ICTS Fluid Dynamics Seminar

Title : Beyond Propagation of Chaos: A Stochastic Algorithm for Mean Field Optimization

Speaker : Dheeraj Nagaraj (Google DeepMind, Bengaluru)

Date : Friday, 14 November 2025

Time : 11:30 AM (IST)

Abstract : Gradient flow in the 2-Wasserstein space is widely used to optimize functionals over probability distributions and is typically implemented using an interacting particle system with n particles. Analyzing these algorithms requires showing (a) that the finite-particle system converges and/or (b) that the resultant empirical distribution of the particles closely approximates the optimal distribution (i.e., propagation of chaos). However, establishing efficient sufficient conditions can be challenging, as the finite particle system may produce heavily dependent random variables.

In this work, we study the virtual particle stochastic approximation, originally introduced for Stein Variational Gradient Descent. This method can be viewed as a form of stochastic gradient descent in the Wasserstein space and can be implemented efficiently. In popular settings, we demonstrate that our algorithm's output converges to the optimal distribution under conditions similar to those for the infinite particle limit, and it produces i.i.d. samples without the need to explicitly establish propagation of chaos bounds.

Joint work with Chandan Tankala and Anant Raj

Venue : Emmy Noether Seminar Room
Zoom Link: https://icts-res-in.zoom.us/j/99947318133?pwd=jpFRpaVMIV60YEnacKVz7zpeBsczVr.1
Meeting ID: 999 4731 8133
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