CityU | School of Data Science
香港城市大學
City University of Hong Kong

Nonlinear Functional Regression by Functional Deep Neural Network with Kernel Embedding

Date: 25 January 2024 (Thursday)

Time: 4:00pm - 5:00pm

Venue: Room 6-209, Lau Ming Wai Academic Building, City University of Hong Kong

ABSTRACT

With the rapid development of deep learning in various fields of science and technology, such as speech recognition, image classification, and natural language processing, recently it is also widely applied in the functional data analysis (FDA) with some empirical success. However, due to the infinite dimensional input, we need a powerful dimension reduction method for functional learning tasks, especially for the nonlinear functional regression. In this seminar, based on the idea of smooth kernel integral transformation, we propose a functional deep neural network with an efficient and fully-data-dependent dimension reduction method. The architecture of our functional net consists of a kernel embedding step: an integral transformation with a data-dependent smooth kernel; a projection step: a dimension reduction by projection with eigenfunction basis based on the embedding kernel; and finally an expressive deep ReLU neural network for the prediction. The utilization of smooth kernel embedding enables our functional net to be discretization invariant, efficient, and robust to noisy observations, capable of utilizing information in both input functions and responses data, and have a low requirement on the number of discrete points for an unimpaired generalization performance. We conduct theoretical analysis including approximation error and generalization error analysis, and numerical simulations to verify these advantages of our functional net.

Dr. Zhongjie SHI
GUEST SPEAKER'S PROFILE

Dr. Zhongjie SHI is now a Postdoc at Department of Statistics and Actuarial Science, The University of Hong Kong. His research interests include deep learning theory and functional data analysis. He received the Ph.D. degree in Data Science from City University of Hong Kong in 2022, and the B.S. degree in Computing Mathematics from City University of Hong Kong in 2018. He worked as a postdoctoral fellow at Department of Electrical Engineering in KU Leuven from 2022 to 2023.

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All are welcome