Non-Linear Time Series Models and Machine Learning

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We recently observed the irruption and rapid development of machine learning (ML) methods in econometrics and statistics, especially for forecasting purposes. For instance, ML methods have been recently used in several studies for forecasting economic and financial variables like assets returns (Gu, Kelly, and Xiu, 2020), stock and bond returns (Bianchi, Buchner, and Tamoni, 2021), volatility (Patton and Simsek, 2023), inflation (Medeiros, Vasconcelos, Veiga, and Zilberman, 2021), and macroeconomic variables (Goulet Coulombe, 2021; Goulet Coulombe, Leroux, Stevanovic, and Surprenant, 2022). An important common conclusion of these studies is that ML methods are successful in forecasting because they account for non-linearities that popular time series models do not. The first goal of the paper is to highlight the non-linearities that ML methods capture and connect them with traditional non-linear time series modeling. The second goal of the paper is to modify some traditional non-linear time series model by including insights from the ML literature. Applications to the Euro-US dollar exchange rate and the SPYDER index are provided.