MATH-IMS Joint Applied Mathematics Colloquium Series
The Chinese University of Hong Kong

This MATH-IMS Joint Colloquium Series is organized by Center for Mathematical Artificial Intelligence (CMAI), under Department of Mathematics and Institute of Mathematical Sciences (IMS) at The Chinese University of Hong Kong. The colloquium series focuses on mathematics and applications of artificial intelligence, big data and related topics.

Date: Nov 24, 2023 (Friday)
Location and Time: LSB LT5, 10:00-11:00am (Hong Kong Time)
Zoom Link: https://cuhk.zoom.us/j/92775210812 (hybrid)

Machine learning assisted exploration for affine Deligne-Lusztig varieties
Speaker: Professor Xuhua He
The University of Hong Kong

Abstract: This talk aims to explore the applications of artificial intelligence (AI) in mathematical research. While AI has been widely used in various fields, such as natural language processing, computer vision, speech recognition, and machine translation, its application in mathematics is relatively limited. Mathematics is a highly abstract and theoretical discipline that focuses on reasoning and proof, which differs from the data-driven and pattern recognition approaches that underlie AI. Therefore, applying AI to mathematical research is a challenging task that requires innovative methods and techniques. Joint with the research team of Prof. Bin Dong from Peking University, we have developed a machine learning-assisted framework to guide the study of fundamental problems related to affine Deligne-Lusztig varieties (ADLV). ADLV is an important object of arithmetic geometry that plays a crucial role in the Shimura varieties and Langlands program. In this talk, we will discuss how to use machine learning tools to generate datasets, train models, and analyze data to discover the geometric properties of ADLVs. We will also emphasize the importance of the data generation process, including how to select meaningful subsets and appropriate feature sets. Additionally, we will present the potential of this method in accelerating pure mathematical research, leading to the discovery of new conjectures and promising research directions.

Bio: Prof. Xuhua He is currently a Chair Professor of Mathematics and New Corner Stone Investigator at HKU. He graduated from Peking University in 2001 with a bachelor's degree in mathematics, then received his PhD from MIT and worked as a postdoc fellow at the Institute for Advanced Study and State University of New York at Stony Brook from 2005-2008. He became an associated professor at HKUST in 2012 and a professor at University of Maryland from 2014-2019. In 2019, he became the Choh-Ming Li Professor of Mathematics at CUHK, before joining HKU in 2023. Prof. He's research area lies in algebraic groups, representation theory, and arithmetic geometry. He is particularly interested in questions related to (finite and affine) Weyl groups and flag varieties, and their applications to arithmetic geometry and representation theory. Among his many prestigious honours and awards, he obtained Chevalley Prize in Lie theory in 2022, got the Xplorer Prize in 2020, Morningside gold Medal of Mathematics in 2013 and was a sectional speaker of ICM in 2018. He has also supervised many outstanding students and postdocs, serving on editorial board of top journals.