



CMAI: Artificial Intelligence Colloquium Series

The Chinese University of Hong Kong

This CMAI AI Colloquium Series is organized by Centre for Mathematical Artificial Intelligence (CMAI), under Department of Mathematics at CUHK.

Date: March 26, 2024 (Tuesday)

Time: 4:00pm-5:30pm (Hong Kong Time)

Zoom Link: 992 9246 1414

Logic and Computation

Speaker: Dr. Wei Chen

Huawei Edinburgh and Cambridge research centres

Abstract: This is a series of lectures on computational logic, also known as mechanical theorem proving, and a gentle invitation into formal hardware verification. The speaker will review several computational pearls in the development of mathematical logic in past 150 years and summarise recent achievements in the practice of automating machine-aided theorem proving. The first lecture will explain natural deduction and the propositional satisfiability problem with their applications in formal hardware verification, in particular, equivalence checking and model checking. In the second lecture, the speaker will introduce the first-order resolution technique and predicate calculus. The latter is the basis of formal software verification. Recent practical achievements: normalisation, instantiation, and automatic structural induction will be explained as well. Intuitionistic logic, simply typed lambda calculus, lambda cube, and type inference will be the main topics in the third lecture. In the fourth lecture, we will move the focus to the methods and techniques in a particular industrial application: formal arithmetic verification, i.e., demonstrating that the computer arithmetic design satisfies the precision requirement. The capability of compressing and decompressing structures and simplifying computing and reasoning via exploiting structure information, in our opinion, is the vital human wisdom in mathematics and computation. In the fifth lecture, we will discuss some difficulties in the automation of theorem proving, in particular, logic abstraction and function construction. These will be our further research in next two or three years, i.e., lifting machines' capability of abstraction and construction to a higher-level, as a solid step towards human-like intelligence. Some functional programming knowledge, in particular, Haskell, will be very helpful for audience to understand these lectures.

Bio: Dr. Wei Chen. MSc from Tsinghua University and PhD from University of Nottingham, both in theoretical computer science. Wei started formally his research career in 2012 as research fellow at Munich University then at University of Edinburgh, focusing on theorem proving, model checking, type theory, inductive inference, and computer security through applying formal methods and machine learning techniques. He has joined Huawei Edinburgh and Cambridge research centres since 2019 as a senior research scientist, focusing on formal hardware verification, mathematical reasoning, and theorem proving.