USD to IDR Price Predictor Using LSTM

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***Abstract*—Trading analysis to predict the future price movement is a hard thing. The price movement history is used to predict using several indicators. It can either gain us profit or lose our money. Unfortunately, amateur traders rarely know about predicting the financial instrument using indicators. They tend to follow recommendations. Therefore, price prediction using LSTM RNN can be implemented to help amateur traders making decision.**

Keywords—LSTM, RNN, Currency, Prediction, Machine Learning, Deep Learning

I. INTRODUCTION

Nowadays, trading is a trend that almost every people know. The trend starts from the COVID-19 market crash. During that time, a lot of people seeking opportunity in the market which is in a high volatility. The market is basically an aggregation of various buyers and sellers. The more buyers and sellers result in higher volatility of that market. There are several markets for traders to choose, such as currencies, stocks, and cryptocurrencies. They need to predict or determine the future value of the financial instrument. The successful prediction will result in getting significant profit and vice versa.

The stocks or usually known as shares represents the ownership claims of a company or business by an individual or group of people. The currencies market is the exchange rate of a pair currencies. Most of currency trading uses forex system. The last market is cryptocurrencies market. It is the newest from the other markets which is a digital currency market.

Every market has its own characteristic and prediction technique. The price prediction for short term appears to be a gamble process, but the price movement over a long period usually develops a linear curve.

Machine Learning is defined as a way of making computer, robot, or software that thinks intelligently or thinks similarly to human. It solves a certain problem same as human did. Machine is one of the Artificial Intelligence applications, which provides computer systems the ability to learn and adapt to a certain condition without any explicit programming. It starts by observing data given to them and learn to predict the data.

Deep Learning is part of Machine Learning based on Artificial Neural Networks in which multiple layers of processing are used to extract the features from the data. Several types of models in deep learning are Convolutional Neural Network (CNN), Long Short Term Memory (LSTM), Recurrent Neural network (RNN), etc.

Based on the problem, the LSTM RNN model from Machine Learning will help amateur traders to predict the price movement.

II. TEORITICAL EXPLANATION

1. Deep Learning

Deep Learning is a type of machine learning below the Artificial Intelligence field where computer learn the way of human thinks to gain certain knowledge. It is an important element in data science. It can predict or classify data to be further analyzed by data analyst or data scientist.

Deep Learning uses neural network models which enable them to learn the problem given to them based on the training data. Each algorithm of deep learning basically creates a statistic model to accommodate the input and output given (supervised learning). The process of learning is divided based on iterations. Every iteration goes through the whole data once. The iteration will end until it reaches the maximum iteration or reaches acceptable accuracy.

Deep Learning requires immense amounts of training data and processing power to create a complex statistical model. The training data also needs to be ensured that it has balance amount of data for each class. A balanced and immense amount of training data will result in a great performance deep learning model.

There are various methods to create strong deep learning models, such as learning rate decay, transfer learning, training from scratch and dropout. Every method has its own advantages and disadvantages that will suit different conditions.

Learning rate decay method uses a hyperparameter named learning rate to control how much change the model experiences in response to the estimated error every time the model weights are altered. The learning rate set for deep learning model should not be too high or too low as it may result in unstable training for high learning rate and lengthy

training process for low learning rate. Therefore, learning rate decay method adapts the learning rate to increase performance

Transfer Learning method is the easiest way to train deep learning models. It is basically a pretrained model that is trained further to adjust the model according to the task with specific category. The main advantages are fewer training data needed and less computation time.

Training from Scratch method is the hardest method yet the most time-consuming method. The methods starts by creating the model architecture and collecting immense data for training.

Dropout method tries to solve the overfitting problem in deep learning model by randomly dropping units and their connections from the neural network during training. It can improve the performance of the neural networks.

2. Recurrent Neural Network (RNN)

Recurrent Neural Network is a neural network that contains loops, allowing information to be stored in the network (learning from experience). RNN has a chain-like structure that is suitable for speech recognition, language translation, etc. The input, output, or both is usually a sequence of vectors.

Recurrent Neural Network applications are usually in deep learning or machine learning. An example of RNN application is determining likelihood of words in a sentence.

3. Long Short Term Memory (LSTM)

Long Short Term Memory networks are a recurrent neural network capable of learning order dependence in sequence prediction problems. It uses the structure founded on short-term memory process for creating longer-term memory. It solves complex problems like speech recognition, machine translation, etc.

III. METHOD

The experiment that we are going to conduct is creating a price movement predictor for currency exchange rate. The predictor uses the Long Short Term Memory to predict the future price movement based on the previous price movements.

The programming language that we used in this experiment is the most used programming language which is Python as it is easy to use and fast. Some of the libraries that will be used are Numpy, Matplotlib, Pandas, Math, Tensorflow, and Scikit-learn.

The data that we are going to use is taken from Kaggle. It is a dataset of USD to IDR exchange rate from 2001 to 2021. It has several features that we can extract, such as open price, high, low, close price, and adjusted close price for every day.

Dataset link: https://www.kaggle.com/konradb/foreign-exchange-rates-2003-2021?select=USDIDR_series.csv

There are several steps to conduct this experiment. The steps for the experiments are:

1. Data preprocessing

The raw data taken from Kaggle dataset needs to be preprocessed. The preprocessing includes feature selection, normalization, and splitting into training and testing dataset.

2. Model Creation & Training

The first thing to do is to create an LSTM model to accommodate the prediction task. After that, we train the model until it reaches acceptable accuracy. The model will also need to be check whether it experience overfitting or underfitting during the training.

3. Testing & Evaluation

The last but the most important step is testing and evaluation. We evaluate the model performance based on testing dataset given to the model. The evaluation variables may be varied according to the input and output. In this experiment, the evaluation variable is Root Mean Square Error (RMSE) which is suitable for getting the difference between the predicted price and ground truth price. Smaller RMSE means the predicted price is nearer to the ground truth price.

$$RMSE = \sqrt{\sum_{i=1}^{n} \frac{(\hat{y}_i - y_i)^2}{n}} \quad (1)$$

Difference (%) = RMSE / Average Closing Price x 100% (2)

IV. RESULT

The model that we have created and trained gives a positive result based on the train RMSE and test RMSE. The train RMSE for this model is 269.37 and the test RMSE for this model is 201.36. The average of train dataset closing price is 10269.03 and the average of test dataset closing price is 14259.97.

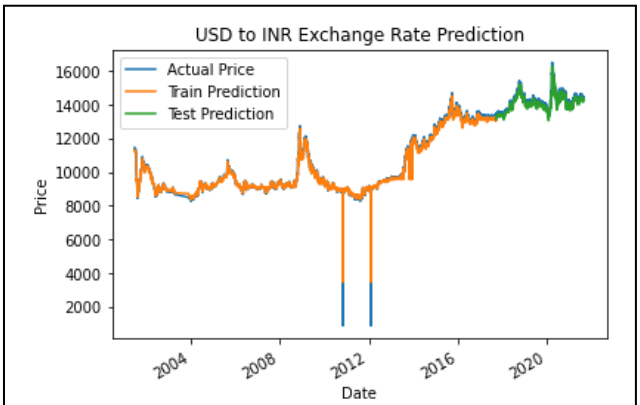

Figure 1. Prediction Result Graph

V. DISCUSSION

Based on the results that we've got, the train RMSE is only 2.62% compared to the average closing price and the test RMSE is only 1.41% compared to the average closing price. The model has a quite small error in terms of predicting the price exchange rate, but the data especially

the closing price in 2012 has a quite large drop that makes the model harder to fit the data. Therefore, the train RMSE is much larger than the test RMSE.

VI. Conclusion

We can conclude that the model able to predict the price quite well using the LSTM model and it should get better with more train data.

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