Workshop on Stochastic Analysis

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Fractional interacting particle system : drift parameter estimation via Malliavin calculus

Abstract

We address the problem of estimating the drift parameter in a system of N interacting particles driven by additive fractional Brownian motion of Hurst index $H \geq 1/2$. Considering continuous observation of the interacting particles over a fixed interval $[0, T]$, we examine the asymptotic regime as $N \to \infty$. Our main tool is a random variable reminiscent of the least squares estimator but unobservable due to its reliance on the Skorohod integral. We demonstrate that this object is consistent and asymptotically normal by establishing a quantitative propagation of chaos for Malliavin derivatives, which holds for any $H \in (0, 1)$. Leveraging a connection between the divergence integral and the Young integral, we construct computable estimators of the drift parameter. These estimators are shown to be consistent and asymptotically Gaussian. Finally, a numerical study highlights the strong performance of the proposed estimators.