A Fast Initial Response Approach to Real-Time Financial Surveillance

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Abstract

Consider the problem of financial surveillance of a heavy-tailed time series modeled as a geometric random walk with log-Student's t increments assuming a constant volatility. Our proposed sequential testing method is based on applying the recently developed taut string (TS) univariate process monitoring scheme to the gaussianized log-differenced process data. With the signal process given by a properly scaled total variation norm of the nonparametric taut string estimator applied to the gaussianized log-differences, the change point detection procedure is constructed to have a desired in-control (IC) average run length (ARL) assuming no change in the process drift. If a change in the process drift is imminent, the proposed approach offers an effective fast initial response (FIR) instrument for rapid yet reliable change point detection. This framework may be particularly advantageous for protection against imminent upsets in financial time series in a turbulent socioeconomic and/or political environment. We illustrate how the proposed approach can be applied to sequential surveillance of real-world financial data originating from Meta Platforms, Inc. (FB) stock prices and compare the performance of the TS chart to that of the more prominent CUSUM and CUSUM FIR charts at flagging the COVID-19 related crash of February 2020.

Keywords: Geometric random walk; heavy tails; taut string (TS) chart; CUSUM FIR chart; FB stock