



The Application and Effectiveness of Machine Learning and Deep Learning Methods in Analyzing and Predicting the Shanghai Stock Index

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Abstract

In recent years, stock price prediction has become a pivotal area of research in finance and economics, attracting significant attention because of its potential for generating profits and managing risk. Financial markets, characterized by high volatility, nonlinear dynamics, and complex endogenous patterns, present considerable challenges for investors and analysts. The Shanghai Stock Exchange, one of the largest and most dynamic markets in Asia, has garnered significant interest from researchers and market participants alike because of its sensitivity to economic, political, and social factors.

This article evaluates and compares the performance of traditional time series models, including the Random Walk model, which is considered a key benchmark and is aligned with the Efficient Market Hypothesis, alongside modern machine learning and deep learning techniques for predicting stock prices in the Shanghai Stock Exchange. The impact of data preprocessing techniques and feature selection on the accuracy of these models is also examined. Additionally, an innovative hybrid model, ARMA-CNN-BiLSTM, is proposed, which combines the classical ARMA model with advanced neural networks such as CNN and BiLSTM. This hybrid approach enhances the extraction and analysis of temporal and spatial patterns from financial data, yielding better results compared to the CNN-BiLSTM model. Since the Random Walk model is used as a benchmark in this study, the more the implemented models outperform this benchmark, the more the Efficient Market Hypothesis, which suggests that market prices fully and instantly reflect all available information, will be challenged.

Keywords: Stock market price prediction, Machine learning, Deep learning

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