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# **Application of Machine Learning Techniques for Stock Price Prediction**

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## Abstract

This study highlights the robustness of selected Machine Learning models in Stock Closing Price prediction, which effectively mitigates several defects and hazards resulting from its indeterminable nature. From different literature consulted, so many tools and techniques have been used widely to tackle the prediction of the stock market In this paper, our focus is to develop a machine learning predictive model for Stock Closing Price using three different machine learning (ML) algorithms. The data inputted into the predictive model was obtained from the Yahoo Finance online repository. The dataset used contains five hundred and eighty-eight instances. Neural Networks (ANN), SVM, and KStar Algorithm were employed for the stock market price predictive models. Stimulated on Waikato Software for Knowledge Analysis (WEKA). Comparative analysis for Stock Closing Price and predictions were performed using MAE, RMSE & RAE. The results of the predictive models revealed that the correlation coefficient of the model developed for SVM, ANN, and KStar Algorithm have values of 0.0104, 0.7184, and 0.4819 respectively. So also, the Root Relative Squared Error of 107.6185%, 96.8064%, and 88.71% for SVM, ANN, and KStar respectively. This shows that ANN has a strong positive relationship frame followed by SVM and KStar. The KStar shows a faster learning time of the three algorithms followed by SVM and ANN. The study concluded that Artificial Neural Network (ANN) performs better than SVM and KStar in predicting Stock Market Prices.

Keywords: Stock, Prediction, SVM, ANN, KStar

# Introduction

The concept of stock can be explained as a unit of ownership an individual or corporate body has in a company. Stock can also be referred to as equity. There are many reasons why companies decide to sell part of their shares to other people. Most companies sometimes sell stock to acquire more funds to expand their business, sometimes to settle debt, or for any other reason. Stock may be classified as Common Stock (CS)or preferred stock. CS as the name implies is generally referred to as an ownership of a few shares of that company while Preferred stock is the type of share owned by a person or company that gave them preference to receive part of the profit made by the issued company. It has higher priority when compared to common stock. Trading in stock usually takes place in the stock market. A place where all the transactions that involve shares, stocks, government bonds, debentures, and other approved securities take place is called the Stock Market (Okobiah, 2000). This market avails the opportunities for large and small investors to buy and sell stocks or shares of companies and government agencies with the assistance of stock brokers. Since individual and cooperate organisations do engage in the stock business this made stock investment popular and lucrative. Stock trading plays a key role in the global economy because of its numerous benefits. However, despite its huge influx of investors into the stock market, it comes with some flaws and risks due to its unpredictable behaviour Therefore, any variation in this market affects personal and corporate financial lives, and as a whole determines the economic health of a country. Stock market prediction have attracted different tools and techniques. In the past, there were two major methods used in stock prediction. They are fundamental analysis (FA) and technical analysis (TA). The FA are more concerned with the company's performance rather than the actual stock. They used the past performance of the company to establish their decision and forecasts. On the other hand, TA is carried out by Technical Analysts, and the stock price is determined using time series based on the past patterns of the stock.

MLTs are often engaged in building real-time application model which yields better results than other traditional methods (Mehar et al., 2019). The use of ML techniques in stock data prediction is more concerned with Technical

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Analysis in order to establish that the algorithm used in the prediction has the capability to learn the underlying patterns in the stock time series. Some of the new work carried out in this field uncovered that ML Techniques can be used greatly in stock market price prediction, for instance, SVM Random Forest (RF), Artificial Neural Network (ANN) (Adebayo et al., 2012; Asagba et al., 2013), Convolutional Neural Network (CNN), Chen (2020) and DNN like LSTM, Chen (2020) also have shown promising results. Kundu, et al., (2020) used ARIMA,. Sathya et al., (2020) used Reinforcement Learning & Features Extraction, and Behravan and Razavi (2020) tested Swarm Intelligence. In this paper, three machine techniques namely: ANN, SVM, and KStar were tested for the stock closing price prediction of an organization. The input for the predictive models was a financial dataset that comprised close, open, low and high. The performance of the models developed would be tested using standard metrics, such as RMSE and MAPE. The rest of the work is: section 2 which clearly explains the methodology used, section 3 also discusses the outcome of the study carried out section 4 concludes the paper.

## **Framework for The Stock Price Prediction**

The Methodology adopted in this study includes: data collection, data pre-processing, development of machine learning models, and performance evaluation of the models as revealed in figure 1



*Figure.1: framework of the model rework* 

## Methodology

The past data for the two firms were retrieved from Yahoo Finance. The dataset spans 5 years dated 18/09/2016 to 18/09/2021 of Nike and JP Morgan Chase and Co. The data includes information about the stock. We extracted the closing price of the stock as shown in Table 1.

 Dataset
 Training Dataset

 Time Interval
 18/09/2016 - 18/09/2021
 18/09/2016 - 17/09/2019

**Testing Datasets** 18/09/2019–18/09/2021

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## **Data Pre-processing**

The data collected for the prediction contain attributes with continuous numeric values. In order to have a better prediction. The standard used for transforming the numeric values to discrete values for the attributes depends on the closing price of the stock. For example, in case values of the properties open, min, max, and last were higher than the value of the preceding for the same trading day, then the numeric values of the attributes will receive the value positive. But if the values of the properties for the same trading day were lower than the attribute previous one, then numeric values of the attributes will be negative. Also, if they are equal, then the numeric values will have equal value.

# **Model Development**

# ANN Model

ANN is a smart data mining technique that comes up with results by observing a basic trend from given data. ANN generally can simulate complex patterns from unstructured data. It uses the basic structure of a network having neurons with various layers. The input, the hidden, and the output are the three layers. The input layers for the ANN model developed are made up of High, Low, Open, Close, and Volume variables. The product of the input load and weight is added and the total summation is sent to the second layer where the processing is done. The calculated weight is displayed in the output. This layer consists of one neuron which is the stock price predicted value. Figure 2 displays the ANN Model used in this study for stock prediction.



Figure 2: Neural Network Model

The Neuron accepts the input quantity and adds a bias with the total assigned weight. The value of the outputs can be discovered by introducing a transfer function. The number of neurons in the input and the output must correspond. Mathematically, the expected result of neuron SP can be described as follows:

$$Usp = \sum_{i=1}^{N} W_{pi} X_i$$
(1a)

$$Ysp = \phi(uSP + bSP)$$
(1b)

where  $x_1, \ldots, x_n$  represents the input parameters;  $W_{P1}, \ldots, W_{Pn}$  denotes the connection weights of neuron SP; while the Usp is the input combiner;  $b_{SP}$  is the bias;  $\phi$  is the activation function, and  $y_{SP}$  is the output of the neuron.

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#### **Activation Function**

The input received the predicting parameters, the relationship between weights and biases that the neurons perform on this input is shown in equation (equation2a)

$$x = (weight * input) + bias$$
 (2a)

The sigmoid activation function used is represented by

$$S(x) = \frac{1}{1 + e^{-x}}$$
(2b)

Sigmoid functions usually show a return value (y-axis) in the range of 0 to 1.

## SVM Model

SVMs are learning algorithms that make use of linear learning machines in kernel-induced feature mode. SVM works with the best margin standard to optimize separating hyperplanes between binary classes. Hyperplane is best applied to linearly separable data which is used in binary decision classes (Cortes &Vapnik; 1995) as shown in (equation 3)

$$y = W_0 + W_1 X_1 + W_2 X_2 \tag{3}$$

Where: y: outcome,  $W_1$ : the attribute values,  $X_1$ : Weights determined by the learning algorithm.

Equation 4 represents the maximum margin hyperplane.

$$\mathbf{y} = \mathbf{b} + \sum_{i=1}^{n} \propto_{i} \mathbf{y}_{i} \mathbf{x}(i) \dots \mathbf{x}$$
(4)

*y* : class value of training

x(i), the vector x represents a test

vector x(i) are the support vectors and represent the dot product.

*b* are parameters used for the hyperplane.

SVM uses a Kernel function to produce high-magnitude feature space from the given inputs as shown in (equation 5).  $y = b + \sum_{i=1}^{n} \propto_{i} y_{i} k(x(i)..x)$ (5)

#### 3.2.3 K-STAR MODEL

K-star makes use of an entropic which depends on the probability of changing one instance to another form by randomly selecting from all possible outcomes. The changes are achieved in a manner: By defining a finite set that will map one instance to another one. The second one is achieved using a program in a finite sequence to change instance (a) to (b)

Assume we have a set of infinite points and stated transformations T,

P, the set of all prefix codes from T\*.

Therefore, Members of T\* and of P uniquely define a transformation as shown in equation (6a)

$$\overline{t}(a) = t_n(t_{n-1}(\cdots t_1(a)\cdots))$$
(6a)

Where  $t = t_1...tn P$  represents the probability function on T\*. Satisfies the following conditions:

$$p \le \frac{p(t u)}{p(t)} \le 1$$
(6b)

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$$\sum_{u} p(\bar{t}u) = p(\bar{t})$$

$$p(\Lambda) = 1$$
(6c)

it satisfies the following:

$$\sum_{rep} p(t) = 1$$
(7)

The probability paths from instance a, to instance b is calculated as the probability function P\*:

$$p^{*}\left(\frac{b}{a}\right) = \sum_{rep \ t(a) \to b} P(t)$$
(8)

P\* satisfies the these conditions

$$\sum_{b} p^{*} \left(\frac{b}{a}\right) = 1 \tag{9a}$$

$$0 \le P^{*} \left(\frac{b}{a}\right) \le 1$$

$$(9b)$$

The K\* is calculated as:

$$K^*\left(\frac{b}{a}\right) = -\log_2 P^*\left(\frac{b}{a}\right) \tag{10}$$

#### **Models Evaluation**

The performance of the stock price prediction models developed was determined using the standard metrics: MAE, RMSE, RAE and Time Taken for each of the models.

**Correlation Coefficients** measure the relationship between two variables. The output returns a value between -1 and 1

- ✤ When the value returns 1 it shows a strong positive relationship
- ♦ When the value returns -1 it shows a strong negative relationship
- ♦ When the value returns a result of zero it shows no relationship at all.

#### MAE

The MAE does neglect direction when measuring. it measures the average magnitude of the errors in a given prediction. It is good at measuring continuous variables. The MAE is a linear score which means that all the individual differences are weighted equally in the average.

$$MAE = \frac{1}{n} \sum_{i=1}^{n} \frac{(o_i - F_i)}{o_i} x \ 100$$

(11)

*Oi*: the original closing price,

'Fi': the predicted closing price and

'n': the total window size.

## RMSE

RMSE is useful in measuring the accuracy, but best at comparing the prediction errors and model configurations for a specific variable and not between variables, RMSE is scale-dependent.

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$$\mathbf{RMSE} = \sqrt{\frac{\sum_{i=1}^{n} (o_i - F_i)^2}{n}}$$
(12)

Where 'Oi' is the first closing price, 'Fi' is the predicted closing price, and 'n' refers to the entire window size.

### RAE

RAE measures the performance of predictive models, It's majorly used in the area like operations management, data mining, and machine learning. RAE is expressed as a ratio of a mean error which is also called a residual to errors produced by an unimportant or naïve model.

#### **Evaluation**

The dataset used for the stock prediction was collected in CSV (comma delimited) format and was transformed and saved in Arff format as shown in Figure 3



Figure 3 the sample of the pre-processed dataset used for the stock prediction

#### **Data Pre-Processing**

The pre-processed dataset was divided into two groups at the ratio of 75:25. The training set represents 75% see Figure 4 and the testing represents 25%. In the stock prediction, a comparison is made between SVM, ANN, and KStar Algorithms.

```
=== Run information ===
Scheme:
              weka.classifiers.functions.SMOreg -C 1.0 -N 0 -I "weka.classifiers.functions.support
              MSFT (1) training
Relation:
Instances:
              588
Attributes:
              7
              Date
              Open
              High
              Low
              Close
              Adj Close
              Volume
              10-fold cross-validation
Test mode:
=== Classifier model (full training set) ===
```

Figure 4. Training data for the stock prediction

## **Predictive Model**

Stock Prediction model using ANN as shown in Figure 5 and Figure 6. While figure 7, 8, and 9 show the predicted

	1	1.	Territoria a	
Preprocess Classify	Cluster	Associate	Select attributes	Visualize
Classifier				
Choose Multilay	erPerceptr	on -L, 0.3 -M 0	.2 -N 500 -V 0 -S 0 -	-E 20 -H a
Test options			Classifier output	
Use training set Supplied test set Cross-validation Percentage split More op	Folds 1 No 6	6	Scheme: Relation: Instances: Attributes:	weka.classifiers.functions.MultilayerPerceptron -L 0.3 -H 0.2 -N 500 -V 0 -S 0 -E 20 -H a MSTT (1)training 588 7 Dats Open High Low
(Num) Volume Start	Sh	•	Test mode:	Close Adj Close Volume 10-fold cross-validation
Result list (right-click fo	r options)		Classifie	er model (full training set)
04.20.47 - functions.8 04.28.47 - functions.8	MOreg IufiliazerPe	rceptron	Linear Node 0 Inputs Threshold Node 1 Node 2 Node 3 Node 4 Node 5 Node 5 Node 6 Node 6 Node 9 Node 9	0 Weights 4 -0.5781717167588563 0.9883715756467417 0.617391353523016 0.6412642106033641 -9.421473280939644 -14.605652565146564 0.64110937480067460 -5.476847722597386 0.73143063748006746 -3.476847722597386 0.731450516542547 -10.7915555554642247 0.59621772661850666

Status
Figure 5 ANN for the stock prediction

Preprocess	Classify	Cluster	Associate	Select attributes	Visualize	• ]		
Classifier								
Conserve								
Choose	Multilayer	Perceptro	n - L U. 3 - M U	2-14 500-00-8 0-	E 20 - H a			
Test options				Classifier output				
C) Line trai	ning not			ALLEL DA	aue-0/21/	2022	0.049292013390214	
Osevan	ning set			Attrib Da	ate=6/22/	2021	0.08483627372871329	
<ul> <li>Supplied</li> </ul>	dtestset	Set		Attrib De	ate=6/23/	2021	0.10277892781810476	
				Attrib Da	ate=6/24/	2021	0.05640064816557394	
Cross-v	alidation F	olds 10	10 A.	Attrib De	ate=6/25/	2021	0.0498365151770965	
O Percent:	age split	\$6 66		Attrib De	ate=6/28/	2021	0.07156257437124365	
				Attrib De	ate=6/29/	2021	0.019934162897440152	
	More optio	ons		Attrib De	ate=6/30/	2021	0.02450897099148	
				Attrib De	ate=7/1/2	2021	0.09093783803393078	
				Attrib De	ate=7/2/2	2021	0.033665380066696775	
(Num) Volum	e		-	Attrib De	ate=7/6/2	2021	0.10686257231024467	
				Attrib De	ate=7/7/2	2021	0.07479650870394648	
Start	11	Sto	0	Attrib Da	ate=7/8/2	2021	0.09511625166549638	
		010		Attrib Op	pen 0.	075837	08650660863	
<b>Result list (rig</b>	ht-click for	options)		Attrib H:	igh 0.	026352	2291061800977	
				Attrib L	O.0	0424749	97422327406	
04:20:47 - ft	unctions.SN	Oreg		Attrib C	lose (	0.06731	1363139871414	
04:28:47 - 1	unctions.Mu	ItilayerPer	ceptron	Attrib Ad	dj Close	0.0	2316532866008257	
				Sigmoid Node	296			
				Inputs	Weights	5		
				Threshold	d -0.0	240056	5920392804	
				Attrib De	ate=3/11/	2019	7.880968487625567E-4	
				Attrib Da	ate=3/12/	2019	0.03002924650463993	
				Attrib De	ate=3/13/	2019	0.05430020907785323	
				Attrib Da	ate=3/14/	2019	0.04671069015956895	
				Attrib De	ate=3/15/	2019	-0.011854387380829735	
				Attrib Da	ate=3/18/	2019	0.034114264890839525	
				Attrib Da	ate=3/19/	2019	0.04797340563159313	
				Attrib De	ate=3/20/	2019	0.04181791607527849	

Figure 6 e ANN for the stock prediction

44

Preprocess Classify Cluster Associat	e Select attributes Visualize
Classifier	· · · · · ·
Choose MultilayerPerceptron -L 0.3 -M	0.2 -N 500 -V 0 -S 0 -E 20 -H a
Test options	Classifier output
Use training set Supplied test set Cross-validation Folds Percentage split % 66 More options	Attrib         Dete=6/23/2021
(Num) Volume	Attrib Date=7/6/2021 0.04107103186682362 Attrib Date=7/7/2021 -0.01859418295635637 Attrib Date=7/6/2021 0.058796266903924606
Start Stop Result list (right-click for options)	Attrib         Open         0.03665522363466414           Attrib         High         0.008209385474295616           Attrib         Low         -0.013065576649017882
04:20:47 - functions.SMOreg 04:28:47 - functions.MultilayerPerceptron	Attrib Close         -0.03384567056742978           Attrib Adj Close         0.019362520101936126           Sigmoid Node 297         Inputs           Inputs         Weights           Threshold         -0.10642647542193613           Attrib Date=3/11/2019         0.17554366579479477           Attrib Date=3/12/2019         0.15280119611034844           Attrib Date=3/13/2019         0.15146143002012462           Attrib Date=3/14/2019         0.1687116772239498           Attrib Date=3/16/2019         0.13261054277338554           Attrib Date=3/18/2019         0.13274159355580915           Attrib Date=3/20/2019         0.132241486839560915           Attrib Date=3/20/2019         0.122241486839560915           Attrib Date=3/20/2019         0.122241486395402

Figure 7 shows the ANN model for the stock prediction.

Preprocess Classify Cluster Asso	iate Select attributes Visualize	
lassifier		_
Choose MultilayerPerceptron -L 0.	-M 0.2 -N 500 -V 0 -S 0 -E 20 -H a	
est options	Classifier output	
Use training set Supplied test set Set. Cross-validation Folds 10 Percentage split % 66 More options	Attrib Date=7/7/2021 0.1036572944051478 Attrib Date=7/2/2021 0.10365572944051478 Attrib Date=7/2/2021 0.1164784166297709 Attrib Date=7/7/2021 0.17484238629736623 Attrib Date=7/8/2021 0.12162198937206796 Attrib Open 0.16750832104080942 Attrib High 0.13213420160306888 Attrib Low 0.1579071930205572	
(Num) Volume	Attrib Close 0.09770445573199618 Attrib Adj Close 0.1177758301702065 Class	
Start Stop Result list (right-click for options)	Input Node 0	
04:20:47 - functions.SMOreg 04:28:47 - functions MultilayerPerceptro	Time taken to build model: 3009.39 seconds === Cross-validation === === Summary === Correlation coefficient 0.0104 Mean absolute error 10123470.6265 Root mean squared error 103.2748 % Root relative squared error 103.2748 % Total Number of Instances 588	

Figure 8 ANN model for the stock prediction



Figure 9 ANN Visualisation for the Stock Prediction

Stock Prediction model using SVM figure 10 and Figure 11, while Figure 12 shows the predicted.

#### Application of Machine Learning Techniques for Stock Price Prediction

Preprocess Classify Cluster Associa	ate Select attributes Visualize	
Classifier		
Choose SMOreg -C 1.0 -N 0 -I weka c	classifiers functions, support ector, RegSMOmproved -T 0.001 -V -P 1.0E-12 -L 0.001 -W 1* -K *weka classifiers fun	ctions, support/ector
Test options	Classifier output	
O Use training set		
O Supplied test set	SHOreg	E
Coopping and and		
Cross-validation Folds 10	weights (not support vectors):	
	- 0.0426 (hormalized) Date=3/11/2019	
O Percentage spin 16 66	- U.ORAS - (DOEMAILED) DATE-3/12/2019	
More options	+ 0.0591 * (normalized) Date=3/13/2019	
	T 0.0063 - (Durmalized) Date=3/14/2015	
	+ 0.2/2/ - (normalized) Deters/10/2019	
(Bluess) Mahama	A DOTE I Incompliand) Departy 10/2010	
(Hump voidine	Contract - Contractional Decembracian	
	- 0.025 - (normalized) Decession of a	
start stop	A DOTE & Increalized) Deter 1/22/2010	
Result list (right-click for options)	- 0.0363 * (pormalized) Date=3/25/2019	
	- 0.0472 * (normalized) Date=3/26/2019	
04:20:47 - functions SMOreg	- 0.0005 * (normalized) Date=3/27/2019	
	- 0.1346 * (normalized) Date=3/28/2019	
	- 0.0544 * (normalized) Date=3/29/2019	
	- 0.082 * (normalized) Date=4/1/2019	
	- 0.1354 * (normalized) Date=4/2/2019	
	- 0.0029 * (normalized) Date=4/3/2019	
	- 0.1159 * (normalized) Date=4/4/2019	
	- 0.1615 * (normalized) Date=4/5/2019	
	- 0.1698 * (normalized) Date=4/8/2019	
	- 0.1408 * (normalized) Date=4/9/2019	
	- 0.1527 * (normalized) Date=4/10/2019	
	- 0.1794 * (normalized) Date=4/11/2019	
	- 0.1153 * (normalized) Date=4/12/2019	
	0 1618 + Impresived) Derest/15/2019	

Figure 10 SVM for the stock prediction

Number of kernel evaluations: 173166 (92.122% cached) Time taken to build model: 1.32 seconds === Cross-validation === === Summary === Correlation coefficient 0.7184 Mean absolute error 9504703.7538 Root mean squared error 13577664.2217 Relative absolute error 96.9624 % Root relative squared error 96.8064 % Total Number of Instances 588

Figure 11 SVM for the stock prediction



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# Figure 12 The SVM for the stock prediction

Stock Prediction model using KStar Algorithm as shown in Figure 13 and figure 14. while the figure 15 shows the predicted

Preprocess Classify Cluster Associa	ite Select attributes Visualize						
Classifier							
Choose KStar -B 20 -M a							
Test options	Classifier output						
O Use training set O Supplied test set Set	=== Run information ===	5					
Cross-validation Folds 10	Scheme: weka.classifiers.lazy.KStar -B 20 -M a						
	Relation: MSFI (1)training						
O Percentage split % 66	Artibures: 7						
Mara antiana	Date						
More options	Open						
	High						
(Num) Volume	Low						
(Nulli) Volume	Close						
Start Stap	Adj Close						
Stop	Volume						
Result list (right-click for options)	Test mode: 10-fold cross-validation						
09:05:39 - lazy.KStar	=== Classifier model (full training set) ===						
09:09:13 - Tazy.LVVL	KStar Beta Verion (0.1b).						
	Copyright (c) 1995-97 by Len Trigg (trigg@cs.waikato.ac.nz).						
	Java port to Weka by Abdelaziz Mahoui (aml4@cs.waikato.ac.nz).						
	KStar options : -B 20 -M a						
	Time taken to build model: 0 seconds						
	=== Predictions on test data ===						
	inst#, actual, predicted, error						
	=== Classifier model for fold 1 ===	•					

Figure 13 The KStar for the stock prediction



Figure 14 The KStar

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Figure 15 The KStar

#### **Evaluation of the predictive model**

The effectiveness of the models is evaluated by doing a comparison between three machine learning techniques which are: SVM, ANN, and KStar models. Predicted closing prices are subjected to RMSE, MAPE, and MBE for finding the final minimized errors in the predicted price. As shown in figures 16, 17, and 18 respectively.

```
Number of kernel evaluations: 173166 (92.122% cached)
Time taken to build model: 1.32 seconds
=== Cross-validation ===
=== Summary ===
Correlation coefficient
                                      0.7184
Mean absolute error
                               9504703.7538
Root mean squared error
                               13577664.2217
Relative absolute error
                                     96.9624 %
                                     96.8064 %
Root relative squared error
Total Number of Instances
                                    588
```

Figure 16 Evaluation of the SVM model



## Figure 17 Evaluation of the ANN

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```
=== Cross-validation ===
=== Summary ===
Correlation coefficient 0.4819
Mean absolute error 7901954.5928
Root mean squared error 12442696.1481
Relative absolute error 80.6119 %
Root relative squared error 88.7143 %
Total Number of Instances 588
```

Figure 18 Evaluation of the KStar stock prediction

# Results

The comparison between the three models for stock prediction as shown in Table 2

S/NO	Particulars	ANN	SVM	KStar Algorithm
1	Correlation Coefficient	0.0104	0.7184	0.4819
2	Mean Absolute Error	10123471	9504704	7901955
3	Root Mean Squared Error	15094126	13577664	12442696
4	Relative Absolute Error(%)	103.27	96.96	80.61
5	Root Relative Squared Error(%)	107.62	96.81	88.71
6	Total Number of Instances	588	588	588
7	Time Taken	3009.39	1.32	0.44 seconds
		seconds	seconds	

 Table 2: Result of three models developed for the stock price prediction

# Discussion

Table 2 shows the results of the model developed using SVM, ANN and KStar Algorithm based on training by inputting 75% of the cleaned dataset, and validation using the remaining 25% dataset. The table describes the results of the three models using 588 instances. The result revealed that the ANN model developed has a 0.0104 correlation coefficient which is close to 1 which indicates that there is a relation between the Prediction Model. Also with 10123470.6265, 1509412.8727, 103.27%, and 107.6185% values for MAE, RMSE, and RAE respectively. The result further revealed that SVM has a 0.7184 correlation coefficient which indicates that there is a strong relationship between the Prediction Model, 9504703.7538, 13577664.2217, 96.9624%, 96.8064% values for MAE, RMSE, RAE respectively. The result of the KStar Algorithm as shown in Table 4.1 shows that the algorithm has a 0.4819 correlation coefficient, 7901955,12442696,80.61%,88.71% values for MAE, RMSE, and RAE respectively.

*Comparison of Developed Models*: We can deduce from the comparative analysis of the models developed using Table 2 which shows that ANN has a strong positive relationship frame followed by SVM and KStar as shown in Figure 19. The KStar shows a faster learning time of the algorithm followed by SVM and ANN. *Note: MAE and RMSE values were converted to percentage* 



*Figure 19 the comparison between the developed model* 

#### Conclusion

The study revealed that ANN, SVM, and K-Star classification algorithms are effective methodologies that can be used in the field of stock prediction. The study concluded that ANN performs better than SVM and KStar in predicting Stock Market Prices. The study recommends that the model can be used by stock brokers and the outcome of this study can be used by researchers working in stock price prediction. The study suggested that Deep Learning algorithms can be used to develop the predictive model for stock price prediction to have better performance comparison.

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