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Inverse Problems Seminar

An inverse problem in mean field game from partial boundary measurement

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Abstract

In this work, we consider a novel inverse problem in mean-field games (MFG). We aim to recover the MFG model parameters that govern the underlying interactions among the population based on a limited set of noisy partial observations of the population dynamics under the limited aperture. Due to its severe ill-posedness, obtaining a good quality reconstruction is very difficult. Nonetheless, it is vital to recover the model parameters stably and efficiently in order to uncover the underlying causes for population dynamics for practical needs.

Our work focuses on the simultaneous recovery of running cost and interaction energy in the MFG equations from a finite number of boundary measurements of population profile and boundary movement. To achieve this goal, we formalize the inverse problem as a constrained optimization problem of a least squares residual functional under suitable norms with L1 regularization. We then develop a fast and robust operator splitting algorithm to solve the optimization using techniques including harmonic extensions, three-operator splitting scheme, and primal-dual hybrid gradient method. Numerical experiments illustrate the effectiveness and robustness of the algorithm.

A future direction will be to develop a technique for algorithmic speedup for inverse problems in higher dimensions with the help of bilevel optimization, machine learning techniques and neural network architecture.

This is a joint work with Samy W. Fung (Colorado School of Mines), Siting Liu (UCLA), Levon Nurbekyan (Emory University), and Stanley J. Osher (UCLA)

Date:	August 9, 2023 (Wednesday)
Time:	3:30pm – 4:30pm (Hong Kong Time)
Venue:	LSB 222, CUHK

All are Welcome