Workshop Center of Mathematical Statistics 60

15 octombrie 2024

REZUMATE

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Măsuri de divergenţă şi utilizarea lor în inferenţa statistică

Măsurile de divergenţă au o mare importanţă în inferenţa statistică; la fel de importante sunt şi versiunile lor limită, cunoscute sub numele de rate de divergenţă. În prima parte a prezentřii noastre, ne vom referi la măsuri de divergenţă generalizate pentru lanţuri Markov. Vom lua în considerare generalizări ale măsurii de divergenţă Alpha (Amari şi Nagaoka, 2000) şi ale măsurii de divergenţă Beta (Basu et al., 1998) şi vom investiga comportamentul lor limită. De asemenea, vom studia măsurile de divergenţă generalizate ponderate corespunzătoare şi ratele asociate acestora (Beliş şi Guiaşu, 1968; Guiaşu, 1971; Kapur, 1994).

În a doua parte a prezentării noastre vom dezvolta o metodologie pentru testarea ipotezelor statistice, bazată pe divergenţe ponderate. Mai precis, vom prezenta un test de conformitate şi un test de omogenitate şi vom studia performanţa acestora. Acest tip de teste bazate pe divergenţe ponderate ne permite să ne concentrăm pe submulţimi specifice ale suportului unei distribuţii (sau a spaţiului stărilor), fără a pierde, în acelaşi timp, informaţia celorlalte submulţimi. Prin această metodă, obţinem un test semnificativ mai sensibil decât cele clasice, dar cu rate de eroare comparabile. Aceasta metodologie este dezvoltată atât într-un cadru i.i.d, cât şi într-un cadru dependent de tip Markov sau semi-Markov.

References

[1] V.S. Barbu, A. Karagrigoriou, V. Preda, *Entropy and divergence rates for Markov chains: I. The Alpha-Gamma and Beta-Gamma case,* Proceedings of the Romanian Academy-series A: Mathematics, Physics, Technical Sciences, Information Science, **18** (4), (2017), 293-301.

[2] V.S. Barbu, A. Karagrigoriou, V. Preda, *Entropy and divergence rates for Markov chains: II. The weighted case*, Proceedings of the Romanian Academy-series A: Mathematics, Physics, Technical Sciences, Information Science, **19**(1), (2018), 3-10.

[3] V.S. Barbu, A. Karagrigoriou, V. Preda, *Entropy and divergence rates for Markov chains: III. The Cressie and Read case and applications*, Proceedings of the Romanian Academy-series A: Mathematics, Physics, Technical Sciences, Information Science, **19** (3), (2018), 413-421.

[4] T. Gkelsinis, A. Karagrigoriou, V.S. Barbu, *Statistical inference based on weighted divergence measures with simulations and applications*, Statistical Papers, **63** (2022), 1511-1536, DOI: https://doi.org/10.1007/s00362-022-01286-z

[5] T. Gkelsinis, V.S. Barbu, *A class of hypothesis tests for general order Markov chains with prior information on the transitions*, 2024, under revision.

[6] T. Gkelsinis, V.S. Barbu, *Statistical Inference for semi-Markov chains with non-parametric sojourn time distributions based on Phi-divergence*, 2024, submitted.

Lucian Beznea

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Semigrupuri multiplicative pe spaţii L^p şi curenţi continui

Demonstrăm că orice curent este continuu într-o topologie convenabilă şi arătăm că un semigrup multiplicativ pe un spaţiu L^p este generat de un curent continuu. Dezvoltăm o metodă de a dirija un proces Markov de-a lungul unui curent continuu. Un exemplu relevant este un superproces cu valori măsuri, având un curent continuu ca mişcare spaţială şi un mecanism de ramificare care nu depinde de variabila spaţială.

Iulian Cîmpean

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Numerical spectral analysis of Cauchy-type inverse problems: A probabilistic approach

In this talk we consider a class of data completion problems that arise in many applications and are modelled by PDEs in a bounded Euclidean domain, subject to over-prescribed measurements at some accessible portion of the boundary and/or inside the domain; the goal is to reconstruct the entire solution from the partial measurements. It is well known that such inverse problems are severely unstable, and in spite of the huge amount of work that has been invested in this subject, several fundamental issues of both theoretical and numerical nature have remained open. The aim of this talk is to present a new framework in which such open issues can be efficiently analyzed with tools like elliptic measures, spectral representations and Monte Carlo approximations. Based on the recent paper arXiv:2409.03686 which is a joint work with Andreea Grecu and Liviu Marin.

Oana Lupaşcu-Stamate

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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).

Ionel Popescu

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În jurul modelelor de matrici aleatoare tridiagonale

In this talk I will discuss the models of random matrices with tridiagonal structures, particularly the convergence of the distribution of the eigenvalues. These appeared a few years ago and the description of the limiting distribution was given entirely in terms of combinatorics of the moments. This time I will show how one can get a characterization of the limiting distribution in analytical terms which is applicable under more relaxed condition on the moments of the entries. This is joint work with Lucas Babet.

Marius Radulescu

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Asymptotic behavior of sequences of powers of matrices with applications to finite Markov chains and to multi-type branching processes

A generalization of Perron-Frobenius theorem is stated. Several conditions that imply the convergence of powers of arbitrary square matrices or of sequences of matrices that are built from powers of matrices to a square matrix are given. The description of the limiting matrices is presented. Applications to finite Markov chains and to multi-type branching processes are discussed also.

Cristian Preda

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Statistical learning with categorical functional data

Unsupervized and supervised methods are presented for data represented by paths of some continuous-time stochastic process with values in a finite set of states. Clustering and regression models are considered in the framework of dimension reduction, linear and RKHS methods. An application with health data for elderly patients trajectories illustrates these methods.