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APPLICATION OF MACHINE LEARNING AND DEEP LEARNING TO PORTFOLIO OPTIMIZATION UNDER FORECAST ERROR IN THE VIETNAMESE STOCK MARKET

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ABSTRACT

This study proposes a methodological framework that integrates machine learning and deep learning models with portfolio optimization strategies, taking forecast errors into account, to enhance investment performance in the Vietnamese stock market. Specifically, four predictive models including Support Vector Regression (SVR), Random Forest (RF), Long Short-Term Memory (LSTM), and One-dimensional Convolutional Neural Network (1D-CNN) are implemented to forecast stock returns. These forecasts are then incorporated into two portfolio optimization models: the traditional Mean-Variance Portfolio (MVP) and the Mean-Variance with Forecasting (MVF) model. The empirical dataset comprises daily closing prices of stocks in the VN30 index over the period 2019-2023. The models are evaluated based on both forecasting accuracy and portfolio performance. The results indicate that strategies utilizing the MVF model outperform the MVP in terms of both average and cumulative returns, while maintaining low volatility. In particular, LSTM-MVF and SVR-MVF emerge as the most effective strategies, demonstrating strong adaptability under volatile market conditions. This study contributes to improving investment efficiency in emerging markets by combining advanced forecasting techniques with optimal asset allocation strategies, while highlighting the importance of forecast error as a critical factor in investment decision-making.

Keywords: Portfolio Optimization; VN30; Support Vector Regression (SVR); Random Forest (RF); Long Short-Term Memory (LSTM); One-Dimensional Convolutional Neural Network (1D-CNN)

JEL codes: C61, G11, G17

1. INTRODUCTION

Portfolio optimization plays a fundamental role in financial decision-making, aiming to achieve the best trade-off between expected return and risk. Since the pioneering work of Markowitz (1959), the Mean-Variance Portfolio (MVP) framework has been the dominant paradigm in this field, providing a mathematical basis for efficient diversification. However, the effectiveness of this approach is critically dependent on the accuracy of return forecasts, which remain a persistent

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