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Bachelor Thesis

The Best of Both Worlds? Forecasting Realized Volatility Using a Hybrid CNN-HAR Model

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Abstract

This study introduces the CNN-HAR model, a novel approach for volatility forecasting that re-introduces modern deep learning techniques into classical econometric methods. The model leverages convolutional neural networks (CNNs) to predict day-ahead realized volatility. These predictions are included as additional regressors in the Heterogeneous Autoregressive (HAR) model. Using minutely return data from 28 stocks in the Dow Jones Industrial Average Index during 2010-2019, we find that the CNN components contribute significantly to explaining variation in day-ahead RV. This implies that the CNNs extract predictive patterns from intraday returns which provide additional information, beyond what is captured by the existing HAR framework. Surprisingly, a linear combination of the three CNN components outperforms the expanded CNN-HAR model in terms of out-of-sample forecasting. This study pioneers the fusion of CNNs with classical volatility forecasting, addressing interpretability issues in deep learning and allowing for comparability to relevant baseline models. The findings highlight the potential for improved forecasting and interpretability of hybrid models, emphasizing the value of combining deep learning with more traditional forecasting approaches.