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# **Time-series Application Research**

CPE 019 - CPE32S3

By Irish Dela Cruz

**“Forecasting Stock Market Prices Using Machine Learning and Deep Learning Models: A Systematic Review, Performance Analysis and Discussion of Implications”**

**Author:** Tej, B.S., Shrestha A,. Neupane, A., Guo W., (2020)

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**Conference:** International Journal Financial Studies (2023), 11(3), 94

**Problem:**

The forecasting of stock prices is challenging in the financial market due to complexity and the several factors influencing market dynamics. Traditional econometric models often struggle to capture the non-linear patterns and sudden changes in stock prices, leading to inaccurate predictions. This highlights the need for improvement and more advanced techniques that can better capture the dynamic nature of stock price movements.

**Motivation of Authors:**

The authors were motivated by increasing interest in applying machine learning techniques to financial forecasting tasks, particularly in predicting stock prices by improving the models accuracy. Traditional econometric models often fail to capture nonlinear patterns and sudden changes in stock prices. To address this issue, the researchers are exploring the potential of machine learning algorithms by comparing them to each other to identify strengths and weaknesses in the dynamic nature of stock prices movements. The study aims to contribute to the advancement of predictive modeling in financial markets [[1]](https://www.mdpi.com/2227-7072/11/3/94).

**Solution:**

The authors of the research paper proposed to compare the performance of several machine learning techniques, including the Integrated Moving Average (ARIMA), Long Short-Term Memory (LSTM) networks, Support Vector Machine (SVM), and Random Forests, in forecasting stock prices. By implementing these algorithms on the history of time series data, the study aims to identify the most effective model for stock price prediction. Additionally, the authors investigate the impact of feature selection and preprocessing techniques on forecasting accuracy to improve the robustness of the model. The study will provide useful recommendations and the future researchers can explore the outcomes derived from various deep learning models in terms of time-series development.

**Methodology:**

The authors first collect all the data from several companies over a significant period from a reliable financial database.Next, they preprocess the data to handle missing values, outliers, and other necessary procedures. Also, feature engineering techniques may be applied to extract relevant features from the raw data. Then, they develop models, including ARIMA, LSTM networks, SVM, and Random Forest, trained using historical stock price data. The trained models are evaluated using a portion of the dataset for testing, where performance metrics like Mean Absolute Error (MAE), Mean Squared Error (MSE), and accuracy are computed to assess the accuracy of each model. Finally, the authors compare the performance of each model based on the evaluation of metrics and analyze the impact of factors like feature selection and preprocessing techniques on forecasting accuracy.

**Result:**

The results of the study stated that LSTM networks outperform other learning models in forecasting stock prices, with lower MAE and MSE values. However, the performance of each model depends on the dataset and hyperparameters. Additionally, it is observed careful preprocessing of data, such as feature selection and normalization scaler, significantly improves the accuracy of stock price forecasts. The model’s prediction is high, and the predicted value floats around the true value. The prediction error is lower than other models, indicating the effectiveness of the WLSM+Attention Model. The study concludes that the proposed model has a better fitting degree and improved accuracy of prediction result, making it highly competitive with existing models.

**Recommendations:**

* I highly recommend that approaches such as data preprocessing and feature selection are very important in enhancing forecast accuracy and suggest further research to explore advanced machine learning algorithms and incorporate additional features for more accurate stock prices predictions.
* I highly recommend considering or choosing the specific requirements and characteristics of your dataset when selecting the most suitable forecasting model.
* I suggest the adoption of LSTM networks for stock price predictions tasks due to superior performance compared to other machine learning.
* I suggest adding data predictions related to stock-related news and basic information to enhance the stability and accuracy of the model in case of a major event.

**References:**

[**[1]**](https://www.mdpi.com/2227-7072/11/3/94) **Dharrao et. al (2023)** compared the performance of machine learning and deep learning models for stock market price forecasting and found that SVM can be the most useful technique for predicting stock price.