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MODELING REALIZED VOLATILITY USING MACHINE LEARNING

Abstract:

This paper investigates the application of Machine Learning (ML) models to predict the intraday Realized Volatility (RV) of the S&P 500 stock index. Two ML models, Random Forest and Support Vector Regression (SVR), are trained using the VIX index (implied volatility of the S&P 500), along with Crude Oil and Gold volatility indices as independent variables. The performance of these models is compared with the traditional Vector Auto Regression (VAR) model. The results demonstrate that both ML models significantly outperform the VAR model, with at least an order of magnitude improvement in predictive accuracy. Notably, the Random Forest model identifies Crude Oil IV (OVZ) and Gold IV (GVZ) as critical predictors, even though these variables were non-stationary and less effective in the VAR model. This finding underscores the ML models' ability to capture complex, non-linear dependencies in the data, which traditional time series models struggle with. The study highlights the potential of integrating ML models into trading systems to enhance the efficiency of portfolio risk management, with the volatilities of Oil and Gold emerging as strong predictors of S&P 500 volatility.

Keywords:

implied volatility, realized volatility, machine learning, forecasting, artificial intelligence

JEL Classification: C22, C53, G17