Matrices aléatoires et/ou probabilités libres

- Ashkan Nikeghbali (University of Zurich)

  Title: Random holomorphic functions associated with random matrix ensembles and a remarkable stochastic zeta function

  Abstract: In this talk I will show how one can naturally associate a random holomorphic function to the circular unitary ensemble, as a scaling limit of the characteristic polynomial, motivated by old and new conjectures in number theory and random matrix theory. Then I will make a connection to the Montgomery or GUE conjecture and show how one can actually associate a random holomorphic function to generic random matrix ensembles or sequences of converging point processes. Throughout the talk I will try to illustrate how questions related to the Riemann zeta function and random holomorphic functions can inspire each other.

- Pierre Tarrago (Sorbonne Université)

  Title: Spectral deconvolution with unitary invariant noise

  Abstract: The spectral deconvolution problem consists in extracting the eigenvalues of a noisy matrix. This deconvolution is often the first step to solve several matrix estimation problems. In this talk, I will present a method to achieve the spectral deconvolution in the high-dimensional setting by using tools from complex analysis. This method reduces the spectral deconvolution to the classical deconvolution of a Cauchy noise. Using old and more recent results on the classical deconvolution, I will finally explain how to get concrete bounds on the recovery of the spectral distribution method in the case where the noise is unitarily invariant. The first part of this talk is a joint work with Octavio Arizmendi and Carlos Vargas Obieta

- Slim Kammoun (ENS Lyon)

  Title: Méthode des moments pour des mots de permutations aléatoires

  Abstract: Tirons uniformément au hasard une permutation de taille N et intéressons-nous à des observables comme la longueur de la plus longue sous-suite croissante, le nombre de descentes, le nombre de cycles d'une taille donnée etc. Le comportement asymptotique de ces observables quand N devient très grand est bien compris. En particulier, il est facile de montrer que la loi jointe des petits cycles est asymptotiquement poissonienne. Si on considère maintenant non plus une permutation, mais un mot en plusieurs permutations uniformes indépendantes, on sait, par des travaux de Nica que le comportement asymptotique des petits cycles dépend de la structure algébrique du mot considéré. Étant donné que la structure en cycles d'une permutation encode son spectre, comprendre les petits cycles revient à comprendre les traces des puissances de cette permutation. Ainsi, la méthode des moments pour les matrices aléatoires s'avère être un outil efficace pour appréhender ces petits cycles. Dans cet exposé, je présenterai des travaux en commun avec Mylène Maïda (Université de Lille)

dans lesquels nous avons essayé de comprendre à quelles conditions (sur les lois des permutations et la structure du mot) les petits cycles du mot en les permutations gardent un comportement asymptotique similaire au cas uniforme.

- Issa Dabo (Université de Bordeaux)

  Title: High-dimensional analysis of ridge regression for non-identically distributed data with a variance profile

  Abstract: High-dimensional linear regression has been thoroughly studied in the context of indepen- dent and identically distributed data. We propose to investigate high-dimensional regression models for independent but non-identically distributed data. To this end, we suppose that the set of observed predictors (or features) is a random matrix with a variance profile and with dimensions growing at a proportional rate. Assuming a random effect model, we study the predictive risk of the ridge estimator for linear regression with such a variance profile. In this setting, we provide deterministic equivalents of this risk and of the degree of free- dom of the ridge estimator. For certain class of variance profile, our work highlights the emergence of the well-known double descent phenomenon in high-dimensional regression for the minimum norm least-squares estimator when the ridge regularization parameter goes to zero. We also exhibit variance profiles for which the shape of this predictive risk differs from double descent. The proofs of our results are based on tools from random matrix theory in the presence of a variance profile that have not been considered so far to study regression models. Numerical experiments are provided to show the accuracy of the aforementioned de- terministic equivalents on the computation of the predictive risk of ridge regression. We also investigate the similarities and differences that exist with the standard setting of independent and identically distributed data.

  Keywords: High-dimensional linear ridge regression; Non-identically distributed data; Degrees of freedom; Double descent; Variance profile; Heteroscedasticity; Random Matrices; Deterministic equivalents.