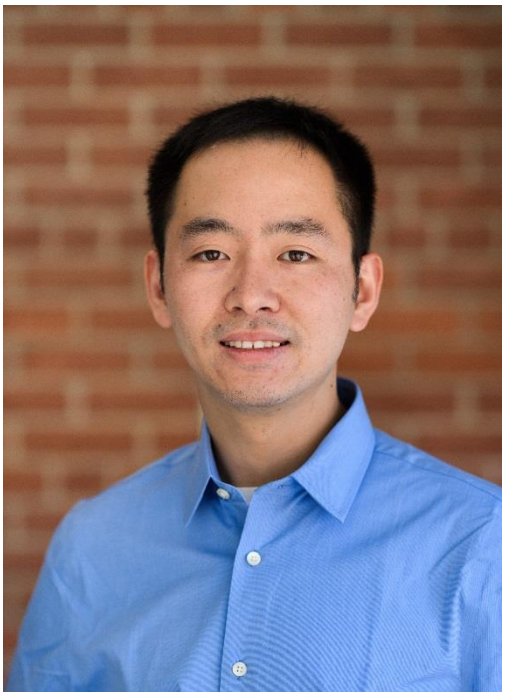
EPSTEIN INSTITUTE SEMINAR ▪ ISE 651

Random Initialization and Implicit Regularization in Nonconvex Statistical Estimation

ABSTRACT Recent years have seen a flurry of activities in designing provably efficient nonconvex procedures for solving statistical estimation / learning problems. Due to the highly nonconvex nature of the empirical loss, state-of-the-art procedures often require suitable initialization and proper regularization (e.g. trimming, regularized cost, projection) in order to guarantee fast convergence. For vanilla procedures such as gradient descent, however, prior theory is often either far from optimal or completely lacks theoretical guarantees.

This talk is concerned with a striking phenomenon arising in two nonconvex problems (i.e. phase retrieval and matrix completion): even in the absence of careful initialization, proper saddle escaping, and/or explicit regularization, gradient descent converges to the optimal solution within a logarithmic number of iterations, thus achieving near-optimal statistical and computational guarantees at once. All of this is achieved by exploiting the statistical models in analyzing optimization algorithms, via a leave-one-out approach that enables the decoupling of certain statistical dependency between the gradient descent iterates and the data. As a byproduct, for noisy matrix completion, we demonstrate that gradient descent achieves near-optimal entrywise error control. This is joint work with Cong Ma, Kaizheng Wang, Yuejie Chi, and Jianqing Fan.



Dr. Yuxin Chen
Assistant Professor
Department of Electrical Engineering
Princeton University

SPEAKER BIO – Yuxin Chen is currently an Assistant Professor in the Department of Electrical Engineering at Princeton University. Prior to joining Princeton, he was a Postdoctoral Scholar in the Department of Statistics at Stanford University, and he completed his Ph.D. in Electrical Engineering at Stanford University. His research interests include high-dimensional statistics, convex and nonconvex optimization, statistical learning, and information theory.

USC Viterbi
School of Engineering
Daniel J. Epstein Department of Industrial and Systems Engineering

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