Dear Colleagues!

Institute of Mathematics of the University of Georgia is pleased to invite you to the Online Tbilisi Analysis & PDE Seminar. The seminar is held bi-weekly on Tuesdays at 20 : 00 local time in Tbilisi.

Talk on January 23, 2024

Speaker: Prof. **Reinhold Schneider**, Technical University of Berlin;
https://scholar.google.de/citations?user=3CmBwQcAAAAJ&hl=de

"Numerical Solution of high-dimensional Hamilton Jacobi Bellmann (HJB) Equations, Mean Field Games and Compositional Tensor Networks"

Abstract: The partial differential equations of Mean Field Games introduced by Lasry & Lions describe the solution of feedback optimal control problems as well as optimal transport problems. These equations play a fundamental role in optimal control, optimal transport, computational finance and machine learning. Therefore solving these kind of equations seems to be of outmost importance in future science and technology. However for solving these non-linear and high dimensional equations one has to deal with two major difficulties, namely 1) the curse of dimensions and secondly, a 2) possible lack of regularity. Here we focus only on the first issue. (The second problem can be relaxed by adding randomness, which is always present in practise.) We consider Potential Mean Field Games and are focusing on the (deterministic/stochastic) HJB. In order to compute semi-global solutions, we consider control affine dynamical systems and quadratic cost for the control as a prototype example.We follow an Lagrangian approach perspective, and a rcent approximation concept of compositional sparsity. In contrast to our earlier published semi-Lagrangian approaches, we describe a direct minimization of the total averaged cost over all initial values, first introduced by Kunisch & Walter (2021). Approximately, the true total cost is replaced by averaging over sampled initial values, where the sought approximate value function is parametrized in tensor form. Compositional sparsity has been inspired by Deep Neural Networks. The individual neural network layers are replaced by tree-based tensor networks (HT/TT) or sparse polynomials, which improves the stability for a numerical treatment of the optimization problem.

Related literature: *A machine learning framework for solving high-dimensional mean field game and mean field control problems*, Ruthotto, Osher, Li, Nurbekyan, Fung - Proceedings of the National Academy of Sciences, 2020

Date: January 23, 2024
Time: 20 : 00 local time in Tbilisi;
(**Compare to your local time**: https://www.timeanddate.com/worldclock/georgia/tbilisi);

How to join: The seminar is organized on the **Cisco Webex Meetings**. If you are already registered, you do not need to register again. Otherwise, to join the seminar please send an e-mail to **seminarim@ug.edu.ge** or register here:

https://forms.gle/xfQJ9fg1uqe7CrZw6

You will then receive further information.

WEB of Seminar: https://www.ug.edu.ge/en/tbilisi-analysis-and-pde-seminars

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