Universität Stuttgart

Einladung zum wissenschaftlichen Kolloquium am Fachbereich Mathematik

Donnerstag, 07.11.2024
Universität Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart
Raum 7.122

09:00 Uhr
Dr. Dennis Schroers, Universität Bonn
Titel: *"Functional Data Analysis for Stochastic Evolution Equations"*

Abstract:
Space-time data often exhibit turbulent behavior, characterized by a high irregularity in time. As a consequence, traditional Functional Data Analysis (FDA) methods, which typically rely on smoothing techniques—including functional principal component analysis—struggle to adequately address respective challenges.
This talk presents a research project aimed at adapting FDA methodologies for the analysis of stochastic evolution equations, which serve as natural frameworks for modeling turbulent space-time phenomena. The proposed approach facilitates spatial smoothing while addressing temporal irregularities through high-frequency statistical techniques for rough stochastic processes. Key theoretical findings from the project and their practical applications are discussed.

Referenzen:
[1] Schroers, D., Dynamically Consistent Analysis of Realized Covariations in Term Structure Models, available on arxiv:2406.19412, 2024.
[2] Schroers, D., Robust Functional Data Analysis for Stochastic Evolution Equations in Infinite Dimensions, available on arxiv:2401.16286, 2024.
[3] Benth, F.E., Schroers, D. and Veraart, A.E.D., A feasible central limit theorem for realised covariation of SPDEs in the context of functional data, Annals of Applied Probabiliy 34(2) (2024) 2208–2242.
[4] Benth, F.E., Schroers, D. and Veraart, A.E.D., A weak law of large numbers for realised covariation in a Hilbert space setting, Stochastic Processes and their Applications 145 (2022) 241-268.

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11:30 Uhr
Dr. Lukas Trottner, Universität Birmingham
Title: "*Snapshots of statistics for SPDEs, optimal control and generative models*"

Abstract:
In this talk I give a short overview of recent research projects that contribute to the development of a broad mathematical toolbox for the statistical analysis of complex stochastic systems originating in applied probability and machine learning. Concretely, I will first demonstrate how nonparametric statistical methods can be employed to develop data-driven solutions for singular optimal control problems in the presence of model uncertainty. Our statistical techniques build on the ergodic properties of reflected diffusion processes, which we also use for generative modelling in the second part of the talk. Here, I will present our recent findings on minimax optimality of denoising reflected diffusion models that exploit the time-reversal of a reflected diffusion to generate new data from an unknown target distribution. The infinitesimal dynamics of the forward model that we employ for this purpose are described by a weighted Laplacian, which is also at the heart of the third statistical problem that I will discuss, albeit with a significant twist: here, a weighted Laplacian with broken diffusivity determines the dynamics of a stochastic heat equation driven by space-time white noise. The presence of a jump in the diffusivity naturally leads us to the statistical identification problem of its spatial location, which translates into a change estimation problem for SPDEs.

14:00 Uhr
Dr. Nils Sturma, TU München
Titel: "*Identifiability and Statistical Inference in Latent Variable Modeling*"

Abstract:
Many applications require flexible multivariate models that allow for latent variables. Examples are given by factor analysis models, graphical models for inferring causal relationships, and models used in machine learning to learn latent representations. Since latent variable models are families of marginal distributions, they generally feature a complicated geometry that may lead to identifiability issues and failures of standard inference methods. For example, the models often contain irregular points like algebraic singularities, where well-known methods such as the likelihood ratio or Wald test are no longer valid. In this talk, I will present new results on parameter identifiability and goodness-of-fit testing for irregular models, with a focus on factor analysis models.