

BIG DATA & ALGORITHMIC FINANCE



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Timothée Fabre is a DPhil Student in the MICS - Mathématiques et Informatique pour la Complexité et les Systèmes - at CentraleSupélec in Paris-Saclay University. He is supervised by Damien Challet and Ioane Muni-Toke and works closely with Sophie Laruelle. His research is focused on market microstructure, machine learning applied to optimal execution and high-frequency price manipulation detection.

His fascination with applying mathematics to solve real-world complex problems always drives his ideas throughout his research projects. This data driven mindset led him to work as a quantitative researcher at SUN ZU Lab while doing his Ph.D. SUN ZU Lab is a crypto start-up that collects and leverages proprietary high-frequency data to provide quantitative solutions to practitioners.

NEURAL HAWKES: NON-PARAMETRIC ESTIMATION IN HIGH DIMENSION AND CAUSALITY ANALYSIS IN CRYPTOCURRENCY MARKETS

Timothée FABRE, and Ioane MUNI TOKE.

We propose a novel approach to marked Hawkes kernel inference which we name the moment-based neural Hawkes estimation method. Hawkes processes are fully characterized by their first and second order statistics through a Fredholm integral equation of the second kind. Using recent advances in solving partial differential equations with physics-informed neural networks, we provide a numerical procedure to solve this integral equation in high dimension. Together with an adapted training pipeline, we give a generic set of hyperparameters that produces robust results across a wide range of kernel shapes. We conduct an extensive numerical validation on simulated data. We finally propose two applications of the method to the analysis of the microstructure of cryptocurrency markets. In a first application we extract the influence of volume on the arrival rate of BTC-USD trades and in a second application we analyze the causality relationships and their directions amongst a universe of 15 cryptocurrency pairs in a centralized exchange.

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