth and become increasingly more orthogonal, (ii) proposing a correction to KFAC, a well known second-order optimization algorithm for training deepnets, and (ii) proving in the context of multinomial logistic regression that the ratio of outliers to bulk in the spectrum of the Fisher information matrix is predictive of misclassification.