41st Finnish Summer School on Probability and Statistics, 2023, Lammi

	Monday 22.5	Tuesday 23.5	Wednesday 24.5	Thursday 25.5	Friday 26.5
08:00 - 09:00		08:00 – 09:00 breakfast	08:00 – 09:00 breakfast	08:00 – 09:00 breakfast	08:00 – 09:00 breakfast
09:00 - 10:00		09:15 – 10:00 Diaconis	09:15 – 10:00 Acciaio	09:15 – 10:00 Diaconis	09:15 – 10:00 Mishura
10:00 - 11:00		10:15 – 11:00 Diaconis	10:15 – 11:00 Acciaio	10:15 – 11:00 Diaconis	10:15 – 11:00 Mishura
11:00 - 12:00		11:15 – 12:00 Acciaio	11:15 – 12:00 Acciaio	11:10 – 11:35 Kailas 11:35 – 12:00 Corenflos	11:10 – 11:35 Tybl 11:35 – 12:00 Maleki Almani
12:00 - 13:00	12:00 – 12:50 lunch 12:50 – 13:00 opening	12:00 – 13:00 lunch	12:00 – 13:00 lunch	12:00 – 13:00 lunch	12:00 – 13:00 lunch
13:00 - 14:00	13:00 – 14:30 Holmes	13:45 – 14:30 Acciaio	13:45 – 14:30 Mishura	13:45 – 14:30 Mishura	
14:00 - 15:00	14:30 – 15:00 coffee	14:30 – 15:00 coffee	14:30 – 15:00 coffee	14:30 – 15:00 coffee	
15:00 - 16:00	15:00 – 15:45 Diaconis	15:00 – 15:45 Acciaio	15:00 – 15:45 Mishura	15:00 – 15:45 Mishura	
16:00 - 17:00	16:00 – 16:45 Diaconis	16:00 – 19:00 sauna by the lake (ladies first)	16:00 – 16:30 Aro 16:30 – 17:00 Deitmar	16:00 – 16:30 Brutsche 16:30 – 17:00 František	
	17:00 – 18:00 dinner		17:00 – 18:00 dinner	17:00 – 18:00 dinner	
		19:00 – 21:00 Summer school "gala" dinner			
	20:00 – 23:00 sauna by the lake (ladies first)		20:00 – 23:00 sauna by the lake (ladies first)	20:00 – 23:00 sauna by the lake (ladies first)	

1. Distinguished Guest Lecture

Statistics and Geometry for Biological Systems

Susan Holmes

Stanford

Abstract Distances are an essential component of modern multivariate statistics and bioinformatics. One can do statistics on complex heterogeneous objects such as trees, networks, tensors, shapes and images. However geometry is not enough as the real data are never uniformly distributed on latent manifolds but occur with varying densities which are hard to capture when the data are sparse. Using prior information one can incorporate data and construct posterior distributions along nonlinear dimensions and provide meaningful approximations to complex data even in non-Euclidean settings.I will provide examples of using both mathematical and computational tools to understand trajectories followed by the human microbiome and even an understanding of how food ingredients are shared across the world.This contains joint work with my past lab members: Lan Huong Nguyen, Elisabeth Purdom, Christof Seiler, Nina Miolane, Claire Donnat, Kris Sankaran and Laura Symul.

2. Minicourses

Stochastic optimal transport and applications in mathematical finance

Beatrice Acciaio

ETH Zürich

The Markov Chain Monte Carlo Revolution : Recent Progress

Persi Diaconis

Stanford

Abstract Markov chain simulation methods are a mainstay of computational statistics. Do they really work? It's harder to answer than one might think! I'll review some real scandals and delineate some standard ways of approaching the question–From proving theorems through convergence diagnostics, along with their strengths and weaknesses. One highlight will be a little known method of making inferences when you can't prove your chain has converged or even if it's connected. This is the approach of Besag-Clifford along with many more modern bells and whistles. Of course, it has strengths and weaknesses too. There is a lot to think about, but many people HAVE been thinking.

Standard and fractional stochastic differential equations of CIR and CKLS type: properties of solutions, reflection and statistical inference

Yuliya Mishura

Taras Shevchenko National University of Kyiv

Abstract We shall start with Cox-Ingersoll-Ross equations and investigate the properties of solutions depending of the number of degrees of freedom. Then it will be demonstrated how the change of degrees of freedom stimulates appearance of the reflection processes. Then the same questions will be studied for fractional CIR and CKLS processes and moreover, for the solutions of SDEs with Hölder noise of any Hölder order. Statistical parameter estimators for these models will be constructed.

3. Contributed talks

Stochastic Quantization: The Study of Quantum Mechanics Through Stochastic Tools

Antti Aro

University of Helsinki

Abstract The most notorious aspect of quantum mechanics is that we can only ever calculate probability distributions. Yet despite of this quantum mechanics is usually formulated using mathematics of

waves rather than mathematics of probabilities. In this talk I briefly explain how stochastic equations can be used to replace wave equations in the study of quantum mechanics. I will also explore what these different mathematical formulations might mean for the underlying physics and why waves ultimately became the mainstream approach.

Trace Moments of the Sample Covariance Matrix with Graph-Coloring

Ben Deitmar

University of Freiburg

Abstract We derive explicit approximations for the trace moments of sample covariance matrices, which allow for precise descriptions of the covariance structure of the limiting Gaussian process in spectral CLTs. This is done by counting Euler-Tours through two-colored graphs by reducing them to bipartite trees and we prove the methods to also be applicable when enumerating Euler-tours contributing to lower orders than are needed for spectral CLTs. The formulas gained for mean and covariance of trace moments yield the structure of the limiting Gaussian process defined in Theorem 2 of [2]. For the case of Gaussian entries, such explicit expressions were already calculated by Bai and Silverstein in [1]. While Anderson and Zeitouni in [3] give a very general spectral CLT for sample covariance matrices, they restrict themselves to the case where $\frac{p}{n}$ converges to zero (p denoting the dimension of the data points and n the number of data points). Our approximations of the trace moments also hold in the case where $\frac{p}{n}$ converges to some constant greater zero.

[1] Z. D. Bai and Jack W. Silverstein, *CLT for linear spectral statistics of large-dimensional sample covariance matrices*, Ann. Probab. **32** (2004), no. 1A, 553–605, DOI 10.1214/aop/1078415845. MR2040792

[2] Jamal Najim and Jianfeng Yao, *Gaussian fluctuations for linear spectral statistics of large random covariance matrices*, Ann. Appl. Probab. **26** (2016), no. 3, 1837–1887, DOI 10.1214/15-AAP1135. MR3513608

[3] Greg W. Anderson and Ofer Zeitouni, *A CLT for regularized sample covariance matrices*, Ann. Statist. **36** (2008), no. 6, 2553–2576, DOI 10.1214/07-AOS503. MR2485007

Auxiliary samplers for state space models OR Debiasing piecewise deterministic Markov process samplers by couplings.

Adrien Corenflos

Aalto University

Sharp adaptive similarity testing with pathwise stability for ergodic diffusions

Johannes Brutsche

University of Freiburg

Abstract Within the nonparametric diffusion model, we develop a multiple test to infer about similarity of an unknown drift b to some reference drift b_0: At prescribed significance, we simultaneously identify those regions where violation from similarity occurs, without a priori knowledge of their number, size and location. This test is shown to be minimax-optimal and adaptive. At the same time, the procedure is robust under small deviation from Brownian motion as the driving noise process. A detailed investigation for fractional driving noise, which is neither a semimartingale nor a Markov process, is provided for Hurst indices close to the Brownian motion case.

Stochastic sewing with Besov regularity

Hendrych František

Charles University

Abstract

Under various conditions, sewing lemmas provide convergence of the Riemann-type sum $\sum_{[s,t]} \Xi_{s,t}$ for a given two-parametric map Ξ as the mesh size of the considered partitions tends to zero. This talk will present a stochastic sewing lemma for two-parameter processes whose increments, when viewed as functions with values in $L^m(\Omega; \mathbb{V})$ for $m \geq 2$ and a real separable Banach space $\mathbb{V}$ with a non-trivial martingale type, are of Besov regularity. The contribution is two-fold: First, the stochastic sewing lemma of Lê [Electron. J. Probab. 25(38): 1–55 (2020)] is generalized for processes whose increments belong to a Besov and not necessarily Hölder space. Second, the assumptions of the Besov sewing lemma of Friz et al. [J. Differ. Equ. 339(4): 152–231 (2022)] can be relaxed if stochastics is incorporated in the sewing from the beginning.

Online mass matrix adaptation for Hamiltonian Monte Carlo

Miika Kailas

University of Jyväskylä

Abstract We consider adaptive Markov Chain Monte Carlo methods within the Hamiltonian Monte Carlo (HMC) sampler and its dynamic variant, the No U-Turn Sampler (NUTS). In particular we study strategies for full-rank mass matrix adaptation and make two primary contributions. First, we study regularization strategies for online estimates relating to full-rank mass matrix adaptation in HMC and variants. Second and more importantly, we propose a novel adaptation target for the mass matrix. Contrasting with the usual choice of choosing the mass matrix as the inverse of (an estimate of) the covariance matrix of the target distribution, a global quantity, our alternative proposal is instead an averag e over local geometric quantities relating to the stability of discretized Hamiltonian dynamics. The proposed target and its estimators are computationally cheap and simple to implement, and our empirical studies show that the proposed adaptation strategies are applicable to challenging problems in hundreds of dimensions.

Parameter Estimation of mmfBm and mmfOU processes

Hamidreza Maleki Almani

University of Vaasa

Stochastic Approximation Procedures for Lévy-driven SDEs

Ondrej Tybl

Charles University

Abstract We consider a continuous-time Robbins-Monro type stochastic approximation procedure for a system described by a (multidimensional) stochastic differential equation driven by a general Levy process and we find sufficient conditions for its convergence in terms of Lyapunov functions. Whilst the jump part of the noise may spoil convergence to the root of the drift in some cases we show that by a suitable choice of noise coefficients we obtain convergence under hypotheses on the drift weaker than those used in the diffusion case or convergence to a selected root in the case of multiple roots of the drift.

4. Participation and Accommodation fees

The participation fee (30 €) is to be paid on location in cash.

The accommodation fee depends on the number of nights the participant is staying and the type of room. The participants who have been awarded on their request a FDNSS-travel grant from the summer school organization do not need to pay the accommodation fee.

You are also very welcome to bring your family, don't need to pay for children under 4 years, and 4-10 old children years pay half of the lodging price.

The participants who are visiting the summer school for the day and do not need accommodation, can pay on place for their lunch or dinner directly to the biological station cantine.

The accommodation fee for each night is

- 82 € in single room with WC and shower
- 73 € in single room
- 64 € in double room with WC and shower
- 59,50 € in double room

which includes also breakfast, lunch, coffee and dinner (the summer school "gala"-dinner on Tuesday is sponsored).

Master and Bachelor students from Finnish universities are getting discounted undergraduate rates for accommodation and lodging, and they should pay the reduced fees directly to the Lammi biological station cashier showing a valid student card. Those getting support from FDNSS will be reimbursed of these expenses (keep the receipt).

The accommodation fee (depending on the number of nights and type of room) can be paid by the participants or their supporting institutions by bank transfer to the University of Helsinki, with the following details:

Bank account IBAN: FI58 5000 0120 3778 32
SWIFT (BIC): OKOYFIHH
Recipient: Helsingin Yliopisto
Payment: First-name Family-name 41st Probability Summer School
Reference Number: H516/4706533
Amount: ? € × number of nights

Please don't forget the reference number!

4.1. Attending the Summer School remotely.

Some lectures will be recorded and broadcasted online (Persi Diaconis lectures are excluded), the webinar link is `https://helsinki.zoom.us/j/64901045322`

4.2. Recommendations on dealing with the Covid epidemic.

We follow the guidelines of our host institution, the University of Helsinki: Coronavirus situation at the University of Helsinki. There are no restrictions anymore, please be sure to practise careful hand and coughing hygiene.

5. Useful Information

VENUE:

Lammi biological station Pääjärventie 320
16900 Lammi, Finland
phone +358-(0)9 191 40733
fax +358-(0)9 191 40746

The nearest towns are Hämeenlinna (about 45 km) and Lahti (about 40 km), from which there are frequent bus connections to Lammi, see matkahuolto, onnibus. When you reach the bus stop in Lammi, please feel free to call Dario (the organizer) at the phone numbers +358503754069 , +358294151407, so that hopefully we can pick you up by car from the nearest bus-stop (Kirkkokallio).

Wi-Fi connection at Helsinki University facilities two Wi-Fi networks are available, eduroam and HelsinkiUni Guest with password *uniguest*

Free time activities The biological research station is surrounded by forest and it is next to a lake. Many activities are possible for relaxing during free time, cycling, rowing , swimming in the lake (bring your swim suit!), fishing, sauna, walking / jogging in the forest, table-tennis, and there is also a volleyball court and a frisbee-golf course.

Let's hope that we will have nice summer weather, you can check the weather forecast here.

Welcome to Lammi !

6. Participants

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