Conférence en l'honneur d'Emmanuel Rio
Concentré de martingales et mélanges de chaînes de Markov

Wednesday june 11

All talks will take place in Amphi J of the Fermat building, while coffee breaks and lunches will be set up in the adjacent room, Amphi I.

- 13h30-14h : Welcome
- 14h-14h45 : Bernard Bercu (Université de Bordeaux)

  A martingale approach for the Gaussian fluctuations and the large deviations for the Ewens-Pitman process

  This talk is devoted to the asymptotic behavior of the Ewens-Pitman process (EPP) using an easy-to-understand martingale approach. We shall prove that the number of blocks in the EPP, properly normalized, converges almost surely to a Mittag-Leffler distribution. We shall also study the Gaussian fluctuations and the large deviation principles associated with the EPP. Lastly, we shall look at the asymptotic normality of the self-normalized Ewens-Pitman process. This is a joint work with Stefano Favaro.

- 14h45-15h30 :

  Thierry Klein (Université de Toulouse)

  Large deviationfor Mandelbrot Multiplicative cascade

  Let W be a nonnegative random variable with expectation 1. For all $r \geqslant 2$, we consider the total mass Z_r^∞ of the associated Mandelbrot multiplicative cascade in the r-ary tree. For all $n \geqslant 1$, we also consider the total mass Z_r^n of the measure at height n in the r-ary tree. Liu, Rio, Rouault established large deviation results for $(Z_r^n)_{r\geqslant 2}$ for all $n \in [1, \infty)$ (resp. for $n = \infty$) in case W has an everywhere finite cumulant generating function Λ_W (resp. W is bounded). Here, we extend these results to the case where Λ_W is only assumed finite on a neighborhood of zero, and even to the case where W has a stretched exponential tail. And we establish all deviation results (moderate, large, and very large deviations). It is noticeable that we obtain nonconvex rate functions. Moreover, our proof of upper bounds of deviations for $(Z_r^\infty)_{r\geqslant 2}$ rely on the moment bound instead of the standard Chernoff bound.

- 15h30-16h : Coffee break
- 16h00-16h45 :

  Florence Merlevède (Université Gustave Eiffel)

  Quadratic transportation cost in the central limit theorem

  In this talk, we will shall give estimates of the quadratic transportation cost between normalized partial sums associated with real-valued random variables and their limiting Gaussian distribution. The estimates will be given in terms of weak-dependent coefficients that are well suited to

a large class of dependent sequences. This class includes irreducible Markov chains, dynamical systems generated by intermittent maps or strong mixing sequences. This talk is based on a joint work with J. Dedecker and E. Rio.

- 16h45-17h30 :

  Elisabeth Gassiat (Université Paris Saclay)

  Evaluation of data security in ML models

  In this talk, I will explain the fundamental statistical limitations associated with MIAs on machine learning models at large. This allows to understand why overfitting learning procedures can lead to vulnerability to MIAs. I will also present consequences of our theoretical findings: discretizing data or quantizing machine learning models improves the security of the learning procedure. This is joint work with Eric Aubinais, Pablo Piantanida, and in part with Philippe Fromont.

- 17h30-18h15 :

  Herold Dehling (Ruhr University Bochum)

  Tests for Constancy of the Variance in a Time Series

  We present a novel approach to test for heteroscedasticity of a non-stationary time series that is based on Gini's mean difference of logarithmic local sample variances. In order to analyse the large sample behaviour of our test statistic, we establish new limit theorems for U-statistics of dependent triangular arrays where the entries are empirical moments computed from non-overlapping blocks of an underlying weakly dependent process. (Joint work with Roland Fried, Davide Giraudo, Sara Schmidt and Max Wornowizki).

From 6:30 PM onwards, we will have the pleasure of welcoming you to Pavillon Panhard (Campus UFR des Sciences) for a cocktail.

Thursday june 12

- 9h45-10h30 :

  Marwa Banna (NYU Abu Dhabi)

  Limit Theorems in Noncommutative Probability

  In this talk, I will introduce the fundamental framework of noncommutative probability theory and its five canonical notions of independence: tensor (classical), free, Boolean, monotone, and anti-monotone. I will highlight their natural emergence in the large-N limit of certain random matrix models, illustrating deep connections between noncommutative probability and random matrix theory.

  Analogous to the classical case, each notion of noncommutative independence gives rise to a corresponding central limit theorem (CLT), which I will discuss. I will also present operator-valued extensions of these CLTs, along with Berry–Esseen-type estimates that quantify the rates of convergence. I will end the talk with the free multiplicative CLT and recent results on quantitative bounds in terms of Wasserstein distances in this setting.

  Based on joint works with Arizmendi, Gilliers, Mai and Tseng.

- 10h30-11h00 : Coffee break
- 11h00-11h45 :

  Radosław Adamczak (University of Warsaw)

  Orlicz spaces satisfying the Hoffmann-Jørgensen inequality

  A classical result by Hoffman-Jørgensen provides estimates for L_p norms of sums of independent Banach space-valued random variables in terms of the L_1 norm of the sum and the L_p norm of their maximum. Talagrand, using his isoperimetric approach, found the optimal order of constants in these inequalities when p tends to infinity and also generalized them to Orlicz spaces defined by the exponential functions Ψ_α. More recently, Chamakh, Gobet and Liu obtained a version of Hoffman-Jørgensen inequalities for some Orlicz functions corresponding to heavier tails. In this talk, I will present a characterization of Orlicz functions for which such inequalities hold. If time permits, I will also describe applications of this characterization to inequalities for empirical processes and convex functions. Based on joint work with Dominik Kutek (University of Warsaw).

- 11h45-12h30 : Quansheng Liu (Laboratoire de Mathématiques de Bretagne Atlantique)

  Large deviations for multitype branching processes in random environments

  We consider a d-type branching process $Z_n = (Z_n(1), ..., Z_n(d))$ in an independent and identically distributed random environment, whose offspring distributions of generation n depend on the environment at time n. We derive a Bahadur-Rao type large deviation asymptotic expansion for the total population size $|Z_n| = \sum_{j=1}^{d} Z_n(j)$ of generation n, by applying precise large deviation asymptotics for products of random matrices. The approach is based on a martingale decomposition and a Cramér type measure change, under which we establish stable convergence for products of random positive matrices, and L^p convergence for the multitype branching process. (Joint work with Ion Grama and Thi Trang Nguyen)

- 12h30-14h00 : Lunch
- 14h00-14h45 : Pascal Massart (Université Paris Saclay)

  Cutoff phenomena in statistics: illustration within a basic framework

  We shall show how the abstract probabilistic material on the concentration of product measures can be used to shed light on cut-off phenomena in statistics. Nothing revolutionary here, as everyone knows the impact that Talagrand's work has had on the development of mathematical statistics since the late 90s, but we've chosen a very simple framework in which everything can be explained with minimal technicality, leaving the main ideas to the fore.

- 14h45-15h30 : Fabienne Comte (Université Paris Cité)

  Nonparametric estimation for additive concurrent regression models

  Joint work with Elodie Brunel (Univ. Montpellier) and Céline Duval (Sorbonne Univ.) Consider an additive functional regression model where a one-dimensional response process $Y(t)$ and a K-dimensional explanatory random process $X_j(t)$, $j = 1, \ldots, K$, are observed for $t \in [0, \tau]$, with fixed τ. Examples of such explanatory processes are continuous or inhomogeneous counting processes. The linear coefficients of the model are K unknown deterministic functions $t \mapsto b_j(t)$, $j = 1, \ldots, K$, $t \in [0, \tau]$. From N independent trajectories, we build a nonparametric least-squares estimator $(\hat{b}_1, \ldots, \hat{b}_K)$ of $(b_1, \ldots, b_K)$, where each $\hat{b}_j$, $1 \leq j \leq K$, is given by its expansion on a finite-dimensional space. We prove a bound on the mean-square risk of the estimator, from which

rates of convergence are obtained and are established to be optimal. An adaptive procedure, achieving simultaneous and anisotropic selection of each space dimension, is then tailored and an oracle risk bound is proved. The procedure is studied numerically and implemented on a real dataset of electric consumption.

- 15h30-16h00 : Coffee break
- 16h00-16h45 : Yannick Baraud (University of Luxembourg)

  Estimating a regression function under weak assumptions

  In collaboration with Guillaume Maillard, we focused on the estimation of a regression function under weak assumptions about the distribution of errors. In particular, we do not assume that they are i.i.d. with finite variance or an exponential moment, but only that they are independent, centered (and thus integrable). In this statistical framework, we will present a generic estimation method leading to estimators whose performance automatically adapts to the integrability properties of the errors. We will provide non-asymptotic risk bounds, which we will illustrate in the specific case where one seeks to estimate a regression function under a shape constraint, such as monotonicity, unimodality, or convexity. We will show that the estimator is not only robust with respect to this a priori shape assumption but also has remarkable adaptive properties when the targeted regression function possesses some additional features.

- 16h45-17h30 :

  Magda Peligrad (University of Cincinnati) et Jérôme Dedecker (Université Paris Cité)

  Rates in the central limit theorem for random projections

Friday june 13

- 9h00-9h45 :

  Sana Louhichi (Université Grenoble-Alpes)

  Bounds on the Hausdorff Distance for Stationary, Compactly Supported Sequences with Applications to Topological Reconstruction

  In topological data analysis, controlling the Hausdorff distance plays a crucial role in persistent homology and shape reconstruction. In this talk, we consider a sequence of stationary, weakly dependent, compactly supported random variables. We first propose several methods to bound the Hausdorff distance between this stationary random sequence and its common support. The obtained bounds allow us to achieve the optimal rate of convergence known for the i.i.d. case, as proved by Chazal et al. in 2015. We discuss various types of dependence within the considered stationary sequence. Next, we present a novel topological reconstruction result and provide illustrative examples. This talk is based on joint work with Sadok Kallel.

- 9h45-10h30 :

  Dalibor Volný (Université de Rouen Normandie)

  Limit Laws in a CLT for Orthomartingales

  By a theorem of Billingsley and Ibragimov, for a strictly stationary and ergodic sequence $(X_1, X_2, ..., X_n)$ of square integrable random variables, the partial sums $Sn = (\frac{1}{\sqrt{n}})(X_1, X_2, ..., X_n)$ converge in law to a normal distribution. Here we will study the CLT for random fields with

completely commuting filtration. As shown by Wang and Woodroofe in 2013, even if the random field of martingale differences is ergodic, we need not get a convergence to a normal law. As shown in [Volný 2019], a convergence always takes place. We will study this phenomenon and present necessary and sufficient conditions of normality of the limit law.

- 10h30-11h00 : Coffee break
- 11h00-11h45 :

  Michael Lin (Ben-Gurion University)

  Global central limit theorems for stationary Markov chains

  Let $P = P(x, A)$ be a Markov transition probability on a general state space (S, Σ), with invariant probability m. Let $\Omega := S^{\mathbb{N}}$ be the space of trajectories with σ-algebra $\mathcal{A} := \Sigma^{\otimes\mathbb{N}}$, and let $\mathbb{P}_m$ be the probability on $\mathcal{A}$ of the chain with transition probability P and initial distribution m. By invariance of m, $\mathbb{P}_m$ is shift-invariant on $(\Omega, \mathcal{A})$. Let X_n be the projection of Ω on the nth coordinate. Then (X_n) on $(\Omega, \mathcal{A}, \mathbb{P}_m)$ is a stationary Markov chain with state space S.

  We assume m ergodic for P, so the chain is ergodic too, i.e., the shift on Ω is ergodic.

  We say that a real centered $f \in L_2(m)$ satisfies the annealed CLT if in $(\Omega, \mathbb{P}_m)$ we have

  $$\frac{1}{\sqrt{n}} \sum_{k=1}^{n} f\left(X_k\right) \xrightarrow{\mathcal{D}} \mathcal{N}\left(0, \sigma^2\right), \quad \text{where} \quad \mathcal{N}(0,0) := \delta_0$$

  We say that a real centered $0 \neq f \in L_2(m)$ satisfies the L_2-normalized CLT if

  $$\frac{1}{\sigma_n(f)} \sum_{k=1}^{n} f\left(X_k\right) \xrightarrow{\mathcal{D}} \mathcal{N}(0,1)$$

  where $\sigma_n(f) := \left\|\sum_{k=1}^{n} f\left(X_k\right)\right\|_2 > 0$ for large n.

  We study conditions which yield that for every centered $0 \neq f \in L_2(m)$ a non-degenerate $\left(\sigma^2 > 0\right)$ annealed CLT and an L_2-normalized CLT hold. Joint work with Christophe Cuny

- 11h45-12h30 :

  Françoise Pène (Université de Bretagne Occidentale)

  Two examples of applications of Emmanuel Rio's ideas and results : for partially hyperbolic systems and for random walks in random scenery

  Emmanuel Rio's work inspired lots of colleagues. I focus here on two very different results I established adapting or using his work. The first result is a Berry-Eessen estimate for partially hyperbolic dynamical systems (result established in collaboration with Stéphane Le Borgne). The second result is the convergence in M1 of some random walks in random scenery for which the convergence in J1 fails (result established in collaboration with Fabienne Castell and Nadine Guillotin-Plantard).