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Predicting Market Performance Using Machine and Deep Learning Techniques

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Abstract: *Stock market movements have long been characterized by uncertainty due to the influence of numerous dynamic factors. This study aims to reduce the risk associated with trend prediction by leveraging a combination of machine learning (ML) and deep learning (DL) algorithms. Four key sectors from the Tehran Stock Exchange—diversified financials, petroleum, non-metallic minerals, and basic metals—are selected for empirical evaluation. The study examines nine machine learning models (Decision Tree, Random Forest, Adaptive Boosting (AdaBoost), eXtreme Gradient Boosting (XGBoost), Support Vector Classifier (SVC), Naïve Bayes, K-Nearest Neighbors (KNN), Logistic Regression, and Artificial Neural Network (ANN)) alongside two advanced deep learning techniques: Recurrent Neural Network (RNN) and Long Short-Term Memory (LSTM). Input features are derived from ten technical indicators based on ten years of historical data, applied through two approaches: (1) as raw continuous data calculated from stock trading values, and (2) as binarized data through thresholding. Each model's performance is evaluated using three standardized metrics under both data formats. Results indicate that RNN and LSTM significantly outperform traditional ML models when using continuous data. Although these DL models also maintain a leading position in binary data evaluations, the performance gap narrows due to notable improvements in ML models when using binarized inputs. This comparative analysis highlights the effectiveness of deep learning in capturing complex temporal patterns in financial data and demonstrates the impact of data representation on predictive accuracy.*

Keywords: Machine Learning, Deep Learning, Stock Market Prediction, Data Representation, Tehran Stock Exchange.

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