SUMMARY

This dissertation introduces a novel two-stage portfolio optimization framework that integrates deep learning-based return forecasting with coherent risk management techniques. In the first stage, three predictive models—Linear Regression, Random Forest, and Long Short-Term Memory (LSTM) neural networks—are evaluated to forecast stock returns based on historical data from 28 publicly listed companies and the S&P 500 index which serves as a benchmark for these companies. The LSTM model demonstrates superior predictive accuracy, validated through an extended out-of-sample testing period covering both realized and forecasted returns from early 2025. Model performance was assessed using Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and Mean Absolute Error (MAE), confirming the strength of LSTM in anticipating future market behavior. Building on these forecasts, the second stage formulates and compares three portfolio optimization models: (1) Traditional Mean-Variance Optimization (MVO), (2) a Value-at-Risk (VaR)-constrained model, and (3) a hybrid LSTM-based model embedding expected returns into a Conditional Value-at-Risk (CVaR)-constrained MVO framework. Alpha was estimated using the Capital Asset Pricing Model (CAPM), and only stocks exhibiting positive alpha during the predictive test period were included in the optimized portfolio to enhance selection precision. Empirical findings indicate that the proposed Hybrid LSTM–CVaR–MVO model significantly outperforms alternative strategies in balancing return generation and downside risk control. By integrating predictive analytics with advanced risk-sensitive optimization, this research offers a data-driven and adaptive framework for strong portfolio construction under uncertainty. It contributes to the intersection of financial econometrics and artificial intelligence, with practical applications for institutional asset managers and algorithmic trading platforms operating in volatile environments.

Keywords: Portfolio Optimization, LSTM, Conditional Value at Risk (CVaR), Deep Learning, Asset Allocation, Machine Learning, Risk Management, Mean-Variance Optimization, Value at Risk (VaR).