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Qin Li is a professor of mathematics at University of Wisconsin-Madison. She holds an affiliation with Wisconsin Discovery Center and is a senior personnel of Institute of Foundation of Data Science housed at UW-Madison. She completed her PhD education at UW-Madison in year 2013, and worked as a von Karman instructor at Caltech till 2015. Li has received NSF Career Award in 2018, Vilas Early Career Investigator in 2017, and was provided a Simons Fellowship while visiting Cambridge in 2022. Her main research focuses lie on kinetic theory, multiscale analysis, interacting particle systems, and their applications to both physical sciences and machine learning.

Title: Speeding up gradient flows on probability measure space

Abstract:
In the past decade, there has been a significant shift in the types of mathematical objects under investigation, moving from vectors and matrices in the Euclidean spaces to functions residing in Hilbert spaces, and ultimately extending to probability measures within the probability measure space. Many questions that were originally posed in the context of linear function spaces are now being revisited in the realm of probability measures. One such question is to the efficiently find a probability measure that minimizes a given objective functional. In Euclidean space, we devised optimization techniques such as gradient descent and introduced momentum-based methods to accelerate its convergence. Now, the question arises: Can we employ analogous strategies to expedite convergence within the probability measure space? In this presentation, we provide an affirmative answer to this question. Specifically, we present a series of momentum-inspired acceleration method under the framework of Hamiltonian flow, and we prove the new class of method can achieve arbitrary high-order of convergence. This opens the door of developing methods beyond standard gradient flow.