Forecasting Historical Data of Bitcoin using ARIMA and α-Sutte Indicator

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Abstract. The purpose of this study is to apply the α-Sutte Indicator and ARIMA in forecasting data. α-Sutte Indicator is a new forecasting method that was developed in 2017 by Ansari Saleh Ahmar. To see the accuracy of these methods, the forecasting results of the α-Sutte Indicator will be forecasting methods compared to other items, namely: ARIMA. Based on the results of forecasting, it is found that α-Sutte Indicator has MSE and MAE values that are lower than other methods (ARIMA). This is supported by MSE data from α-Sutte Indicator smaller than ARIMA (1,1,1).

1. Introduction

Bitcoin is a transaction tool in the form of digital currency. Bitcoin was developed by someone who had the same name, Satoshi Nakamoto, in 2009 [1]. Bitcoin is the same as gold but shaped virtual and only exist in the digital world. Bitcoin is just like any other e-money - paypal and perfect money - the difference is bitcoin is not set by the server because the entire user's computer is the server. The development of Bitcoin assumes that a good transaction tool (currency) is a transaction tool that is not controlled by the government or central bank. Government negligence in maintaining economic stability during the financial crisis some time ago is one of the reasons that bitcoin exists. Bitcoin became a trending topic since 2014 and a new transaction option in the internet world. Bitcoin is created using data mining processes. In its work, miner (bitcoin players) use sophisticated computers to decipher the complex mathematics in finding new block of bitcoin and if the miner finds it will be rewarded with a number of bitcoins. Böhme, Christin, Edelman, & Moore [2] describe the bitcoin approach to the flow of transactions and validation that can be seen in figure 1.

From figure 1 it appears that Alice gives 3 bitcoins to Bob and Bob receives the 3 bitcoins [2]. Each bitcoin transaction will be logged and will reduce the block chain. This transaction uses public-private key cryptography. And every miner has its own bitcoin address. This address is the transaction flow.

At first, if the miner finds 1 block it will get 50BTC prize and this will decrease with increasing circulation. For today (07 May 2018), based on Google, the price of 1 BTC is equivalent to USD 9574.86. This bitcoin price can rise or fall suddenly over a short period of time in the sense that the
price is fluctuating. One way to predict bitcoin prices is to forecast data based on historical data from Bitcoin. There are several methods of doing the forecasting, including ARIMA, Holt-Winters, α-Sutte Indicator, etc.

![Figure 1. Bitcoin approach to transaction flow and validation](image)

2. Method

Data from this research are historical data for Bitcoin obtained from CoinMarketCap. Data used in this study is daily data starting from January 1, 2016 - May 4, 2018. The data will be divided into 2 parts, i.e. fitting and testing data. Fitting data will be used as a match so that forecasting model is obtained and the model obtained will be test process on testing data. This data will be forecast using ARIMA [3], [4], NNETAR [5], [6], and α-Sutte Indicator [7][8] methods with the help of sutteforecastR package.

3. Result and Discussion

In this section, the process of forecasting uses fitting data from January 1, 2016 - April 27, 2018. From this forecasting process the following results are obtained:

ARIMA:

$\text{AutoARIMA}$

Series: al_mi_10

ARIMA(1,1,1)

Coefficients:

- ar1  ma1
  -0.6590  0.7503
  s.e.  0.1118  0.0975

\text{sigma}^2\text{ estimated as 120728: } \log \text{likelihood}=-6156.35\n
AIC=12318.71  AICc=12318.74  BIC=12332.93
Neural Network Time Series Forecasts (NNETAR):

\[
\text{series: al\_mi\_10}
\]

Model: NNAR(21,11)

Call: nnetar(y = al\_mi\_10)

Average of 20 networks, each of which is a 21-11-1 network with 254 weights

options were - linear output units

\(\sigma^2\) estimated as 14477

In this data fitting using ARIMA method results ARIMA(1,1,1) and NNETAR method obtained by NNAR(21,11). The next stage is forecasting data using the obtained model in fitting data to testing data. Results of forecasting are displayed as the following:

\[
\text{alpha.sutte(bitcoins)}
\]

\[
\text{Tes\_Data}
\]

\[
\text{Forecast\_AlphaSutte}
\]

\[
\text{Forecast\_AutoARIMA}
\]

\[
\text{Forecast\_NNETAR}
\]

To see the accuracy levels of each method, we will compare the MSE and MAE values of each method. The comparison is presented in table 1.

Table 1. Comparison of Accuracy Levels Forecasting based on MSE and MAE

|           | ARIMA (1,1,1) | NNETAR (21,11) | Sutte   |
|-----------|---------------|----------------|---------|
| MSE       | 295797.315    | 175192.050     | 121362.344 |
| MAE       | 497.657       | 360.710        | 299,766  |
Table 1 shows that the α-Sutte Indicator method has a good accuracy in predicting data. This is then followed by methods of Neural Network Time Series Forecasts (NNETAR) and ARIMA Method. Forecasting results from each method can be seen in table 2.

**Table 2. Results Forecasting of Various Methods on Testing Data**

| Year             | Data     | ARIMA   | NNETAR  | Sutte     |
|------------------|----------|---------|---------|-----------|
| 28 April 2018    | 9348,48  | 8856,163| 8710,424| 8768,349  |
| 29 April 2018    | 9419,08  | 8942,419| 8887,647| 9523,509  |
| 30 April 2018    | 9240,55  | 8885,576| 9033,012| 9468,982  |
| 01 May 2018      | 9119,01  | 8923,036| 9087,413| 9328,083  |
| 02 May 2018      | 9235,92  | 8898,349| 9381,776| 9043,446  |
| 03 May 2018      | 9743,86  | 8914,618| 9275,002| 9175,952  |
| 04 May 2018      | 9700,76  | 8903,897| 9199,127| 9916,678  |

4. Conclusion
Forecasting the results and discussion, it can be concluded that α-Sutte Indicator method has a good accuracy in predicting historical data of bitcoin more than ARIMA(1,1,1) and NNAR(21,11). It can be seen from the value of MSE and MAPE value of α-Sutte Indicator method is smaller than ARIMA(1,1,1) and NNAR(21,11). This is indicate that α-Sutte Indicator more suitable to forecasting historical data of bitcoin.

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