HYBRID CNN-LSTM MODEL FOR MINUTE-WISE STOCK MARKET PRICE PREDICTION

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

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Name of the supervisor: Dr. Sapumal Ahangama

Signature of the supervisor: Date:

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Abstract

Stock market prediction is considered as a challenging problem because of the non-linear and dynamic price changes in stock markets. And need to deal with high volume and high frequency data. Despite the fact that a variety of machine learning and deep learning approaches can be applied to construct prediction algorithms, stock value prediction is difficult due to the high frequency data. Economic factors such as change in corporate policy, economic shifts, expectations of investors, other stock markets' movements and government change influence the stock market movements. When developing a prediction model, these influenced factors need to be considered to get highly accurate results. The successful stock market prediction results in better decisions and high profits.

Minute-wise stock market prices provide better understanding about stock price behavior within a particular day. Since it is very important to thoroughly analyze stock price behavior to make trading decisions, analyzing and predicting trading trends within a day is very crucial. Rather than predicting daily close price, open price and highest price, if we can predict the next upcoming couple of minutes or hours stock price with highest accuracy, then it is a great improvement in stock market prediction. Stakeholders including buyers and sellers can get good predictions and they can make proficient decisions on time.

This paper considers implementing a hybrid CNN-LSTM model to predict minute wise stock market prices by using minute-wise stock market data which provides a best performance. Stock market data of different companies including Apple, Google and Amazon were collected from Yahoo Finance API. As for the evaluation, several benchmark models were created and compared their performance with the proposed model. Furthermore, proposed model was evaluated using various datasets and timeframes. The next 5 minutes forecasted stock prices were compared with the actual prices and measured the performance of model. In this research, as for the evaluation metrics, Mean Absolute Percentage Error and Root Mean Square Error were used and the best model was selected considering the validation results. Models were fine-tuned using different time windows, model parameters and selected the best parameters for the forecasting model. Finally, the proposed model outperformed the state-of-art models for predicting short-term stock market values.

Keywords - Deep learning; LSTM; CNN; Hybrid CNN-LSTM; Machine Learning; Stock price prediction;

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LIST OF ABBREVIATIONS

Abbreviation	Description
ANN	Artificial Neural Network
RF	Random Forest
CNN	Convolutional Neural Network
RNN	Recurrent Neural Network
NN	Neural Network
MAPE	Mean Absolute Percentage Error
LSTM	Long Short-Term Memory
SVM	Support Vector Machine
RMSE	Root Mean Square Error
HMM	Hidden Markov Model
DL	Deep Learning
SVR	Support Vector Regression