Center for Applied Mathematical Sciences Distinguished Lecturer, Fall 2023

Eitan Tadmor

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Swarm-Based Gradient Descent Method for Non-Convex Optimization

Abstract: We discuss a novel swarm-based gradient descent (SBGD) method for non-convex optimization. The swarm consists of agents identified with positions, x, and masses, m. There are three key aspects to the SBGD dynamics.
(i) communication: persistent transition of mass from high to lower ground; (ii) marching: mass-dependent marching in directions randomly aligned with gradient descent; and (iii) time stepping protocol which decreases with m.

The interplay between positions and masses leads to dynamic distinction between `leaders' and `explorers': heavier agents lead the swarm near local minima with small time steps; lighter agents use larger time steps to explore the landscape in search of improved global minimum, by reducing the overall 'loss' of the swarm.

Convergence analysis and numerical simulations demonstrate the effectiveness of SBGD method as a global optimizer.

Monday, November 13, 2023

Kaprielian Hall

Tea: 3:00 p.m.
KAP 410

Lecture: 3:30 p.m.
KAP 414

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Eitan Tadmor is a distinguished university professor at the University of Maryland, College Park, known for his contributions to the theory and computation of PDEs with diverse applications to shock wave, kinetic transport, incompressible flows, image processing, and self-organized collective dynamics.

Tadmor has given numerous invited lectures, including an invited lecture at the 2002 International Congress of Mathematicians (ICM) (Beijing), plenary addresses in the international conferences on hyperbolic problems (Zürich 1990 and Beijing 1998), the 2008 Foundations of Computational Mathematics meeting in Hong Kong, and the SIAM invited address at the 2014 Joint Mathematical meeting in Baltimore.

In 2012 he was in the inaugural class of Fellows of the American Mathematical Society. In 2015 he was awarded the SIAM-ETH Henrici prize. He was named a SIAM Fellow in the 2021 class of fellows. In 2022 he was awarded the Norbert Wiener Prize in Applied Mathematics and he delivered the 2022 AMS Josiah Willard Gibbs Lectureship.

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