On Excess Risk Convergence Rates of Neural Network Classifiers

Date: 15 November 2023 (Wednesday)
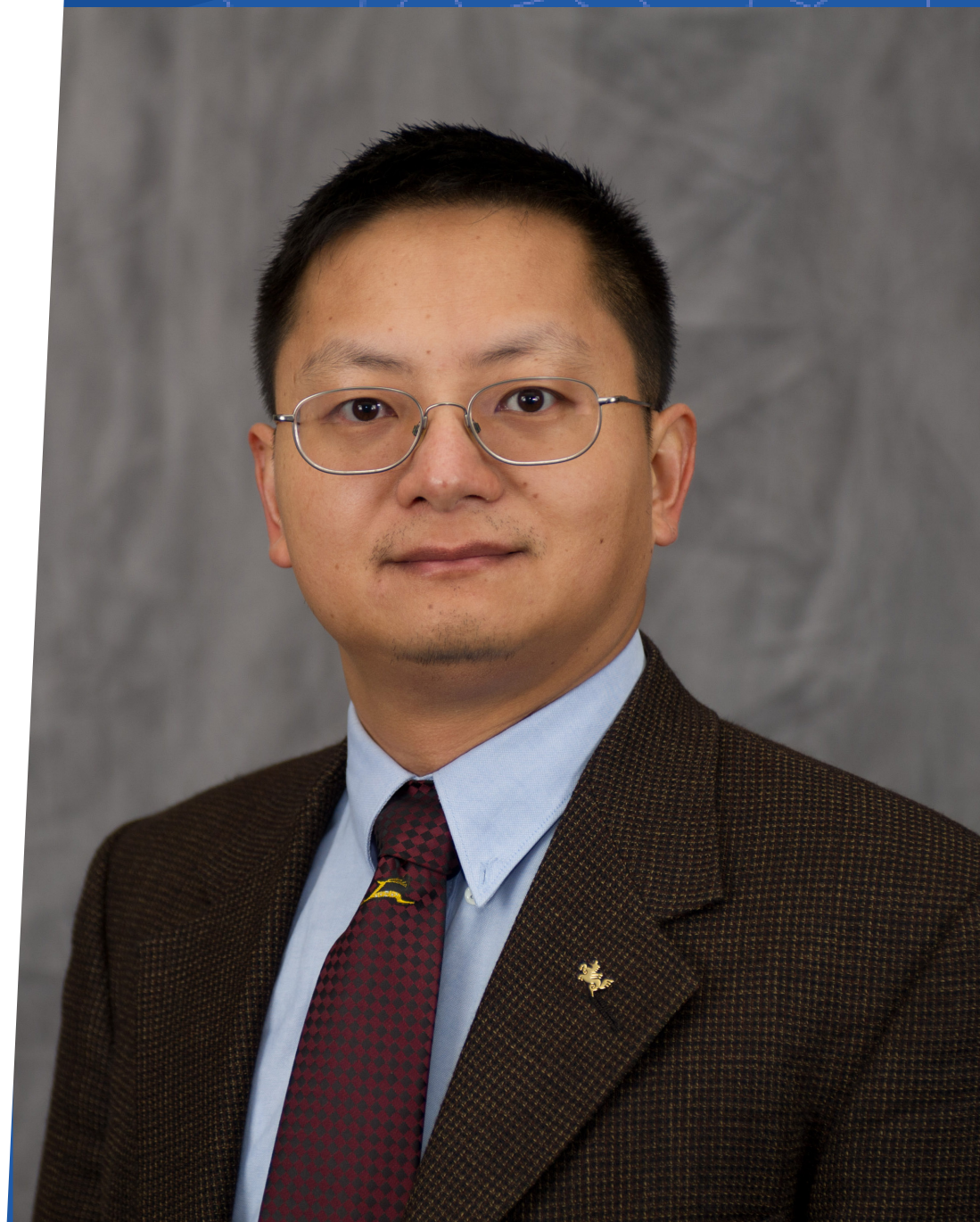
Time: 10:00am - 11:00am

Seminar Link: https://cityu.zoom.us/j/94376893313

ABSTRACT

The recent success of neural networks in pattern recognition and classification problems suggests that neural networks possess qualities distinct from other more classical classifiers, such as SVMs or boosting classifiers. This paper studies the performance of plug-in classifiers based on neural networks in a binary classification setting as measured by their excess risks. Compared to the typical settings imposed in the literature, we consider a more general scenario that resembles actual practice in two respects: first, the function class to be approximated includes the Barron functions as a proper subset, hence smooth functions, and second, the neural network classifier constructed is the minimizer of a surrogate loss instead of the 0-1 loss so that gradient descent-based numerical optimizations can be easily applied. We study the estimation and approximation properties of neural networks to obtain a dimension-free, uniform rate of convergence. In the analysis of the estimation error, we obtain a novel result that relates the approximate excess risk to the approximate excess ϕ-risk, which is of interest on its own. Finally, we show that the rate obtained is, in fact, minimax optimal up to a logarithmic factor, and the lower bound obtained shows the effect of the margin assumption in this regime.

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GUEST SPEAKER'S PROFILE

Professor Xiaoming Huo is A. Russell Chandler III Professor in the H. Milton Stewart School of Industrial and Systems Engineering at Georgia Tech and Associate Director for Research at the Institute for Data Science and Engineering. Professor Huo is also an Associate Director in the Master of Science in Analytics program. His research interests include statistical theory and computing, optimization, and data sciences. His papers appeared in top journals, and some of them are highly cited. He is a senior member of IEEE and a Fellow of ASA. He was the sole winner of the Georgia Tech Sigma Xi Young Faculty Award in 2005. His work led to an interview by Emerging Research Fronts in June 2006 in the field of Mathematics -- every two months, one paper is selected. Professor Huo received a Ph.D. degree in statistics from Stanford University, Stanford, CA, in 1999. He participated in the 30th International Mathematical Olympiad (IMO), held in Braunschweig, Germany, 1989 and received a gold prize.