Forecasting Trading-Time based Profit-Making Strategies in Forex Industry: Using Australian Forex Data

Mihiran Rupasinghe
Technium eCommerce
Melbourne, Victoria 3000, Australia
mihiran@technium.com.au

Malka N. Halgamuge, Senior Member, IEEE
Dep. of Electrical and Electronic Engineering
The University of Melbourne
Victoria 3010, Australia
malka.nisha@unimelb.edu.au

Nguyen Tran Quoc Vinh
Faculty of Information Technology
The University of Da Nang - University of Science and Education, Vietnam
ntquocvinh@ued.udn.vn

Abstract: Due to the constant fluctuation on global currency rates, it is challenging to make predictions on trading in foreign exchange (Forex) currency market without an intensive analysis; hence, traders struggle to make a profit. This study aims to analyze the relationship between the trade open time and profit in the Forex currency market to help traders to increase the chance of winning trades and make a profit. We developed a technique to observe the most suitable time duration to trade and the profit. This technique assists traders to enhance the chance of winning trades and make a profit by identifying whether it is more likely to make a profit when they keep the trade opened for a longer time or a shorter time. A Forex dataset (*N=1,000,000* trades) from a third-party broker database based in Australia has been used. The collected data were filtered according to the popularity of currency pairs. Five currency pairs (as EUR vs USD, GBP vs JPY, USD vs JPY, GBP vs USD and EUR vs JPY) were further analyzed using Support Vector Machine (SVM) with the Radial Basis Function (RBF) kernel and K-Means clustering algorithms. It showed that EUR vs USD and USD vs JPY have sensitive movements of profit with the trading time. The highest profit was observed trading time in between 5 to 15 minutes. Our analysis illustrates that shorter time traders are making more profits than the longer time traders. Hence, this study demonstrates that Forex traders make a profit when the market has a unique volatile situation. This study should be useful as a reference for researches in Forex market analyses and Forex Industry to utilize profit-making strategies.

Key Words— *Forex industry, Volatile market, Open price, Close price, Volume, Currency rate, Support Vector Machine, K-Means clustering algorithms*

1. INTRODUCTION

Forex industry is one of the biggest currency markets in the world today. It has changed significantly during the last year and strives towards a legitimate trading environment [1] with the growth of the market and daily trade volume of over $5 trillion a day which is over 200 times bigger than the New York Stock Exchange [2]. The most emerging question for Forex traders is how to make a profit from currency trading industry. Therefore, this study utilizes a k-means clustering model and the SVR radial basis kernel to analyze the trade open time and the profit movement of the foreign exchange market. For the analysis, data is collected from a third-party broker database and used major forex currencies such as EUR/ USD, USD/ JPY, GBP/ JPY, GBP/ USD and EUR/ JPY.

The initial study of the problem domain background showed that there were a few past researchers in the area who had a passion for the forex market. Most of the research studies were conducted to predict the next day exchange rates so the traders can make decisions whether to buy or sell.

Xuan et al. [3] implemented the Support Vector Machine (SVM) model to predict the currency rate using actual forex transactions. They believed that it might help to make transaction decisions in the market (buy or sell). Their research shows the advantages of using SVMs compared to the transactions without using SVMs. On the other hand, Raimundo et al. [4] have predicted using Wavelet Support Vector Regression model and a hybrid and adaptive model for prediction which combine Support Vector Regression (SVR) and Wavelet [4]. In another study, Taveeapiradeecharoen et al. [5] applied Dynamic Model Averaging (DMA) to predict the rates for most traded Forex such as EUR/USD, GBP/USD and JPY/USD. The results showed that AR modal and TVP AR modal were the most accurate predicting models for USD/JPY [5]. A few methods were applied to find a model with the best prediction percentage to forecast the most accurate results from 14/08/2017 to 02/02/2018. Moreover, Tuchsanai [6] found that most of the analysis methods like exponential moving average (EMA) and simple moving average (SMA) are impossible or very difficult to predict due to the uncertainty of Forex currency prices.

The results proved that the Artificial Fish Optimization algorithm could be used to obtain higher prediction accuracy. In another research, Yaroslav et al. [7] investigated and designed a neural network model for Forex market prediction based on the historical data movement of USD/EUR currency pair exchange rates. They found that neural networks offer autocorrelation analysis and the estimation of possible errors in forecasting. The empirical data used in the model of neural networks are related to the exchange rate of USD/EUR during

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23/04/2012 - 04/05/2012. The results show that the model can be used for Forex market prediction. The neural network forecasting modal was designed by selecting high and low indicators as parameters of forecasting. The statistics data from 02/09/2010 to 20/04/2012 were taken as the training sample. Machine learning seems to be an excellent mechanism to get on decision making [8, 9] since it establishes some unexplained correlations in various characteristics in any application.

Most of the previous studies predicted the next day value of a currency pair. Hence, traders can make decisions about buy or sell. Most of them have used SVR regression and Neural networks to predict the price. In this study, the main aim was to find a correlation between trading time and profit. Consequently, traders can increase their advantage by focusing the trading time as well.

Paper Contributions

The main contributions of this paper include the following:

1. Develop a new method to identify the most valuable trading time and profit in the Forex currency market to help traders to increase the chance of winning trades and make a profit.
2. Conduct an extensive analysis for a trade opened time and profit using 1,000,000 Forex datasets from a third-party broker database based in Australia.
3. Compute prediction accuracy of profit using radial basis kernel function in Support Vector Regression (SVR).
4. Compare difference currency pair spreads in related to profit and trade opened time using K-means clustering.

In Section 2, we describe the material and methods of the study. Section 3, we explain the results and the discussion of the results in Section 4. Finally, the study is concluded in Section 5.

2. MATERIAL & METHODS

This section discusses materials and methods used for this study: 1) data collection; 2) classification and clustering framework; and 3) data analysis. Figure 1 shows the steps by step procedure to analyze the dataset and to observe the relationship between the trade open time, close time and profit in Forex currency market to assist traders to enhance the chance of winning trades and make a profit.

A. Data Collection

Step 1:

First, it was necessary to collect real data set for the analysis. For that, a large dataset was collected from a financial broker company based in Australia. Data was gathered (Table 1) according to the following format.

Table 1: Attribute description used in data collection

Attribute	Definition
OPEN_PRICE	Price when a trader opens the trade
CLOSE_PRICE	Price when a trader closes the trade
VOLUME	Number of lots/volumes traded
BUY/SELL	BUY trade or SELL trade
PROFIT	Profit made on that specific trade
TIME	Trade was open for a long time or short time: 1 for long and 0 for short (anything below 4 hours considered a short time)
TRADE OPEN TIME	Time duration Forex traders keep the trade opened (closed time - opened time)

Step 2:

In this dataset, we categorized each trade into long-time trade and short-time trade. Trades which are less than 4 hours were considered as short time trades, and all other trades were considered as long-time trades.

B. Data Analysis

Step 3:

We analyzed the data using Support Vector Regression (SVR) radial basis kernel to calculate the prediction accuracy. Traders will be able to get an idea of what kind of trade they have to place to make a targeted profit.

Step 4:

After that, the K-Means clustering algorithm will be applied to find out the actual spreading of the data with trading time and the profit. From this analysis, traders will be able to identify what is the most profitable time period for specific currencies. This research is based on the five most popular currency pairs in the world, including EUR vs USD as well.

Step 5:

We propose a method to identify the most suitable time duration of trading time by clustering the dataset based on the trading time and observe the most profitable trading time. This technique assists traders to enhance the chance of winning trades and make a profit by identifying whether it is more likely to make a profit when they keep the trade opened for a longer time or a shorter time.

Moreover, we observe the specific time gap for the most profit for each currency pair. Time gaps will be less than 1 minutes, 1-5 minutes, 5-15 minutes, 15-30 minutes, 30-60 minutes, 1-4 hours, 4-24 hours, 1-30 days and more than 30 days (Table 2).

Table 2: Proposed method for the most suitable time duration of trading time

Symbol	Time Duration of Trading Time
t_1	less than 1 minutes
t_2	1-5 minutes
t_3	5-15 minutes
t_4	15-30 minutes
t_5	30-60 minutes
t_6	1-4 hours
t_7	4-24 hours
t_8	1-30 days
t_9	more than 30 days

In this study, we observe the most suitable time duration to trade to obtain the highest profit from different currency pairs. The analysis is performed by using Python 3.6.5 on Windows 10 Pro (64 bit), Intel(R) Core (TM) i7-8650U CPU @ 1.90GHz 2.11GHz 32GB RAM.

A. Algorithms used

The K-means clustering [10] was used to find the correlation between profit and trading time. Histogram function was used to find the highest profit observation within the specific time gap. Algorithms used in this study: (i) SVR radial basis to find profit when other factors are given, (ii) K-means clustering algorithm to find the correlation between profit and trading time, and histogram function to observe highest profit observation within specific time gap.

Table 3: Algorithms used in the research. SVR radial basis was used to find profit when other factors are given.

Algorithm	Description
Support Vector Regression radial basis kernel function	$K(\mathbf{x}, \mathbf{x}') = \exp\left(-\frac{\|\mathbf{x} - \mathbf{x}'\|^2}{2\sigma^2}\right)$ $K(\mathbf{x}, \mathbf{x}') = \exp(-\gamma\|\mathbf{x} - \mathbf{x}'\|^2)$ the RBF kernel expression on profit and trading time $(\mathbf{x}, \mathbf{x}')$.
K – Means clustering algorithm	$\arg\min_{\mathbf{S}} \sum_{i=1}^{k} \sum_{\mathbf{x} \in S_i} \|\mathbf{x} - \boldsymbol{\mu}_i\|^2 = \arg\min_{\mathbf{S}} \sum_{i=1}^{k} \|S_i\| \operatorname{Var} S_i$ $\arg\min_{\mathbf{S}} \sum_{i=1}^{k} \frac{1}{2\|S_i\|} \sum_{\mathbf{x},\mathbf{y} \in S_i} \|\mathbf{x} - \mathbf{y}\|^2$ where set of profit values ($\mathbf{x}_1$, $\mathbf{x}_2$, …, $\mathbf{x}_n$) where each observation is a real vector.

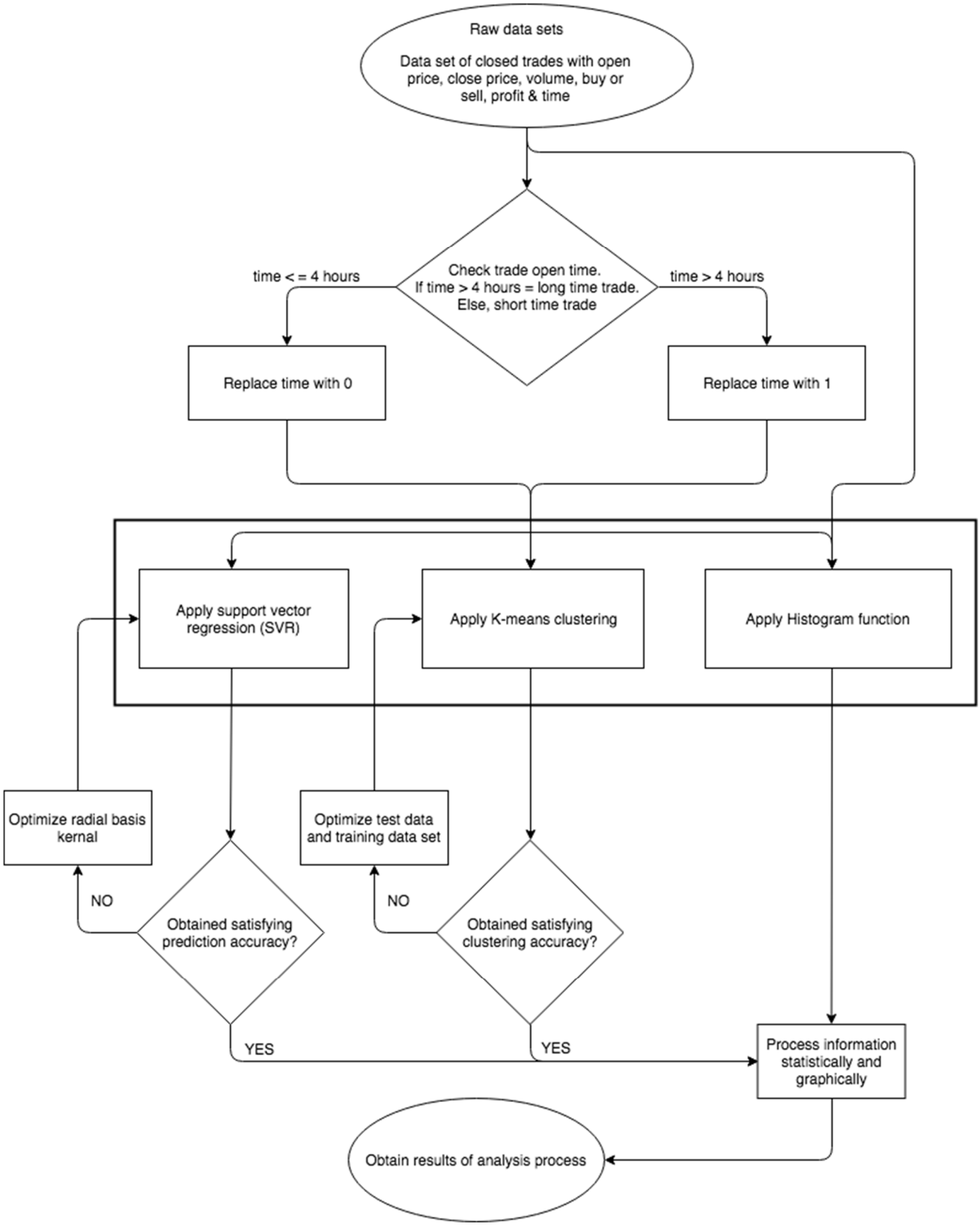

Figure 1: Steps by step procedure to analyze the dataset: 1) data collection; 2) classification and clustering framework; and 3) data analysis.

3. RESULTS & DISCUSSION

Big data is making a vital influence on the worldwide economy [11]. A dataset with 1,000,000 trades was analyzed using different techniques; SVR radial basis, K-means clustering and histograms to find the relationship between profit times and currency pairs.

A. SVR radial basis

First Test was performed in SVR using radial basis function (RBF) kernel. Table 4 shows a sample portion of the dataset that used for the test and each row represents a single trade.

Table 4: Sample dataset that used for the analysis

OPEN_PRICE	CLOSE_PRICE	VOLUME	BUY	SELL	PROFIT	TIME
1.15914	1.15896	0.01	0	1	0.24	1
1.15914	1.15886	0.01	1	0	0.38	0
1.15922	1.15916	0.01	0	1	0.09	1
1.15919	1.15911	0.01	0	1	0.11	0
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Different percentages from the original dataset were used for the training model, and the accuracy of each percentage was determined.

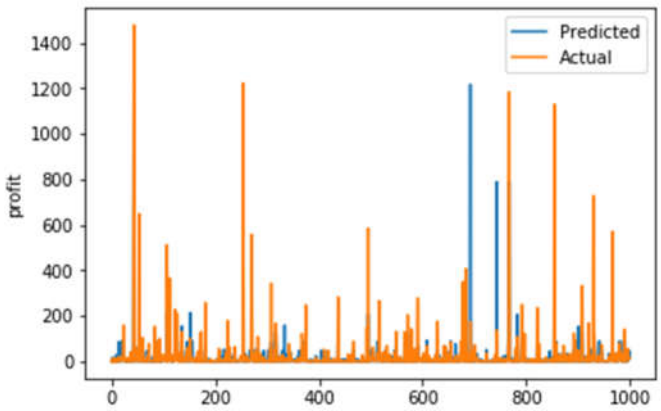

Figure 2: Variation of predicted and actual values when the test data portion is 20%

Table 5 shows the percentages of the dataset used for the training model, accuracy and the used formulas. Furthermore, predicted and actual values were graphically illustrated to get a clearer view of the variation, as shown in Figure 2, Figure 3, and Figure 4.

Table 5: Used percentages from the original dataset for the training model, accuracy percentage, and the used formulas

Percentage of the dataset (%)	**Accuracy (%)**	**Used formula**	**Related graphical figure**
20	48	X_train, x_test, Y_train, y_test = train_test_split(X, Y, test_size=0.2, random_state=0) regression_model = SVR (kernel='rbf',C=1000)	Figure 2
10	72	X_train, x_test, Y_train, y_test = train_test_split(X, Y, test_size=0.1, random_state=0) regression_model = SVR (kernel='rbf', C=1000)	Figure 3
2	82	X_train, x_test, Y_train, y_test = train_test_split(X, Y, test_size=0.02, random_state=0) regression_model = SVR (kernel='rbf', C=1000)	Figure 4

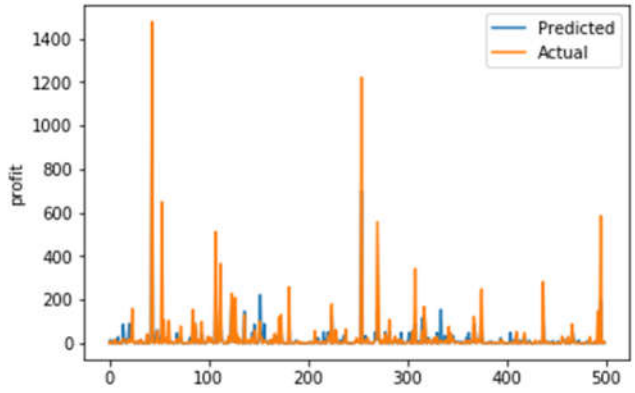

Figure 3: Variation of predicted and actual values when the test data portion is 10%

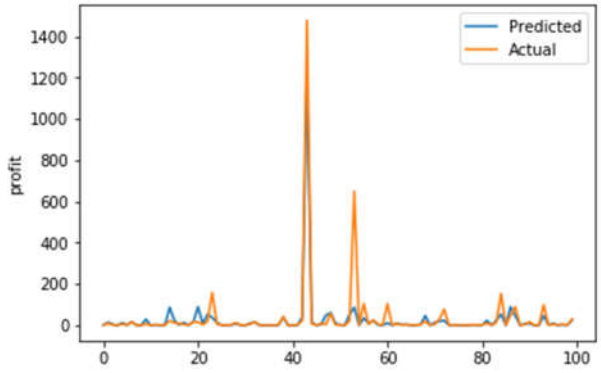

Figure 4: Variation of predicted and actual values when the test data portion is 2%

A. K-Means for currency pairs, comparison trading time and profit

K-Means clustering was used in the research to analyze the spreading between trading time (seconds) and the profit (AUD). The aim is to explain the profit variation among long-time traders and short-time traders. Different currency pairs were used to analyze further how the traders trade with each currency pair and how the profit is made by long-time and short-time trading. Table 6 shows the profit variations of different currency pairs against trading time grouped by the number of traders.

Table 6: Profit variations of different currency pairs against trading time grouped by the number of traders

Currency Pair	Related Figure	Description
EUR vs JPY	Figure 5	The traders who trade EUR vs JPY for a shorter time make the highest profit. However, most of the traders are trading for a longer time, although they do not make much profit in contrast to the short-time traders.
EUR vs USD	Figure 6	The traders who are trading for shorter times makes the most profit, although the number of traders is low. It also shows that the traders who trade a long time make less profit in EUR/USD
GBP vs JPY	Figure 7	Traders who trade for a short-time make the most profit, and in contrast, long-time traders make less profit. However, several long-time traders are higher than short-time traders.
GBP vs USD	Figure 8	Traders who trade short-time still get the highest profit than long-time traders. However, there is an average number of traders who trade short-time. Lowest profit is made by long-time traders although there is a high number of traders in this group. From all the charts, only with GBP vs USD, there is a medium number of short-time traders although, in other currency pairs, the number of short-time traders is low.
USD vs JPY	Figure 9	Short-time traders make a very high profit while long-time traders make less profit. However, the graph shows that there is a lesser number of short-time traders compared to the number of long-time traders.

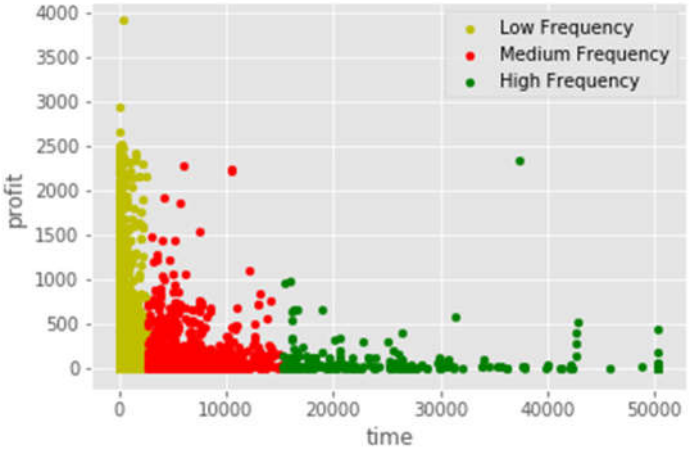

Figure 5: Profit variation of trading EUR vs JPY against trading time grouped by the number of traders

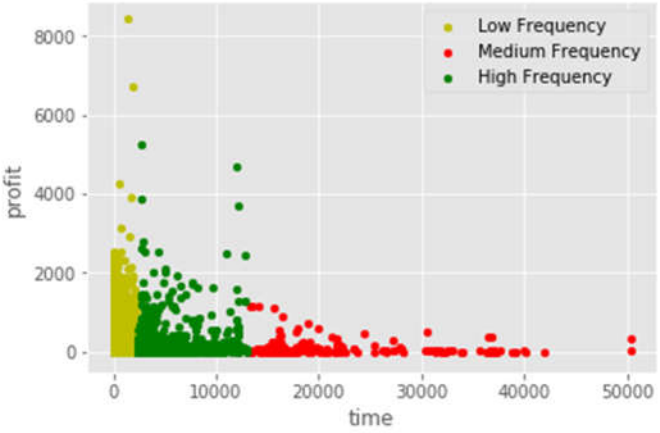

Figure 6: Profit variation of trading EUR vs USD against trading time grouped by the number of traders

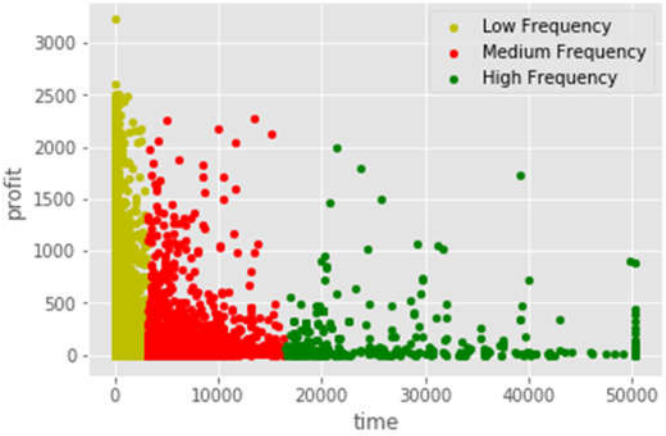

Figure 7: Profit variation of trading GBP vs JPY against trading time grouped by the number of traders

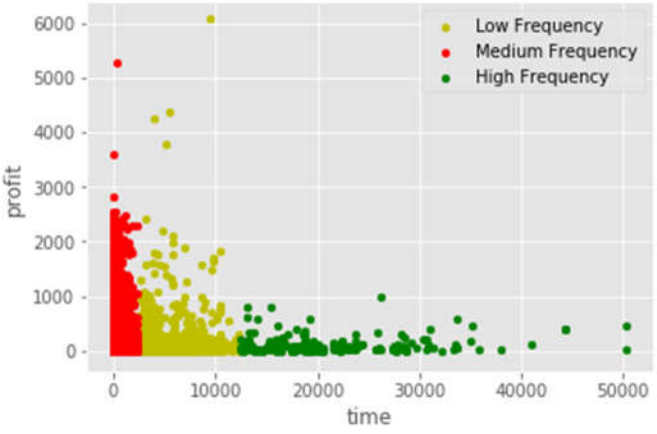

Figure 8: Profit variation of trading GBP vs USD against trading time grouped by the number of traders

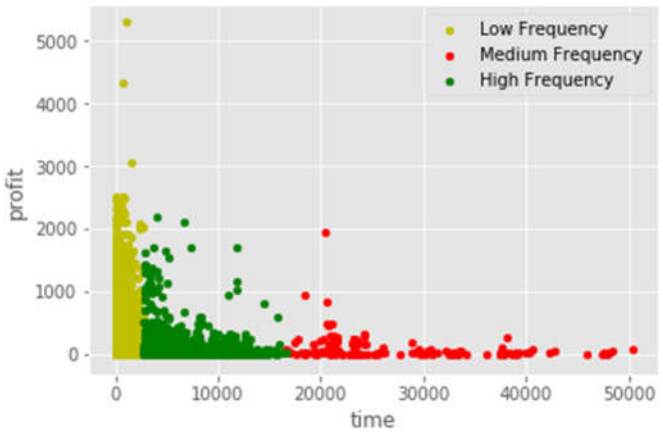

Figure 9: Profit variation of trading USD vs JPY against trading time grouped by the number of traders

B. The most suitable time duration to trade for to get the highest profit from different currency pairs

The dataset was further analyzed to find the most suitable time duration to trade to obtain the highest profit from different currency pairs, and Table 7 contains the results.

Table 7: Most suitable time duration to trade to obtain the highest profit from different currency pairs

Currency Pair	Related Figure	The most suitable time duration to trade	Description
EUR vs JPY	Figure 10	5-15 minutes and 1-4 hours	
EUR vs USD	Figure 11	1-5 minutes	
GBP vs JPY	Figure 12	1-4 hours	Although 1-4 hour trading time shows the highest profit, there is less difference between 1-4 hour trading and 1-5 minutes/ 5-15 minutes trading
GBP vs USD	Figure 13	1-4 hours	
USD vs JPY	Figure 14	1-4 hours	1-4 hour trading time is significantly profitable compared to the rest of the duration.

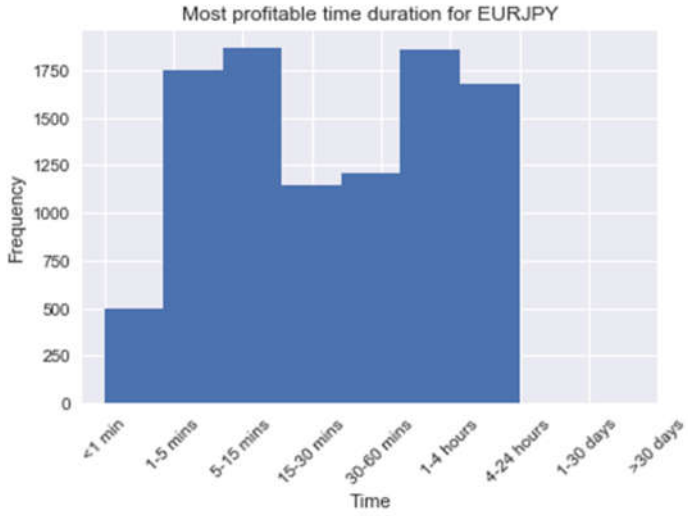

Figure 10: Most profitable time duration for EUR vs JPY currency pair

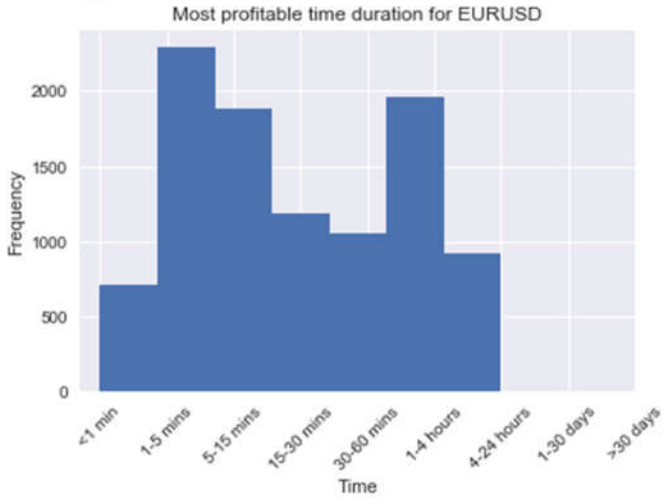

Figure 11: Most profitable time duration for EUR vs USD currency pair

Figure 12: Most profitable time duration for GBP vs JPY currency pair

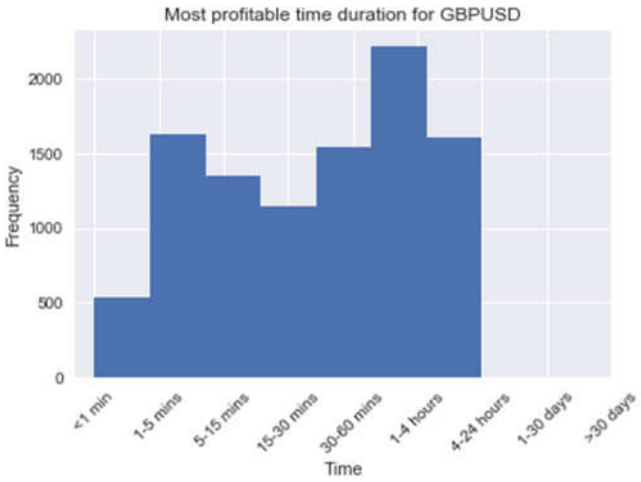

Figure 13: Most profitable time duration for GBP vs USD currency pair

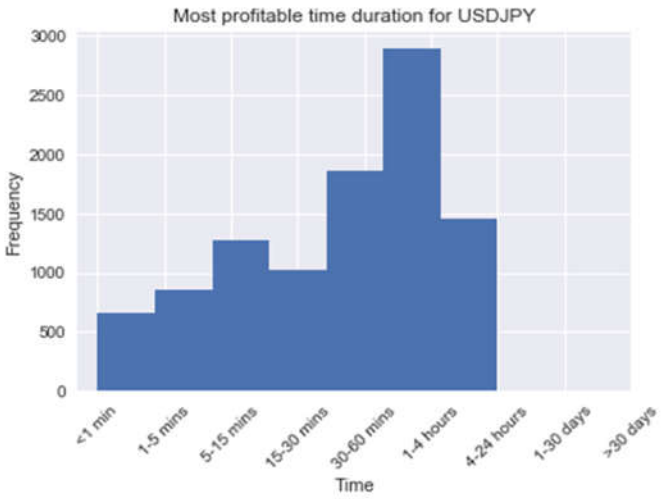

Figure 14: Most profitable time duration for USD vs JPY currency pair

In this study, we analyze previous studies in the area of Forex market trading. One of the research studies was SVR (Support Vector Regression). The main concern of Support Vector Machine research is that Robotics transactions that were conducted using a demo account [3], and the transactions and other factors were not real. However, in SVM, Polynomial kernel shows better results than Gaussian in general.

Furthermore, SVR-Wavelet Adaptive Model research was limited to few currency pairs, including USD vs JPY and EUR vs USD [4]. A few methods were discussed in the article used for regression analysis such as statistical models that rapidly used as a regressor for machine learning in financial time sectors, Wavelet Transform and SVR. Traditional models showed significantly better results in predicting time series for linear and non-linear.

Our study shows that shorter time traders make more profit than longer time traders. However, the number of traders who make a profit is very less comparing with total. The most profitable time gap is 5 minutes to 15 minutes for most currency pairs. In our study, it was predicting the profit using SVR radial basis kernel, and it can be seen that accuracy was increased when the train data set increases.

One of the limitations of our study was that we used five major currency pairs only as we selected those most trades have happened in the market, and the other limitation is that no clue about losing percentage is given in the research. Even though we found most profitable time gap, the most losing time gap was not discovered by this study. Future studies study could perform to observe the most losing time gap and to find the percentage of the most profitable and most losing time gaps. This study also could extend by utilizing more currency pairs.

4. CONCLUSIONS

In this research, we analyzed the movement of profit with trading time with Forex market data gathered from third-party broker database based in Australia. Using the data, we observed who makes the most profit between long-time traders and short-time traders. Short-time was identified by less than 4 hours, and longer-time was identified by more than 4 hours of trading time. The research was conducted with most popular currency pairs such as EUR vs USD, GBP vs JPY, USD vs JPY, GBP vs USD and EUR vs JPY. The SVR radial basis kernel was used to find the prediction accuracy for profit, and then, K-means clustering was used to find the spread of each currency pair for-profit and trading time. Finally, from our observed data from a third-party broker, we demonstrated the short time traders are making more profit than long-time traders. The portion of making a profit was very less when compared with medium time traders and long-time traders. The best profit-making time gap was 5-15 minutes was observed. This study should be useful for Forex market traders to be more focused on their trading time. Hence, this study demonstrates that traders are more likely to make a profit when the market has a unique volatile situation. Further research in this area could be conducted to analyze who lose more money from short time traders and long-time traders and what is the time gap traders lose more.

REFERENCES

[1] “The Forex Industry in 2018: Regulation, Market Size, and the Future", Fxempire.com, 2018. [Online]. Available: https://www.fxempire.com/education/article/the-forex-industry-in-2018-regulation-market-size-and-the-future-447777

[2] “Introduction to the Forex Market | Sharp Trader", Sharptrader.com, 2018. [Online]. Available: http://www.sharptrader.com/new-to-trading/forex/introduction-to-the-forex-market/

[3] T. Thi Thu and V. Xuan, “Using Support Vector Machine in Forex Predicting”. Vietnam: IEEE International Conference on Innovative Research and Development (ICIRD), 2018.

[4] M. Raimundo and J. Okamoto. “SVR-Wavelet Adaptive Model for Forecasting Financial Time Series”. International Conference on Information and Computer Technology, 2018.

[5] P. Taveeapiradeecharoen and N. Aunsri, “Dynamic Model Averaging for Daily Forex Prediction: A Comparative Study”. Thailand: The 3rd International Conference on Digital Arts, Media and Technology (ICDAMT2018), 2018.

[6] P. Tuchsanai and C. Roungsan, “Gaussian Process Kernel Crossover for Automated Forex Trading System”. Thailand: The 14th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology, 2017.

[7] V. Yaroslav, V. Darko and J. Ana, “Forex Prediction with Neural Network: USD/EUR Currency Pair”. Serbia: Actual problem of economics, Issue 10 (148) 2013.

[8] M. N. Halgamuge, "Machine Learning for Bioelectromagnetics: Prediction Model for Weak Radiofrequency Radiation Effect from Mobile Phone on Plants" International Journal of Advanced Computer Science and Applications (IJACSA), Vol 8, No 11, pp 223-235, November 2017.

[9] C. Wanigasooriya, M. N. Halgamuge, A. Mohamad, "The Analyzes of Anticancer Drug Sensitivity of Lung Cancer Cell Lines by Using Machine Learning Clustering Techniques", International Journal of Advanced Computer Science and Applications (IJACSA), Vol 8, No 9, September 2017.

[10] M. N. Halgamuge, S. M. Guru, and A. Jennings, "Centralised Strategies for Cluster Formation in Sensor Networks", Classification and Clustering for Knowledge Discovery, Springer-Verlag, ISBN: 3-540-26073-0, Chapter 20, pp. 315-334, Aug 2005.

[11] S. Kalid, A. Syed, A. Mohammad, and M. N. Halgamuge, "Big-Data NoSQL Databases: Comparison and Analysis of "Big-Table", "DynamoDB", and "Cassandra", IEEE 2nd International Conference on Big Data Analysis (ICBDA'17), Beijing, China, pp 89-93, 10-12 March 2017.