



For favour of Posting

THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

SEMINAR ON DATA SCIENCE

Theory of Deep Convolutional Neural Networks

By

Prof. Ding-Xuan ZHOU

City University of Hong Kong

Abstract

Deep learning has been widely applied and brought breakthroughs in speech recognition, computer vision, and many other domains. The involved deep neural network architectures and computational issues have been well studied in machine learning. But there lacks a theoretical foundation for understanding the modelling, approximation or generalization ability of deep learning models with network architectures. Here we are interested in deep convolutional neural networks (CNNs) with convolutional structures. The convolutional architecture gives essential differences between the deep CNNs and fully-connected deep neural networks, and the classical theory for fully-connected networks developed around 30 years ago does not apply. This talk describes a mathematical theory of deep CNNs associated with the rectified linear unit (ReLU) activation function.

In particular, we give the first proof for the universality of deep CNNs, meaning that a deep CNN can be used to approximate any continuous function to an arbitrary accuracy when the depth of the neural network is large enough. We also give explicit rates of approximation, and show that the approximation ability of deep CNNs is at least as good as that of fully-connected multi-layer neural networks for general functions, and is better for radial functions. Our quantitative estimate, given tightly in terms of the number of free parameters to be computed, verifies the efficiency of deep CNNs in dealing with big data.

Biography:

Ding-Xuan Zhou is a Chair Professor in School of Data Science and Department of Mathematics at City University of Hong Kong, serving also as Associate Dean of School of Data Science, and Director of the Liu Bie Ju Centre for Mathematical Sciences. His recent research interest is deep learning theory.

He is an Editor-in-Chief of the journals "Analysis and Application" and "Mathematical Foundations of Computing", and serves editorial boards of more than ten journals. He received a Fund for Distinguished Young Scholars from NSF of China in 2005, and was rated in 2014-2017 by Thomson Reuters/Clarivate Analytics as a Highly-cited Researcher.

Date : 18 November 2020 (Wednesday)

Time : 3:00pm – 4:20pm

Zoom Meeting : <https://hkust.zoom.us/j/98248767613> (Passcode: math6380p)

All are Welcome!