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: Oct 8, 2021 (Friday)
Time: 16:00-17:00 (Hong Kong Time)
Zoom Link: https://cuhk.zoom.us/j/92775210812

Consensus-Based Interacting Particle Systems and Mean-field PDEs for Optimization and Sampling
Speaker: Professor Jose A. Carrillo
University of Oxford

Abstract: We will start by doing a quick review on consensus models for swarming. Stability of patterns in these models will be briefly discussed. Then we provide an analytical framework for investigating the efficiency of a consensus-based model for tackling global optimization problems. We justify the optimization algorithm in the mean-field sense showing the convergence to the global minimizer for a large class of functions. An efficient algorithm for large dimensional problems is introduced. Theoretical results on consensus estimates will be illustrated by numerical simulations. We then develop these ideas to propose a novel method for sampling and also optimization tasks based on a stochastic interacting particle system. We explain how this method can be used for the following two goals: (i) generating approximate samples from a given target distribution, and (ii) optimizing a given objective function. This approach is derivative-free and affine invariant, and is therefore well-suited for solving complex inverse problems, allowing (i) to sample from the Bayesian posterior and (ii) to find the maximum a posteriori estimator. We investigate the properties of this family of methods in terms of various parameter choices, both analytically and by means of numerical simulations. This talk is a summary of works in collaboration with Y.-P. Choi, O. Tse, C. Totzeck, F. Hoffmann, A. Stuart and U. Vaes.

Bio: Prof. Carrillo is currently a Professor of the Analysis of Nonlinear Partial Differential Equations and Tutorial Fellow in Applied Mathematics at University of Oxford. He was previously Chair in Applied and Numerical Analysis at Imperial College London from October 2012 till March 2020, and formerly ICREA Research Professor at the Universitat Autònoma de Barcelona during 2003-2012. Prof. Carrillo's research focuses on PDEs, the modelling based on PDEs, their mathematical analysis, numerical schemes and simulation in applications. His expertise comprises long-time asymptotics, qualitative properties and numerical schemes for nonlinear diffusion, hydrodynamic, and kinetic equations in the modelling of collective behaviour of many-body systems. Prof. Carrillo has been elected as member of the European Academy of Sciences, Section Mathematics in 2018 and SIAM Fellow Class 2019. He is currently the head of the Division of the European Academy of Sciences, Section Mathematics, has been Fellow of the Institute of Mathematics and its Applications since 2021, an invited speaker at the 2008 European Conference of Mathematics and plenary speaker at the Joint SIAM-CAIMS Annual Meeting 2020, as well as at the Joint British Mathematics Colloquium 2021.