



THE UNIVERSITY OF GEORGIA  
DEPARTMENT OF STATISTICS  
AND  
THE STATISTICS CLUB  
*jointly present*

# *The Bradley Lecture*

**Friday, April 29, 2022**

Botanical Garden | Garden Club Terrace Room

**Dr. Jianqing Fan**

Department of Oper Res and Fin. Eng, Princeton University

## **Stability and Approximability of Deep ReLU Networks in Statistical Learning**

This talk is on the stability of deep ReLU neural networks for nonparametric regression under the assumption that the noise has only a finite  $p$ -th moment. We unveil how the optimal rate of convergence depends on  $p$ , the degree of smoothness and the intrinsic dimension in a class of nonparametric regression functions with hierarchical composition structure when both the adaptive Huber loss and deep ReLU neural networks are used. This optimal rate of convergence cannot be obtained by the ordinary least squares but can be achieved by the Huber loss with a properly chosen parameter that adapts to the sample size, smoothness, and moment parameters. A concentration inequality for the adaptive Huber ReLU neural network estimators with allowable optimization errors is also derived. To establish a matching lower bound within the class of neural network estimators using the Huber loss, we employ a different strategy from the traditional route: constructing a deep ReLU network estimator that has a better empirical loss than the true function and the difference between these two functions furnishes a low bound. This step is related to the Huberization bias, yet more critically to the approximability of deep ReLU networks. As a result, we also contribute some new results on the approximation theory of deep ReLU neural networks. (Joint work with Yihong Gu and Wenxin Zhou)

### *• About the Speaker •*

Dr. Jianqing Fan, is a statistician, financial econometrician, and data scientist. He is Frederick L. Moore '18 Professor of Finance, Professor of Statistics, and Professor of Operations Research and Financial Engineering at the Princeton University where he chaired the department from 2012 to 2015. He is the winner of The 2000 COPSS Presidents' Award, Morningside Gold Medal for Applied Mathematics (2007), Guggenheim Fellow (2009), Pao-Lu Hsu Prize (2013), Guy Medal in Silver (2014), and Noether Senior Scholar Award (2018). He got elected to Academician from Academia Sinica in 2012.

Dr. Jianqing Fan is a joint editor of Journal of Business and Economics Statistics and an associate editor of Management Science (2018--), among others, was the co-editor(-in-chief) of the Annals of Statistics (2004-2006) and an editor of Probability Theory and Related Fields (2003-2005), Econometrical Journal (2007-2012), Journal of Econometrics (2012-2018; managing editor 2014-18), and on the editorial boards of a number of other journals, including Journal of the American Statistical Association (1996-2017), Econometrica (2010-2013), Annals of Statistics (1998-2003), Statistica Sinica (1996-2002), and Journal of Financial Econometrics (2009-2012). He was the past president of the Institute of Mathematical Statistics (2006-2009), and past president of the International Chinese Statistical Association (2008-2010).



## · *History of the Bradley Lecture* ·

The University of Georgia Department of Statistics and the Statistics Club are proud to host the 28th Annual Bradley Lecture. The event honors former faculty member Dr. Ralph A. Bradley, who was born on November 28, 1923 in Smith Falls, Ontario, Canada, and who grew up in the village of Wellington. After graduating from Queen's University in 1944 with an honors degree in mathematics and physics, he served in the Canadian Army from 1944 to 1945, and afterwards earned his Masters of Arts degree in 1946. He received his PhD in 1949 at the University of North Carolina Chapel Hill, and went on to a very distinguished career. He was founder of the Department of Statistics at Florida State University and served as its chair from 1959 to 1978. He joined UGA in 1982.

Dr. Ralph Bradley made many contributions to the field of statistics as a researcher in design of experiments, nonparametric statistics, sequential analysis and multivariate analysis. He also had an exemplary record of service to the profession of statistics as a member of ASA, IMS, ISI, as well as by serving as a president of ASA in 1981.

The Bradley Lecture provides an opportunity for UGA graduate students to interact with the speaker, who is normally an eminent statistician of their choice. After the seminar in the afternoon, the speaker gives an after-dinner presentation and often stays for the next day's spring picnic to mingle with faculty and students.

We hope you'll join us for what should be an informative and exciting event!

## · *Schedule of Events* ·

### **Friday, April 29, 2022**

**4:00pm – 4:30pm**

*Arrival*

Botanical Garden | Garden Club Terrace Room

**4:30pm – 5:30pm**

*Lecture*

Botanical Garden | Garden Club Terrace Room

**5:30pm – 6:00pm**

*Break*

Botanical Garden | Garden Club Terrace Room

**6:00pm – 8:00pm**

*Dinner and After-Dinner Talk*

Botanical Garden | Garden Club Terrace Room

### **Saturday, April 30, 2022**

**10:00am – 2:00pm**

*Bradley Spring Picnic*

Memorial Park | Picnic Shelter #1

*Registration Fee: \$25 for non-members, \$10 for members*

## · *After-Dinner Talk* ·

***Dr. Jianqing Fan***

Botanical Garden | Garden Club Terrace Room

**Can Machines Statistically Learn Finance?**

## · *Bradley Spring Picnic* ·



**Memorial Park | Picnic Shelter #1**

**Saturday, April 30, 2022 10:00am – 2:00pm**

**293 Gran Ellen Dr, Athens, GA**

Enjoy a relaxing afternoon full of food, fun and fellowship! Mingle with the guest speaker, faculty members, and graduate students while watching the students show off their outdoor grilling skills.