

Séminaire de Probabilités et Statistique

Mardi 18 octobre à 14h00

Salle de conférences

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The Kravchuk transform: a novel covariant representation for discrete signals amenable to zero-based detection tests

Recent works in time-frequency analysis proposed to switch the focus from the maxima of the spectrogram toward its zeros, which form a random point pattern with a very stable structure. Several signal processing tasks, such as component disentanglement and signal detection procedures, have already been renewed by using modern spatial statistics on the pattern of zeros. Tough, they require cautious choice of both the discretization strategy and the observation window in the time-frequency plane. To overcome these limitations, we propose a generalized time-frequency representation: the Kravchuk transform, especially designed for discrete signals analysis, whose phase space is the unit sphere, particularly amenable to spatial statistics. We show that it has all desired properties for signal processing, among which covariance, invertibility and symmetry, and that the point process of the zeros of the Kravchuk transform of complex white Gaussian noise coincides with the zeros of the spherical Gaussian Analytic Function. Elaborating on this theorem, we finally develop a Monte Carlo envelope test procedure for signal detection based on the spatial statistics of the zeros of the Kravchuk spectrogram.