Workshop on Stochastic (Partial) Differential Equations and its Applications

November 02-03, 2019

Beijing Normal University

Schedule

Address: **Lecture hall 1223, rear main building, Beijing Normal University**

	November 2		**November 3**
Chairman	**Feng-Yu Wang**	**Chairman**	**Yutao Ma**
09:00–09:45	**Zhao Dong**	09:00–09:45	**Dong Han**
09:45–10:30	**Tusheng Zhang**	09:45–10:30	**Xiaohong Lan**
10:30–10:50	**Tea Break**	10:30–10:50	**Tea Break**
10:50–11:35	**Lijun Bo**	10:50–11:35	**Dangzheng Liu**
11:45–	**Lunch**	11:45–	**Lunch**
Chairman	**Zhao Dong**		
14:30–15:15	**Huaizhong Zhao**		
15:15–16:00	**Yuan Liu**		
16:00–16:20	**Tea Break**		
Chairman	**Huaizhong Zhao**		
16:20–17:05	**Ran Wang**		
17:05–17:50	**Jianliang Zhai**		
18:00–	**Dinner**		

Abstract

Relaxed Control and Gamma-Convergence of Stochastic Optimization Problem with Mean-Field

Lijun Bo

Abstract: We study the relaxed control and Gamma-convergence of a class of mean field stochastic optimization problems arising from training deep residual neural networks. We consider their sample and continuous-time idealization, and establish existence of optimal relaxed solutions to such a class of mean field {optimization} problems when the training sample is finite. The core of our paper is to show that, when the sample capacity is large, the minimizer of the sampled relaxed optimization problem converges to the minimizer of the limiting relaxed optimization problem. To prove the Gamma-convergence of sampled objective functionals, we establish general convergence properties of empirical measure-valued processes arising from the finite sample controlled model. Then, we connect the limit of the large sampled objective functional to the unique solution of a nonlinear Fokker-Planck-Kolmogorov (FPK) equation in a random environment. We prove the uniqueness of solutions to the FPK equation in the trajectory sense.

Large deviation principles for first-order scalar conservation laws with stochastic forcing

Dong Zhao

Abstract: In this paper, we established the Freidlin-Wentzell type large deviation principles for first-order scalar conservation laws perturbed by small multiplicative noise. Due to the lack of the viscous terms in the stochastic equations, the kinetic solution to the Cauchy problem for these first-order conservation laws is studied. Then, based on the well-posedness of the kinetic solutions, we show that the large deviations hold by utilizing the weak convergence approach. This is joint work with Wu Jiang Lun, Zhang Rang Rang, Zhang Tu sheng.

On Optimal Stopping Time for Change-Point Detection in General Dependent Observation Sequences

Dong Han

Abstract: We develop a method to construct the optimal stopping time for monitoring the changes in the distribution of finite observation sequences with a general dependence structure. This method allows us to prove that different optimal stopping time can be constructed for different performance measures of detection delay times. We also provide a formula to calculate the value of the generalized out-of-control average run length for every optimal stopping time. Moreover, we show that there is an equivalent optimal control limit which does not depend on the test statistic directly when the post-change conditional densities (probabilities) of the observation sequences do not depend on the change-point.

Regularity properties of the solution to a stochastic heat equation driven by a fractional Gaussian noise on S2

Xiaohong Lan

Abstract: We study the linear stochastic heat equation driven by an additive infinite dimensional fractional Brownian noise on the unit sphere S2. The existence and uniqueness of its solution in certain Sobolev space is investigated and sample path regularity properties are established. In particular, the exact uniform modulus of continuity of the solution in time/spatial variable is derived.

Phase transition for infinite products of large non-Hermitian random matrices

Dangzheng Liu

Abstract: We consider local eigenvalue statistics for M products of independent N×N non-Hermitian random matrices as both M and N go to infinity. When the ratio M/N changes from 0 to ∞, we prove that the eigenvalues undergo a transition from Ginibre statistics to Gaussian. Especially at the critical scaling $M/N \to \gamma \in (0, \infty)$, we observe a phase transition phenomenon.

The Poincaré inequality and quadratic transportation-variance inequality

Yuan Liu

Abstract: It is known that the Poincaré inequality is equivalent to the quadratic transportation-variance inequality. We give two alternative proofs to this fact and the same arguments lead to more characterizations of the Poincaré inequality. As a by-product, we obtain the equivalence between the logarithmic Sobolev inequality and strict contraction of heat flow in Wasserstein space provided that the Bakry-Émery curvature has a lower bound (note that the control constants here may depend on the curvature bound).

A decomposition of the stochastic convolution with rough dependence in space and its application

Ran Wang

Abstract: Let $u = \{u(t,x); (t,x) \in R_+ \times R\}$ be the solution to a linear stochastic heat equation driven by a Gaussian noise, which is a Brwonian motion in time and a fractional Browinian motion with Hurst parameter H $\in$ (1/4,1/2). For any given x 2 R, we show a decomposition of the stochastic process $t \to u(t,x)$ as the sum of a fractional Browinian motion with Hurst parameter H/2 plus a stochastic process with absolutely continuous trajectories. Some applications of this decomposition are discussed.

2D Stochastic Chemotaxis-Navier-Stokes System

Jianliang Zhai

Abstract: We establish the existence and uniqueness of both mild(/variational) solutions and weak (in the sense of PDE) solutions of coupled system of 2D stochastic Chemotaxis-Navier-Stokes equations. The mild/variational solution is obtained through introducing a new method of cutting off the stochastic system and using a fixed point argument in a carefully constructed Banach space. To get the weak

solution we first prove the existence of a martingale weak solution and then we show that the pathwise uniqueness holds for the martingale solution.This talk is based on a joint work with Prof.Tusheng Zhang.

Stochastic reaction diffusion equations with logarithmic nonlinearity

Tusheng Zhang

Abstract: In this talk, I will present a recent result on the existence and uniqueness of solutions to stochastic reaction diffusion equations with logarithmic nonlinearity on a bounded domain in the setting of square integrable functions. This is a joint work with Shijie Shang.

Huaizhong Zhao

TBA