THE 27TH CONFERENCE OF THE ROMANIAN SOCIETY OF PROBABILITY AND STATISTICS

24-25 APRIL 2026

Babeș-Bolyai University
Faculty of Mathematics and Computer Science
1 Mihail Kogălniceanu
Cluj-Napoca, Romania

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SCHEDULE

SOCIETATEA DE PROBABILITĂȚI ȘI STATISTICĂ DIN ROMÂNIA

DAY 1 - PLENARY TALKS

Friday, April 24

Room: Emil Stoicovici Amphiteatre (ground floor)

8:30 – 9:00 Registration

9:00 – 9:15 Opening

Chair: Ionel Popescu

9:20 – 10:00 Dan Crișan

Imperial College London

On the uniqueness of the solution of the filtering problem for general signal and observation processes

10:00 – 10:40 Alex Karagrigoriou

University of Piraeus

On the Predictive Performance of Markov Chain Grey Models

10:40 – 11:10 Coffee break

Chair: Dan Crișan

11:10-11:50 Sophie Dabo-Niang

University of Lille

Bridging Nonparametric Statistics and Functional Data Analysis

11:50 – 12:30 Arnaud Debussche

École Normale Supérieure de Rennes

Law of large numbers for stochastic multiscale spatial gene networks

12:30-13:10 Ilya Chevyrev

SISSA (Scuola Internazionale Superiore di Studi Avanzati)

Large scale problems in singular stochastic PDEs

13:10-14:30 Lunch

14:30-15:30 SPSR General Meeting

SCHEDULE

SOCIETATEA DE PROBABILITĂȚI ȘI STATISTICĂ DIN ROMÂNIA

DAY 1 - STATISTICS SESSION

Friday, April 24

Room: Emil Stoicovici Amphiteatre (ground floor)

Chair: Valentin Patilea

15:30-15:50 Ionuț Bebu
The George Washington University
A Grant Proposal in the Life of a Biostatistician

15:50-16:10 Andreas Makrides
University of the Aegean
Temporal Interaction Patterns in Rare Events: A Multi Component Probabilistic View

16:10-16:30 Manuela-Simona Cojocea
University of Bucharest
Statistical Inference in Probability Coordinates via Kolmogorov Expectations

16:30-17:00 Coffee break

Chair: Vlad Barbu

17:00-17:20 Radu Craiu
University of Toronto
Bayesian nonparametric mixtures of Archimedean copulas

17:20-17:40 Salim Bouzebda
Université de Technologie de Compiègne
M-processes and their applications in change-points

17:40-18:00 Petre Caraiani
Bucharest University of Economic Studies
Investor Sentiment and Bubbles

19:00 Conference dinner

SCHEDULE

SOCIETATEA DE PROBABILITĂȚI
ȘI STATISTICĂ DIN ROMÂNIA

DAY 1 - PROBABILITY SESSION

Friday, April 24

Room: Farkas Gyula (2nd floor)

Chair: Iulian Cîmpean

15:30-15:50 Oana Lupașcu-Stamate
ISMMA
Multiple-fragmentation stochastic processes driven by a spatial flow

15:50-16:10 Alexandru Hening
Texas A&M University
Invariant probability measures of ecological systems

16:10-16:30 Vasile Stănciulescu
The National Institute of Economic Research of The Romanian Academy
The National Science and Technology University Politehnica of Bucharest
Numerical solution of the Neumann problem for linear elliptic PDEs via numerical solution of the Dirichlet problem for linear elliptic PDEs by a probabilistic approach

16:30-17:00 Coffee break

Chair: Hannelore Lisei

17:00-17:20 Mario Lefebvre
Polytechnique Montréal
Optimization problems for a queueing system with an infinite number of servers

17:20-17:40 Iulian Cîmpean
University of Bucharest & IMAR
Extended Walk-on-Spheres algorithm for linear and nonlinear elliptic PDEs

17:40-18:00 Alexandra Andriciuc
University of Bucharest & IMAR
Perspectives on Particle Swarm Optimization

19:00 Conference dinner

SCHEDULE

SOCIETATEA DE PROBABILITĂŢI ŞI STATISTICĂ DIN ROMÂNIA

DAY 2 - PLENARY TALKS 1

Saturday, April 25

Room: Emil Stoicovici Amphiteatre (ground floor)

Chair: Radu Craiu

9:00-9:40 Ana-Maria Staicu
North Carolina State University
Longitudinal Functional Data Methods for Emerging Repeated Measurements

9:40-10:20 Dan Nicolae
University of Chicago
Statistical genomics challenges in light of AI

10:20-11:00 Antoine Lejay
Inria & IECL, France
Estimation of the parameter of the Skew Brownian motion

11:00 – 11:30 Coffee break

Chair: Eugen Pircalabelu

11:30-12:10 Spiros Dafnis
University of the Aegean
New families of continuous univariate distributions

12:10-12:50 Erika Hausenblas
Montanuniversität Leoben
The stochastic Keller-Segel model

12:50-14:30 Lunch

Chair: Oana Lupașcu-Stamate

14:30 – 15:10 Eugen Pircalabelu
UC Louvain
High-dimenisonal model averaging

SCHEDULE

SOCIETATEA DE PROBABILITĂȚI ȘI STATISTICĂ DIN ROMÂNIA

DAY 2 - STATISTICS SESSION

Saturday, April 25

Room: Farkas Gyula (2nd floor)

Chair: Ionuț Bebu

15:20-15:40 Florentina Suter

University of Bucharest and "Gheorghe Mihoc – Caius Iacob" Institute of Mathematical Statistics and Applied Mathematics

Residual Entropies and Orderings in Stochastic Systems

15:40-16:00 Vlad Barbu

LMRS, University of Rouen-Normandy, France & Centre for Demographic Research "Vladimir Trebici", "Costin C. Kiritescu" National Institute of Economic Research of Romanian Academy

Drifting Hidden Markov Models: Modeling and Estimation

16:00-16:20 Iuliana Iatan

Department of Mathematics and Informatics, Technical University of Civil Engineering Bucharest

Bayesian Analysis in the Gaussian Case

16:20-16:50 Coffee break

SCHEDULE

SOCIETATEA DE PROBABILITĂȚI ȘI STATISTICĂ DIN ROMÂNIA

DAY 2 - PROBABILITY SESSION

Saturday, April 25

Room: Emil Stoicovici Amphiteatre (ground floor)

Chair: Oana Lang

15:20-15:40 **Răzvan Sfetcu**

University of Bucharest

On the ordering of Awad-Varma entropy and its applications to statistical models

15:40-16:00 **Ionel Popescu**

University of Bucharest

Tridiagonal random matrices, an analytic approach

16:00-16:20 **Dan Leonte**

KAUST

Simulation-based inference via telescoping ratio estimation

16:20-16:50 **Coffee break**

SCHEDULE

SOCIETATEA DE PROBABILITĂȚI ȘI STATISTICĂ DIN ROMÂNIA

DAY 2 - PLENARY TALKS 2

Saturday, April 25

Room: Emil Stoicovici Amphiteatre (ground floor)

Chair: Ciprian Tudor

16:50-17:30 Valentin Patilea

ENSAI CREST, France

Testing the mean of multivariate random functions

17:30 Closing remarks

17:45 City Center Tour

led by Prof Andrei Mărcuș, Head of the Mathematics Department at UBB

ABSTRACTS

SOCIETATEA DE PROBABILITĂȚI ȘI STATISTICĂ DIN ROMÂNIA

ALEXANDRA ANDRICIUC

University of Bucharest and IMAR, Romania

Perspectives on Particle Swarm Optimization

In this talk, we examine a specific setting of Particle Swarm Optimization (PSO) from a probabilistic perspective, modeling particle trajectories as stochastic processes. The analysis draws on classical tools from probability theory and stochastic processes, allowing randomness to be treated as an intrinsic component of the dynamics rather than a secondary perturbation.

The proposed framework seeks to bridge mathematically tractable assumptions with parameter regimes commonly used in practice. Alongside original results, we discuss relevant contributions from the literature in order to situate the approach within the broader context of existing work.

Overall, this perspective highlights PSO as a mathematically rich optimization method, lying at the intersection of stochastic processes, dynamical systems, and applied optimization, with connections to areas such as finance and economics.

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VLAD BARBU

LMRS, University of Rouen-Normandy, France & Centre for Demographic Research "Vladimir Trebici", "Costin C. Kiritescu" National Institute of Economic Research of Romanian Academy, Romania

Drifting Hidden Markov Models: Modeling and Estimation

This presentation focuses on the modeling and estimation of time series data with latent structures using Hidden Drifting Markov Models (HDMMs).
First, we introduce drifting Markov processes, a nonhomogeneous alternative to classical Markov processes, with specific types of nonhomogeneity. Second, we present a theoretical overview of HDMMs, highlighting their key components and probabilistic assumptions. We then develop the Expectation–Maximization (EM) algorithm for parameter estimation and present some numerical simulations to illustrate the practical implementation and performance of these techniques. Joint work with Aguemon TEHUNGUE and Nicolas VERGNE (University of Rouen-Normandy, France).

References:

Kalligeris, E.N., Barbu, V.S., Hacques, G., Seifert, L. Vergne, N. (2024). Unveiling the persistent dynamics ofvisual-motor skills via drifting Markov modeling, Nonlinear Dynamics, Psychology, and Life Sciences, 28(4), 431-447.
Barbu, V.S., Vergne, N. (2019). Reliability and survival analysis for drifting Markov models: modelling and estimation, Methodology and Computing in Applied Probability, 21(4), 1407-1429.
Barbu, V.S., Mavrogiannis, I., Vergne, N. (2022). package R dsmmR: Estimation and Simulation of Drifting Semi-Markov Models https://cran.r-project.org/web/packages/dsmmR/index.html
Barbu, V.S., Brelurut, G., Gilles, A., Lefebvre, A., Lothode, C., Mataigne, V., Seiller, A., Vergne, N. (2021). package R drimmR, Estimation, Simulation and Reliability of Drifting Markov Models https://cran.r-project.org/web/packages/drimmR/index.html.

IONUȚ BEBU

The George Washington University, USA

A Grant Proposal in the Life of a Biostatistician

Academic research in United States is primarily funded through grants. Biostatisticians are a central part of the research groups applying for medical grants. The process of applying for such a grant is illustrated using a proposal aimed at characterizing ectopic fat by magnetic resonance imaging (MRI) and body composition by whole body dual-energy x-ray absorptiometry (DXA) in a group of children at-risk for T2D as they traverse puberty. Both clinical and biostatistical issues will be presented and discussed.

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SALIM BOUZEBDA

Université de Technologie de Compiègne, France

M-processes and their applications in change-points

We consider the problem of the estimation of a parameter θ, in Banach spaces, maximizing some criterion function which depends on an unknown nuisance parameter h, possibly infinite-dimensional. The classical estimation methods are mainly based on maximizing the corresponding empirical criterion by substituting the nuisance parameter by a nonparametric estimator. We show that the M-estimators converge weakly to maximizers of Gaussian processes under rather general conditions. The conventional bootstrap method fails in general to consistently estimate the limit law. We show that the m out of n bootstrap, in this extended setting, is weakly consistent under conditions similar to those required for weak convergence of the M-estimators. The aim of this paper is therefore to extend the existing theory on the bootstrap of the M-estimators. Examples of applications from the literature are given to illustrate the generality and the usefulness of our results. Finally, we investigate the performance of the methodology for small samples through a short simulation study.

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PETRE CARAIANI

Bucharest University of Economic Studies, Romania

Investor Sentiment and Bubbles

This paper investigates whether investor sentiment can help ex-plain and predict speculative bubbles in equity markets. We propose a Bayesian Markov-switching state-space model in which the transition probabilities between fundamental and bubble regimes are time-varying functions of lagged sentiment indicators (TVTP). The model is estimated via Hamiltonian Monte Carlo and applied to monthly U.S. stock market data over 1971–2023. The estimated bubble regime probabilities align with historically documented episodes of speculative excess. Sentiment-augmented transition probabilities yield improved predictive performance relative to constant-transition and simpler TVTP specifications, as measured by leave-one-out cross-validation and Bayesian model averaging. The results suggest that behavioral indicators contain forward-looking information about the life cycle of speculative regimes.

ILYA CHEVYREV

SISSA (Scuola Internazionale Superiore di Studi Avanzati), Italy

Large scale problems in singular stochastic PDEs

In this talk, I will give an introduction to singular stochastic PDEs and rough path theory, which are frameworks for solving stochastic differential equations by separating analysis and probability. I will motivate scaling as a guiding principle in these theories, which can be used to show that these singular SPDEs inherit several properties from deterministic PDEs, especially large scale a priori estimates.

IULIAN CÎMPEAN

University of Bucharest and IMAR, Romania

Extended Walk-on-Spheres algorithm for linear and nonlinear elliptic PDEs

The Walk-on-Spheres algorithm, introduced by M. E. Muller in 1956, is a well known Monte Carlo method that leverages Brownian exit distributions from spheres to solve the Laplace equation with Dirichlet boundary conditions. Its mesh-free nature, robustness on complex geometries, favorable scaling with dimension, and intrinsic parallelism distinguish it from mesh-based solvers. However, its efficient applicability is limited to operators that admit explicit probabilistic exit laws, excluding most variable-coefficient and nonlinear elliptic operators.

We propose a general framework that aims to overcome this limitation by using the classical Dirichlet Laplacian and harmonic extension as universal building blocks. Rather than seeking a custom stochastic representation for each operator, we employ Walk-on-Spheres to precompute a reusable numerical operator toolbox that approximates the inverse Dirichlet Laplacian, the harmonic extension operator, and their gradients. These precomputed operators are then used to represent candidate solutions and to transform arbitrary Dirichlet boundary value problems into finite-dimensional algebraic systems for an unknown source term. Solving the resulting algebraic system and substituting back yields an approximate solution to the original PDE. Even more, for a general linear second order elliptic operator, the above mentioned precomputed toolbox can be directly used to obtain not just an approximation of a certain solution of the corresponding generalized Dirichlet problem, but an estimator of both the Green's integral operator and the Elliptic measure operator.

Numerical experiments on a range of benchmarks, including non-symmetric and anisotropic linear elliptic equations, semilinear and quasilinear problems, demonstrate the method's flexibility and promising performance.

Joint work with A. Grecu and A. Zarnescu.

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MANUELA-SIMONA COJOCEA

University of Bucharest, Romania

Statistical Inference in Probability Coordinates via Kolmogorov Expectations

We propose a framework for statistical inference based on probability coordinates induced by monotone transformations, with a particular focus on cumulative distribution functions. Within this setting, expectations are computed after transforming the data into a probability scale, averaging in this transformed space, and then mapping the result back to the original domain. This leads to a class of estimators that can be interpreted as barycenters in probability coordinates.

We establish consistency and asymptotic normality by combining classical limit theorems in the transformed space with standard smoothness arguments. The resulting asymptotic variance reflects both the variability of the transformed data and the local behavior of the transformation, highlighting the role of the chosen coordinate system in statistical performance.

This perspective suggests that aspects of efficiency and robustness can be influenced by the choice of transformation. In particular, suitable transformations can lead to more stable behavior in heavy-tailed settings where classical averages may be unreliable or undefined. We also discuss implications for Monte Carlo methods and outline extensions to multivariate settings using copula-based probability coordinates.

The proposed approach provides a geometric interpretation of estimation and points toward new directions for robust and efficient statistical procedures.

RADU CRAIU

University of Toronto, Canada

Bayesian nonparametric mixtures of Archimedean copulas

Copula-based dependence modeling often relies on parametric formulations. This is mathematically convenient, but can be statistically inefficient when the parametric families are not suitable for the data and model in focus. A Bayesian nonparametric mixture of Archimedean copulas is introduced to increase the flexibility of copula-based dependence modeling. Specifically, the Poisson-Dirichlet process is used as a mixing distribution over the Archimedean copulas' parameter. Properties of the mixture model are studied for the main Archimedean families, and posterior distributions are sampled via their full conditional distributions. The performance of the model is illustrated via numerical experiments involving simulated and real data.

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DAN CRISAN

Imperial College London, United Kingdom

On the uniqueness of the solution of the filtering problem for general signal and observation processes

I will discuss a generalized filtering framework in which the signal process X and observation process Y are both driven by correlated Brownian motions, and the coefficients of their governing stochastic differential equations depend jointly on (X,Y), with the exception of the diffusion coefficient of the observation process, which does not depend upon the signal. Unlike many prior works, the observation equation may have a degenerate (noninvertible or even zero) diffusion coefficient. In this framework, I will introduce the filtering equations and prove of equivalence between the uniqueness of the nonlinear Kushner–Stratonovich equation and the linear Zakai equation. Then I will introduce a novel proof of uniqueness for the Zakai equation using a backward stochastic partial differential equation (BSPDE), overcoming the limitations of classical duality arguments. This approach successfully handles the randomness and anticipation introduced by the observation-dependent coefficients, which are not tractable under traditional deterministic PDE methods. This is joint work with Étienne Pardoux and is based on the paper: Dan Crisan, Étienne Pardoux, "Uniqueness of the solution of the filtering equations in spaces of measures for general signal and observation processes", Annals of Applied Probability 2026, Vol. 36, No. 2, 1347-1376.

SOPHIE DABO-NIANG

University of Lille, France

Bridging Nonparametric Statistics and Functional Data Analysis

This talk examines functional nonparametric regression models in the presence of error structures. Whereas classical functional regression methodologies generally rely on the assumption of independent and identically distributed errors, many practical applications—especially in longitudinal and time-series contexts—exhibit temporal dependence that can substantially affect both estimation accuracy and inferential validity.

We adopt a general framework in which the response variable depends on functional covariates through an unknown nonlinear operator, while the error process evolves according to an autoregressive process. Within this setting, we investigate the asymptotic behavior of nonparametric estimators, with particular emphasis on efficiency bounds and on how temporal dependence modifies convergence rates relative to the independent-error benchmark.

We develop estimation procedures that explicitly incorporate the underlying correlation structure and show that modeling the autoregressive dynamics yields efficiency gains over standard methods that ignore dependence. The theoretical findings are corroborated by simulation studies, which illustrate improvements in estimation precision and the robustness of subsequent statistical inference.

SPIROS DAFNIS

University of the Aegean, Greece

New families of continuous univariate distributions

In this work we focus on a recently introduced family of continuous univariate distributions $D_g^+(h)$ which involves two functions, g (generator) and h (parametric part) satisfying appropriate conditions. We first discuss the properties of the members of the family. We also present a technique to generate new families by transforming g and introduce the transformed $D_g^+(h)$ -- family. Finally, we demonstrate how the new theoretical framework can be exploited for constructing new distributional models with desirable properties.

ARNAUD DEBUSSCHE

École Normale Supérieure de Rennes, France

Law of large numbers for stochastic multiscale spatial gene networks

We study a stochastic multiscale spatial gene network. These naturally arise in molecular biology. In our model, the reactants are subject to on-site reactions on both scales and diffusion on the continuous scale only, although diffusion on both scales could easily be handled. We obtain, under a light condition on the scales between the total population size and the mesh discretisation, the convergence of the stochastic system to a deterministic system consisting of a PDE coupled to a ODE. This is in contrast with the well-stirred case where jumps remain at the limit. In order to prove this convergence result, we develop some moments control for martingales in discrete Sobolev topologies and use products rule in discrete Sobolev spaces.

ERIKA HAUSENBLAS

Montanuniversität Leoben, Austria

The stochastic Keller-Segel model

Nonlinear Stochastic Partial Differential Equations and Cross Diffusion Nonlinear partial differential equations (PDEs) arise naturally in many biological and chemical systems, particularly in the context of cross-diffusion systems such as chemotaxis. Additionally, random fluctuations are prevalent in the real world, and this randomness can lead to various new phenomena that significantly impact the behavior of the solutions. The introduction of a stochastic term (or noise) in the model often results in qualitatively new behaviors, enhancing our understanding of real processes and often making them more realistic. The interplay between noise and nonlinearity can give rise to effects such as noise-induced transitions, stochastic resonance, metastability, or even noise-induced chaos.

In the case of simple Keller-Segel models, a dichotomy exists based on the initial mass; depending on this mass, a blow-up phenomenon may occur. However, it is possible to suppress this blow-up by introducing an additional term. When incorporating some multiplicative noise, the mass may change over time. In this scenario, it is also possible
to demonstrate the existence of a global solution if a proliferation term or a porous media term is included. In the talk, we will introduce some Keller-Segel systems for which a global solution exists even in the two-dimensional case.

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ALEXANDRU HENING

Texas A&M University, USA

Invariant probability measures of ecological systems

It is of fundamental importance to understand how environmental fluctuations influence the long term behavior of ecological models. In the current work we focus on the effects of random environmental fluctuations on a single species which, in the absence of stochasticity, is modeled by an ordinary differential equation (ODE) with a globally stable nonzero equilibrium point. We work under the assumption that the environmental fluctuations can be modeled by turning the ODE into a stochastic differential equation (SDE). We can give sufficient and necessary conditions for the extinction and persistence of the species. If the species persists we can find the invariant probability measure explicitly and also have explicit small noise expansions which can help us quantify how the population size at equilibrium changes because of noise.

ABSTRACTS

IULIANA IATAN

Department of Mathematics and Informatics, Technical University of Civil Engineering Bucharest, Romania

BAYESIAN ANALYSIS IN THE GAUSSIAN CASE

The paper involves a bayesian analysis in the Gaussian case, both in the unidimensional hypothesis and in the multidimensional hypothesis, which one applies in the pattern recognition. This paper presents the elements of bayesian decision theory, both in the unidimensional case and the multidimensional case. In every cases, the risk of taking a misclassification decision with Bayes rule was evaluated. In the both hypotheses, the minimization condition of the risk of taking a misdecision with Bayes's rule exactly corresponds to this decision rule. In the second paragraph the discriminant functions for multidimensional normal distribution which are used by a Bayes classifier are introduced. In this paragraph are also analyzed both the expression of these discriminant functions and the decision boundaries which one obtain for some expression of the covariance matrices corresponding to the considered classes. One uses the original MIAS MiniMammographic Database, digitised at 50 micron pixel edge, which has been reduced to 200 micron pixel edge and clipped/padded so that every image is 1024 pixels x 1024 pixels, from the Department of Physics, Royal Marsden Hospital, Fulham Road, London.

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ALEX KARAGRIGORIOU

University of Piraeus, Greece

On the Predictive Performance of Markov Chain Grey Models

Forecasting insurance loss data represents an important problem in actuarial and statistical modelling. This study investigates the predictive performance of the Grey Model GM(1,1) and the Markov Chain Grey Model MCGM(1,1) using state-level auto insurance incurred loss data from the United States. Forecast accuracy is evaluated using the Mean Absolute Percentage Error (MAPE). The empirical findings indicate that the MCGM(1,1) provides substantial improvements in predictive accuracy compared with the standard GM(1,1). The study also investigates the role of the background coefficient in the construction of the background sequence. The results suggest that optimal values of the background coefficient frequently occur near the boundaries of the interval [0,1], rather than the empirical mean value commonly adopted in the literature.

ABSTRACTS

MARIO LEFEBVRE

Polytechnique Montréal, Canada

Optimization problems for a queueing system with an infinite number of servers

Stochastic control problems known as "homing problems" are considered for the $M/M/ \infty$ queueing system. The aim is to find the control that minimizes the expected value of a cost functional with quadratic control costs. The terminal time is a random variable. It is the first time that the number of customers in the system is equal to a given constant. Explicit solutions are obtained.

ANTOINE LEJAY

Inria & IECL, France

Estimation of the parameter of the Skew Brownian motion

The Skew Brownian motion is a stochastic process that behaves like a Brownian motion away from zero, but with a propensity to be positive or negative that depend on a parameter θ in (-1,1). This behavior is due to the action of the local time at 0. This process may be used as a model for a diffusive particle in a media with a permeable barrier. We will present a maximum likelihood estimation procedure for the parameter θ of the Skew Brownian motion. We will discuss the difficulties linked to the fact that the Skew Brownian motion is a null recurrent process, and that the estimation of θ depends on the time the process spend around 0. Besides, we will show that using an asymptotic implicit function theorem, we could gives a series representation of the MLE with respect to the number of samples. From joint works with Sara Mazzonetto (IECL, France), Soledad Torres (Universidad de Valparaíso, Chile) and Ernesto Mordecki (Universidad de la República, Uruguay).

DAN LEONTE

KAUST, Saudi Arabia

Simulation-based inference via telescoping ratio estimation

The growing availability of complex datasets has increased interest in temporal stochastic processes capable of capturing stylized facts such as non-Gaussian marginals, long memory, and non-Markovian dynamics. While such models are often easy to simulate, parameter estimation remains challenging. Simulation-based inference (SBI) offers a promising way forward, but existing approaches typically require large training datasets or complex architectures and often yield confidence (credible) regions that fail to attain nominal coverage, questioning the reliability of estimates for the very features that make these models appealing. To address these challenges, we propose a fast, accurate, and sample-efficient SBI framework for amortized posterior inference in intractable stochastic processes. Our method relies on two steps: first, we learn the posterior density by decomposing it sequentially across parameter dimensions; second, we employ Chebyshev polynomial approximations to efficiently generate independent posterior samples, enabling accurate inference even when Markov chain Monte Carlo methods mix poorly. Moreover, we develop novel diagnostic tools and post-hoc calibration techniques that improve performance and allow reusing the trained inference network with time series of varying lengths, further amortizing training costs. We demonstrate the effectiveness of the method on trawl processes, a flexible class of infinitely divisible models that generalize univariate Gaussian processes, applied to energy data.

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OANA LUPAȘCU-STAMATE

ISMMA, Romania

Multiple-fragmentation stochastic processes driven by a spatial flow

We investigate stochastic fragmentation processes for particles with spatial position. The mathematical problem models the time evolution of a system of particles which move on an Euclidean surface driven by a given force (e.g., gravitational, fluid interaction, repulsion/attraction), and split in fragments with smaller masses and velocities. We establish a multiple-fragmentation process and we solve the corresponding stochastic integro-differential equation. Finally, we present several numerical simulations of such processes. These results are obtained jointly with Lucian Beznea (Bucharest) and Ioan R. Ionescu (Paris).

ANDREAS MAKRIDES

University of the Aegean, Greece

Temporal Interaction Patterns in Rare Events: A Multi Component Probabilistic View

A novel idea for modelling extreme events especially focused on seismic activity is presented in this paper. Unlike classical models, the proposed framework incorporates a multivariate state space where each state is defined as a vector encoding both the magnitude of the mainshock and temporal or numerical features of the associated foreshock and/or aftershock sequences. This structure enables a dynamic and data-informed correlation between the mainshock characteristics and the surrounding seismic activity, enhancing the descriptive and predictive power of the model. The generalized Markov structure allows flexible sojourn time distributions, capturing the non-memoryless nature of seismic transitions. Empirical validation using real earthquake catalogs demonstrates that the model effectively captures key patterns in seismic sequences, offering new insights into the temporal evolution and interdependence of seismic events. This new approach might reveal promising paths for probabilistic seismic hazard analysis and provide additional stochastic tools for thorough investigation of extreme phenomena attributes.

DAN NICOLAE

University of Chicago, SUA

Statistical genomics challenges in light of AI

Understanding the genetic and environmental architecture of human phenotype has been the main motivator for the development of new technologies and the dramatic increase in the variety and scale of data we have seen for the past two decades. I will introduce a series of challenges that arise in genomic data integration of genetic variation, expression, methylation, microbiome and clinical data. I will also describe some of the difficulties in this field, from sparsity of signals to non-standard missing data issues, the statistical problems they generate, and the progress of AI solutions in this field.

VALENTIN PATILEA

ENSAI CREST, France

Testing the mean of multivariate random functions

The problem of testing linear hypotheses for the mean functions of random functions is considered. This includes testing whether the mean is zero, whether two sample means are equal, and whether two means differ by a constant shift or ratio. The random functions are defined on a multidimensional compact domain, and multiple independent realizations are observed at random design points, possibly with heteroscedastic errors. The number of design points per realization may be either bounded or arbitrarily large. For two-sample tests, the samples may be unbalanced and dependent. The proposed testing approach is based on a non-asymptotic Gaussian approximation for the estimated Fourier coefficients. Two pivotal chi-square–type test statistics are introduced. The extension to Hilbert space-valued random functions is also discussed.

EUGEN PIRCALABELU

UC Louvain, Belgium

High-dimenisonal model averaging

Selection methods for high-dimensional models are well developed, but they do not take into account the choice of the model, which leads to an underestimation of the variability of the estimator. We propose a procedure for model averaging in high-dimensional regression models that allows inference even when the number of predictors is larger than the sample size. The proposed estimator is constructed from the debiased Lasso and the weights are chosen to reduce the prediction risk. We derive the asymptotic distribution of the estimator within a high-dimensional framework and offer guarantees for the minimal loss prediction obtained using our choice of the weights. In contrast to existing approaches, our proposed method combines the advantages of model averaging with the possibility of inference based on asymptotic normality. The estimator shows a smaller prediction risk than its competitors when applied to a real, high-dimensional dataset and along various simulation studies, confirming our theoretical results.

IONEL POPESCU

University of Bucharest, Romania

Tridiagonal random matrices, an analytic approach

We study the general random matrix model and its spectral limit distribution in the case of weak assumptions. We do this via the Stieltjes transform. Joint work with Lucas Babet.

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SOCIETATEA DE PROBABILITĂȚI ȘI STATISTICĂ DIN ROMÂNIA

RĂZVAN SFETCU

University of Bucharest, Romania

On the ordering of Awad-Varma entropy and its applications to statistical models

Entropy is a fundamental concept in information theory and statistics, serving as a measure of uncertainty associated with random variables. Motivated by Awad-Shannon entropy introduced by Awad, we investigate Awad-Varma entropy as a generalized framework for quantifying uncertainty. We introduce a new ordering based on Awad-Varma residual entropy, which provides a systematic way to compare lifetime distributions according to their uncertainty behavior over time. Several key properties of the proposed order are established. In particular, we examine its closure and reversed closure under a variety of operations and transformations, identifying conditions under which the ordering is preserved. These results offer insight into the structural behavior of the order and its robustness when applied to derived distributions. In addition, we study the preservation of Awad-Varma entropy order within a class of statistical models commonly used in reliability and survival analysis. The findings demonstrate that the proposed ordering is compatible with important modeling frameworks and remains stable under typical constructions. Overall, this work contributes to the development of entropy-based orderings and provides useful tools for comparing systems in terms of uncertainty and aging properties, with potential applications in reliability analysis and related fields.

SOCIETATEA DE PROBABILITĂȚI
ŞI STATISTICĂ DIN ROMÂNIA

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Longitudinal Functional Data Methods for Emerging Repeated Measurements

In recent years, longitudinal studies increasingly collect data where the primary measurements are functions or surfaces observed repeatedly over time. This talk introduces parsimonious modeling frameworks for such functional data, designed to extract meaningful low-dimensional features while respecting the longitudinal design. The methodology is computationally efficient and well-suited for characterizing the dynamic evolution of the underlying process. The framework is then extended to accommodate pointwise skewness in the data, broadening its applicability. Building on the key ideas, we discuss inference in the form of significance tests for hypotheses of scientific interest in this setting. We conclude by highlighting several open challenges and emerging directions in the analysis of longitudinal functional data.

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Numerical solution of the Neumann problem for linear elliptic PDEs via numerical solution of the Dirichlet problem for linear elliptic PDEs by a probabilistic approach

Numerical solution of the Neumann problem for linear elliptic PDEs via numerical solution of the Dirichlet problem for linear elliptic PDEs is obtained. The idea of the simplest random walk for the Dirichlet problem for linear elliptic PDEs developed by Milstein and Tretyakov together with an equivalence result proved by Beznea, Pascu and Pascu are utilized in this respect. Results of some numerical experiments are presented. The Monte Carlo technique is used for practical results of the experiments. The results are in agreement with the theoretical findings.

FLORENTINA SUTER

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Residual Entropies and Orderings in Stochastic Systems

We study stochastic orderings induced by residual entropy measures for the comparison of random lifetimes and costs in stochastic systems. These orderings capture variability and may differ in general, even under equal mean, but coincide under suitable structural conditions, such as monotonicity of the hazard rate. Appling these orderings in the context of coherent systems and dependent models, the role of system structure and dependence in shaping uncertainty is highlighted.