Approximating the first passage time density of diffusion processes using generalized Laguerre polynomials

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Abstract

I will describe a method to approximate the first passage time probability density function which turns to be particularly useful if only sample data are available. The method relies on a Laguerre-Gamma polynomial approximation and iteratively looks for the best degree of the polynomial such that a normalization condition is preserved. The proposed iterative algorithm relies on simple and new recursion formulae involving first passage time moments. If they are known, the approximated density can be used also for the maximum likelihood estimates of the parameters of the underlying stochastic process. To check the feasibility of the method both in fitting the density and in estimating the parameters, the first passage time problem of a geometric Brownian motion will be considered. Finally I will present some case-studies coming from neuronal and financial modeling to show the goodness of the proposed approximation even for a low number of terms of the approximating series.
The talk is based on joint works with *Elvira Di Nardo* and *Tommaso Martini*.