A REVIEW ON DEEP NEURAL NETWORK APPROACH FOR FORECASTING TIMESERIES DATA ON FOREIGN EXCHANGE RATES

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Abstract: *Research on foreign exchange (Forex) forecasting has long been valuable. Applications of deep learning have shown better accuracy and return in the field of financial forecasting and prediction. Financial data is one type of historical time series data that provides a wealth of information and is frequently used in data analysis tasks. With each new development in technology, algorithms are modified to understand the nature of persistent events. Deep learning is one of the best time series forecasting techniques. Deep learning techniques can automatically extract features, manage massive datasets, discover linear and nonlinear relationships, and capture temporal dependencies from sequential data—even when there is noise and missing values. In order to increase the performance of existing networks in time series forecasting, it is thought that modeling exchange rates is a difficult issue when it comes to financial time series forecasting because of their unpredictability. This work adds to the body of research on deep learning by investigating whether Deep Learning models are appropriate for forecasting exchange rates.*

Keywords: Deep Learning, Time series, Forex, Forecasting

1. Introduction

The largest currency exchange market in the world is the foreign exchange (forex) market, which sees daily trades of about $5.1 trillion [1]. Despite the fact that precise results are notoriously difficult to come by due to the significant volatility of currency rates, interest in currency rate forecasting has recently surged [2]. The relative values of various currencies serve as the foundation for the trade and investment decisions made by governments and corporations. When forex rate forecasts are accurate, traders and investors can make significant profits with little risk [3, 4]. The data is gathered as a time series to comprehend the influence on currency rates since political and economic factors affect the market. Because of this, it is difficult to create a model that can manage unpredictable inputs and anticipate currency rates with accuracy [5].A prediction model can identify past and future market events using time series data since the market is dynamic [6]. Numerous models for forecasting currency rates are presented in the literature. Researchers use a variety of methods to develop reliable models for handling financial time-series data [7, 8].

These models may be based on statistics or soft computing, with the latter producing better prediction outcomes [9]. Financial time-series prediction commonly uses well-known statistical models such as autoregressive moving average (ARMA) [10], autoregressive integrated moving average (ARIMA) [11], etc. These models forecast future events by using historical data that has been taken from time-series data. Because soft computing-based algorithms are stable and able to handle any type of non-linear data, they are more effective at predicting currency rates. Artificial neural networks (ANN) [13], fuzzy set theory [12], and support vector machines (SVM) [14] are examples of soft computing techniques that are commonly used in literature. To optimize returns, these models consider the important variables and choose the right exchange rate. In soft computing, neural network models outperform alternative methods in terms of performance [15]. As a result of this requirement, hybrid models were created, combining elements of several neural network types, statistical models (such as ARIMA), optimization techniques, etc.

Performance rates are higher in hybrid cars than in non-hybrid ones. The stability of processing a variety of huge datasets is maintained through the hybridization of deep learning models for prediction, which handle non-linear data. Decisions must be made quickly and carefully, considering all relevant elements, in order to improve forecast accuracy [19]. Q-learning models stand out in the setting of time-series data because they continue to generate optimal decisions as the number of prediction days is increased [20]. In order to predict the exchange rates, a hybrid strategy that blends Q-learning with a powerful deep learning model has been put out. In order to maximize returns while lowering risk, this model suggests suitable trading rules.

2. Related Work

Even time-series datasets with non-linear patterns can be handled by deep learning models. As a result, when predicting currency rates, scholars favor using these models. Using various methodologies and learning models, the following are some of the most recent methods for predicting future exchange rates: Over time, time series analysis improves the accuracy of economic factor forecasts. Because exchange rates fluctuate across a range of time periods, this study is useful for predicting future exchange rates. Joarder Kamruzzaman [1] developed and analyzed three Artificial Neural Network (ANN) based forecasting models using Standard Backpropagation (SBP), Scaled Conjugate Gradient (SCG), and Backpropagation with Bayesian Regularization (BPR) for Australian Foreign Exchange to forecast six different currencies against the Australian dollar. Five moving average technical indicators are used in the construction of the models. These models were evaluated using three performance metrics, and they were contrasted with ARIMA, the most popular conventional forecasting model.

Every ANN-based model performs worse than the ARIMA model. SCG-based models are found to perform the best. Yasiret al. [21] suggested a novel intelligent model that takes the sentiments of the events into account in order to forecast the daily FX rates. The deep learning system was used to forecast the exchange rates. The approach was based on the idea that social and political news had a big influence on the currency market, thus it took that into account to make more accurate predictions. Important factors, including the price of crude oil and the index of gold prices, were included in the model's construction. The model produced the greatest results when we examined its ability to predict the HKD/USD, GBP/USD, and PKR/USD exchange rates. To increase the precision of currency rate forecasts, Fu et al. [22] introduced an extra model.

A genetic algorithm (GA) was used to develop one of the two SVR-based models, while particle swarm optimization (PSO) was used to improve the other. By controlling the arbitrary SVR parameters, those evolutionary algorithms assisted in lowering mistake rates. One of the primary objectives of the model was to forecast the value of the RMB, or Chinese yuan, in relation to the US dollar, the euro, the British pound, and the Japanese yen. On several criteria, the PSO-SVR and GA-SVR models performed better in the tests than the comparator algorithms. When it comes to predicting future exchange rates, hybrid models outperform non-hybrid models.

Das et al. [23] combined a neural network model with an optimization technique to create a hybridized forecasting model that can forecast currency exchange rates. To predict the exchange rates between the US dollar and the Euro and the US dollar and the Indian rupee, the model combined an optimization algorithm with an extreme learning machine (ELM). Both statistical and technological metrics were used to make forecasts throughout a variety of time periods.

According to the evaluations, technical indicators would be the most successful way to predict future currency rates in addition to yielding more accurate estimates. When the number of days to be anticipated was increased, the system's main fault became apparent: the prediction results were limited. Islam and Hossain [24] used a novel hybrid network model consisting of two neural networks to increase prediction accuracy. Future closing prices of foreign currencies were predicted using network models like the gated

recurrent unit (GRU) and the long short-term memory (LSTM). With 20 hidden neurons, the GRU layer served as the network's initial building component. The LSTM layer, which had 256 hidden neurons, was the network's second building block. This prediction is based on four different currency pairings: USD/CHF, USD/CAD, EUR/USD, and GBP/USD. According to the tests, this model outperformed the independent LSTM and GRU models in terms of prediction accuracy.

Accurate currency rate forecasts are necessary in a variety of domains, such as monetary policy, financial management, and international business. It is necessary to be knowledgeable about political and economic developments in order to make accurate predictions. Shenet al. [5] proposed a hybrid approach to predict seven nations' currency rates from 1971 to 2017.The FSPSOSVR system was developed by combining PSO and random forest (RF) with support vector regression (SVR). RF was used for feature selection, and PSO was used to optimize SVR parameters. Despite having outstanding prediction capabilities, the model was unable to account for price increases.

Alexander Jakob al. [28] investigate the possibilities of deep learning for forecasting the exchange rates of the Euro (EUR), British Pound (GBP), Japanese Yen (JPY), and Swiss Franc (CHF), all of which are valued in relation to the US dollar (USD). They carefully compare feedforward networks, extended short-term memory networks, and gated recurrent units with traditional recurrent network topologies in terms of the accuracy of directional forecasting and the profitability of trading model projections. Empirical results demonstrate that deep networks are often appropriate for exchange rate forecasting, but they also emphasize how difficult it is to create and optimize related architectures.

3. Conclusion

This study examined studies on forecasting changes in stock and currency prices from 2015 to the present using deep learning algorithms. The existing Forex models were evaluated by looking at data sets, variables, the use of different models, and evaluation measures. The paper review covers a wide range of deep learning techniques, including CNN, LSTM, DNN, RNN, reinforcement learning, and additional methods including DQN, NLP, and Wavenet. The data sets, variables, and models of each technique were also analyzed and compared, along with the different results they yielded. The study also discusses each model's key performance indicators. Accuracy, return rate, Sharpe ratio, RMSE, MAPE, MAE, and MSE are some of these. This study aimed to further the field of Forex market prediction research by analyzing the different deep learning prediction models previously discussed. There aren't many studies that combine multiple deep learning techniques, especially when it comes to other deep learning techniques, as the research makes clear. There are positive signs that the hybrid networks need more research. In the future, we will create a specific hybrid model to predict the Forex market based on the previously provided data..

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