Signal Processing with Lévy Information

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Abstract:
Lévy processes, which have stationary independent increments, are ideal for modelling the various types of noise that can arise in communication channels. If a Lévy process admits exponential moments, then there exists a parametric family of measure changes called Esscher transformations. If the parameter is replaced with an independent random variable, the true value of which represents a "message", then under the transformed measure the original Lévy process takes on the character of an "information process". In this paper we develop a theory of such Lévy information processes. The underlying Lévy process, which we call the fiducial process, represents the "noise type". Each such noise type is capable of carrying a message of a certain specification. A number of examples are worked out in detail, including information processes of the Brownian, Poisson, gamma, variance gamma, negative binomial, inverse Gaussian, and normal inverse Gaussian type. Although in general there is no additive decomposition of information into signal and noise, one is led nevertheless for each noise type to a well-defined scheme for signal detection and enhancement relevant to a variety of practical situations.
In this presentation we consider applications to the theory of finance. (Joint work with Dorje C. Brody, Brunel University, and Xun Yang, Imperial College London. The paper can be found at: arxiv.org/abs/1207.4028v1)