

Workshop MESA - Stein's Method and Applications

Rapport sur les contributions

ID de Contribution: 1

Type: **Non spécifié**

Quantitative Generalized CLT with Self-Decomposable Limiting Laws by Spectral Methods

jeudi 23 mars 2023 11:10 (55 minutes)

In this talk, I will present new stability results for non-degenerate centered self-decomposable laws with finite second moment and for non-degenerate symmetric alpha-stable laws with alpha in (1,2). These stability results are based on Stein's method and closed forms techniques. As an application, explicit rates of convergence are obtained for several instances of the generalized CLTs.

Auteur principal: ARRAS, Benjamin (Laboratoire Paul Painlevé, Université de Lille)

Orateur: ARRAS, Benjamin (Laboratoire Paul Painlevé, Université de Lille)

ID de Contribution: 2

Type: **Non spécifié**

Intertwinings and Stein's magic factors for birth-death processes

jeudi 23 mars 2023 14:00 (55 minutes)

We present some quantitative bounds on the so-called Stein magic factors of discrete distributions. These ones are obtained from intertwining relations between Markov semigroups of birth-death processes and discrete gradients. We also illustrate the application of this Stein magic factors for the convergence of the binomial negative law to the Poisson one.

Orateur: CLOEZ, Bertrand (INRAE Montpellier)

ID de Contribution: 3

Type: **Non spécifié**

Exponential convergence of Sinkhorn algorithm for quadratic entropic optimal transport

mardi 21 mars 2023 14:00 (55 minutes)

Over the past decade, Entropic Optimal Transport problem has emerged as a versatile and computationally more tractable proxy for the Optimal Transport (Monge-Kantorovich) problem for applications in data science and statistical machine learning. One of the reasons behind the interest in adding an entropic penalty in the Monge Kantorovich problem is the fact that solutions can be computed by means of Sinkhorn's algorithm, a.k.a. Iterative Proportional Fitting Procedure. While the exponential convergence of Sinkhorn's iterates is well understood in a discrete setting or for compactly supported measures and bounded costs, when moving to unbounded costs and non compact marginals the picture is far less clear. In this talk, we shall present an exponential convergence result in the landmark example of quadratic entropic optimal transport and approximately log-concave marginals. The main innovation in the proof strategy are new propagation of weak convexity results along Hamilton Jacobi Bellman equations, that may be of independent interest. Finally, we will highlight how Stein's method could potentially lead to improvement and extension of our results.

Joint work(s) with Alain Durmus, Giacomo Greco and Maxence Noble

Orateur: CONFORTI, Giovanni (CMAP École Polytechnique)

ID de Contribution: 4

Type: **Non spécifié**

Invertibility of functionals of the Poisson process and applications

mercredi 22 mars 2023 11:20 (55 minutes)

Joint work with L. Coutin

Solving the SDE $dX(t) = r(X(t))dt + dB(t)(1)$ is equivalent to invert the map $B \mapsto B(t) - \int_0^t r(B(s))ds$.

We study the analog of this problem on the Poisson space. Because of the Girsanov Theorem, it turns out that equivalent problem consists in inverting a time change.

We can then reinterpret the solution of the generalized Hawkes problem (find a self excited point process for a given compensator) as the analog to solving an SDE like (1). We then show a Yamada-Watanabe like theorem for weak and strong solutions to the Hawkes problem.

Some relationships are also established between Hawkes processes and directed transport between point processes.

Auteur principal: DECREUSEFOND, Laurent (LTCI, Télécom Paris)

Orateur: DECREUSEFOND, Laurent (LTCI, Télécom Paris)

ID de Contribution: 5

Type: **Non spécifié**

Malliavin calculus for marked binomial processes and Chen-Stein method

mardi 21 mars 2023 16:20 (55 minutes)

We can observe a clumping phenomenon when counting the number of series of t heads in a sequence of independent coin tosses or the occurrences of a rare word in a DNA sequence. The Chen-Stein method is an efficient tool to limit the approximation error when the law of the number of clusters can be approximated by a Poisson law (possibly compound).

We revisit this method by reducing these two problems to that of a Poisson approximation for functionals of marked binomial processes (MBPs), which are discrete analogues of marked Poisson processes. We then develop stochastic analysis tools and a Malliavin calculus for MBPs. Under this new formalism, we obtain a general criterion - for the distance in total variation - of the Poisson approximation for MBP functionals, in terms of Malliavin operators. In this talk, I will give elements of the Malliavin formalism for MBPs, state the general result of the approximation and illustrate it by applying it to the two situations of interest.

Orateur: HALCONRUY, Hélène (ESILV)

ID de Contribution: 6

Type: **Non spécifié**

Régularité des lois de formes quadratiques en des variables iid : une approche par forme de Dirichlet

mardi 21 mars 2023 11:15 (55 minutes)

Nous présentons une nouvelle approche pour étudier la régularité de la loi d'une variable aléatoire quand l'espace de probabilité est équipé d'une forme de Dirichlet. Plus précisément nous développons une nouvelle technique pour contrôler les moments négatifs du carré du champ d'une variable aléatoire et utilisons le résultat (bien connu) qu'un tel contrôle implique un contrôle sur les normes de Sobolev de la densité. Notre approche se base sur une représentation du carré du champ par des variables gaussiennes et un calcul explicite sur les variables gaussiennes. Je présenterai une application à la régularité des lois de la forme quadratique évaluée en une suite de variables iid.

Travail en collaboration avec Dominique Malicet et Guillaume Poly.

Orateur: HERRY, Ronan (IRMAR, Université de Rennes 1)

ID de Contribution: 7

Type: **Non spécifié**

Second order Poincaré inequalities and applications to geometric functionals

jeudi 23 mars 2023 09:45 (55 minutes)

Stein's method applied to orthogonal decompositions has allowed to establish second order Poincaré inequalities for random functionals of binomial input and Poisson input. We will show how to apply these inequalities, and in particular how they enabled to show limit theorems for geometric functionals for random processes defined on the Euclidean space or a smooth manifold.

Orateur: LACHIÈZE-REY, Raphaël (MAP5, Université de Paris)

ID de Contribution: 8

Type: **Non spécifié**

Total variation bound for Hadwiger's functional using Stein's method

mercredi 22 mars 2023 10:25 (55 minutes)

Let K be a convex body in \mathbb{R}^d . Let X_K be a d -dimensional random vector distributed according to the Hadwiger-Wills density μ_K associated with K , defined as $\mu_K(x) = ce^{-\pi \text{dist}^2(x,K)}$, $x \in \mathbb{R}^d$. Finally, let the information content H_K be defined as $H_K = \text{dist}^2(X_K, K)$.

In this talk, we will study the fluctuations of H_K around its expectation as the dimension d go to infinity.

Stein's method plays a crucial role in our analysis.

This is joint work with Valentin Garino.

Orateur: NOURDIN, Ivan (University of Luxembourg)

ID de Contribution: 9

Type: **Non spécifié**

The normal approximation of compound Hawkes functionals

mercredi 22 mars 2023 09:00 (55 minutes)

Joint work with N. Privault and A. Réveillac

We derive quantitative bounds in the Wasserstein distance for the approximation of stochastic integrals of deterministic and non-negative integrands with respect to Hawkes processes by a normally distributed random variable. Our results are specifically applied to compound Hawkes processes, and improve on the current literature where estimates may not converge to zero in large time, or have been obtained only for specific kernels such as the exponential or Erlang functions.

Orateur: KHABOU, Mahmoud (IMT, Université de Toulouse)

ID de Contribution: 10

Type: Non spécifié

Central convergence on Wiener chaoses always implies asymptotic smoothness and C -infinite convergence of densities

mardi 21 mars 2023 09:45 (55 minutes)

Let (F_n) be any sequence of Wiener chaoses of any fixed order converging in distribution towards a standard Gaussian. In this talk, without any additional assumptions, we shall explain how to derive the asymptotic smoothness of the densities of F_n , as well as the convergence of all its derivatives in every $L^q(\mathbb{R})$ for all $q \in [1, +\infty]$ towards the corresponding derivatives of the Gaussian density. In particular, these findings greatly improve the currently known types of convergence which are total variation and entropy that were obtained through Malliavin/Stein method.

Joint work with Ronan Herry and Dominique Malicet

Orateur: POLY, Guillaume (IRMAR, Université de Rennes 1)

ID de Contribution: 11

Type: **Non spécifié**

Stein's method for stability estimates of the Poincaré constant

mardi 21 mars 2023 14:55 (55 minutes)

The Poincaré inequality governs the exponential convergence rate of algorithms such as Langevin dynamics. Interesting questions are then to understand how the Poincaré constant changes when the dynamics is perturbed, or to understand when this constant is minimal under certain constraints. In this talk, I will present some such results in the context of Markov diffusions. Their proof is based in particular on Stein's method for general one-dimensional distributions.

Orateur: SERRES, Jordan (CREST - ENSAE)

ID de Contribution: 12

Type: **Non spécifié**

Central Limit Theorems for Poisson Random Waves

jeudi 23 mars 2023 14:55 (55 minutes)

We introduce a model of Poisson random waves in S^2 and we study Quantitative Central Limit Theorems when both the rate of the Poisson process and the frequency of the waves (eigenfunctions) diverge to infinity. We consider finite-dimensional distributions, harmonic coefficients and convergence in law in functional spaces, and we investigate carefully the interplay between the rate of divergence of eigenvalues and Poisson governing measures. The results were obtained exploiting Stein-Malliavin techniques on the Poisson space for the univariate and the multivariate case.

Orateur: TODINO, Anna Paola (Università degli Studi di Milano-Bicocca)