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# **The Innovation Breakthrough in Digital and Disruptive Era**

## Use of Patterned Datasets (Minimum and Maximum) to predict Bitcoin and Ethereum price movements

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**Abstract.** Bitcoin is always interesting to keep predicting where the next price movement will go. Bitcoin is the first and most influential Cryptocurrency on cryptocurrency price movements. Bitcoin is traded in many markets, the largest in Indonesia is Indodax. Indodax provides a document sharing API so that third parties can build applications that are able to process data on bitcoin price movements in real-time and continuously. This research shows how patterned datasets can be applied to monitor bitcoin price movements from the indodax market and show their effects on other cryptocurrency assets besides bitcoin. This research shows how data that is patterned and then processed using the minimum and maximum functions can provide 2 important information, namely the potential position of bitcoin when it is at the maximum and minimum points. The results of the patterned dataset formula are then compared to the movements of the 2 cryptocurrencies with the largest capitalization, namely BTC (Bitcoin) and ETH (Ethereum). The results of the comparison show that the use of patterned dataset formulas successfully shows important points in cryptocurrency trading, with simpler instructions.

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## 1 Introduction

Research in the area of predicting the price position of bitcoin [16] and the next cryptocurrency price position is very interesting to do because it is volatile and not easy to predict [5],[7],[8],[9]. However, this topic is always interesting to continue studying [5],[6],[9],[10]. The most research found in various publications related to bitcoin [16] is regarding the prediction of the next Bitcoin price. Why is Bitcoin the most highlighted? even though there are many alternative coins made by various companies and communities with various supporting utilities. The answer is because Bitcoin [16] is the price determinant of all cryptocurrencies and the fact that coinmarketcap [14] has over the years shown that often the total Bitcoin Market Cap [14] dominates the overall Cryptocurrency Capitalization.

Examining the movement of Bitcoin [16] and Cryptocurrency prices means that we must first know where the initial data source came from. In this paper, Bitcoin price movement data is taken from the indodax [13] exchange [15] market on the rupiah pair (idr). Bitcoin on the IDR pair, abbreviated as BTC/IDR, then collects the data and then applies the maximum and minimum functions. This minimum and maximum pattern is then analyzed and sought for its influence on the potential for the next bitcoin price and also the top 2 alternative cryptocurrencies besides the stable coin market cap version, namely ETH, which are on the Indodax market [13]. This research focus on collecting, processing and displaying the results of the analysis in the period from May 2022.

Indodax [13] was chosen as the cryptocurrency market for research data providers because it provides support for reading data on bitcoin price movements and alternative cryptocurrency assets by sharing relatively complete API documents [1],[11]. From the access document through this API, third parties as developers can apply formulas to filter data obtained in real time and continuously. This process may in the future support mining and building more specific and useful data sets.

In this study, a patterned dataset cut for May 2022 is presented, which, combined with the maximum and minimum functions, is able to deduce the current bitcoin price position. In this research a simple formula is formulated for the future this patterned dataset can serve as an indicator of whether the current bitcoin price is at the highest or lowest position to be subsequently executed in the form of buying decisions followed by selling to gain profit. This research was conducted because the Auto Trade Bot application in previous studies did not guarantee that it would always provide profits because cryptocurrency price movements were very volatile [12]. In this study, the results achieved are expected to provide information to help cryptocurrency traders before making a decision to buy or sell their assets in the trading system in spot mode on the Indodax digital trading market [13]. This research shows how other cryptocurrency assets move in response to bitcoin movements.

## 2 Literature Review

### 2.1 Indodax API access

The Bitcoin API from indodax can be seen at [indodax.com/downloads/indodaxcom-api-documentation.pdf](https://indodax.com/downloads/indodaxcom-api-documentation.pdf), where on page 3 above there is a way to retrieve data in real time via the BTC/IDR Ticker link ([indodax.com/api/btc\\_idr/ticker](https://indodax.com/api/btc_idr/ticker)) and also ticker ALL ([indodax.com/api/tickers](https://indodax.com/api/tickers)) for the btc idr ticker [1]. for a snippet of the btc/idr ticker display as follows

```
{"ticker":{"high":"448901000","low":"446369000","vol_btc":"8.90470089","vol_idr":"3990444781","last":"446820000","buy":"446820000","sell":"446821000","server_time":1681613892}}
```

 (1)

then with a slight change in the Low, Last, High Algorithm [1], Equations 2 to 7 are obtained as follows

$$\text{Range} = \text{High Price} - \text{Low Price} \quad (2)$$

$$\text{High Range} = \text{High Price} - \text{Last Price} \quad (3)$$

$$\text{Low Range} = \text{Last Price} - \text{Low Price} \quad (4)$$

$$\text{Percent of Range} = \text{Range} / \text{Low Range} * 100\% \quad (5)$$

$$\text{Percent of High Range} = \text{High Range} / \text{Range} * 100\% \quad (6)$$

$$\text{Percent of Low Range} = \text{Low Range} / \text{Range} * 100\% \quad (7)$$

from equations 2 to 7 then the data is stored for 24 hours, 7 days a week continuously.

### 2.2 Maximum and minimum equations

Data that has been collected using equations 2 to 7 filters are then separated per month and maximum and minimum graphs are made using equations 8 and 9

$$\text{MAX}(\text{value-1}; \text{value-2}; \dots \text{value-n}) \quad (8)$$

$$\text{MIN}(\text{value-1}; \text{value-2}; \dots \text{value-n}) \quad (9)$$

where n refers to the amount of data

Next, the SQL Query applied to the data set is as follows

```
SELECT DAY(date) AS "XDAY", MIN(data_count) AS "XMIN", MAX(data_count) AS "XMAX", COUNT(data_count) AS "XCOUNT" FROM BTCIDR WHERE MONTH(date)=5 AND YEAR(date)=2022 AND type='crash' GROUP BY DAY(date) \quad (10)
```

The SQL command above will collect all patterned datasets in the 5th month of 2022 on a crash or degrade state. Since the data set is of the time series type, it needs to be grouped by date so that it appears sequentially. And here is a view of table 1 which contains the patterned dataset for month 5 of 2022 at crash conditions, as an example. From table 1, information can be obtained that the smaller the difference between the MIN and MAX values, then this is a sign that the bitcoin price is in the lower price area and can be considered as a marker to start buying.

**Table 1.** patterned dataset, month 5 of 2022 in crash condition.

DAY	COUNT	MIN	MAX
1	1.723	0	136

2	1.928	0	41
3	1.845	0	68
4	1.702	0	83
5	1.567	1	116
6	2.453	0	103
7	1.755	12	51
8	1.689	0	129
9	2.679	0	146
10	1.682	6	128
11	2.809	0	152
12	3.311	0	135
<b>13</b>	<b>2.486</b>	<b>0</b>	<b>16</b>
14	1.906	1	88
15	1.854	0	23
16	4.487	0	56
17	2.923	0	45
18	2.028	0	107
19	2.908	0	111
20	1.677	0	91
21	1.636	8	72
22	1.527	0	23
23	2.356	0	23
24	3.770	0	108
25	2.544	0	34
26	2.908	0	131
27	2.642	0	91
28	1.670	10	74
29	2.120	0	37
<b>30</b>	<b>1.904</b>	<b>0</b>	<b>19</b>
31	1.640	3	31

### 2.3 Predictive Techniques on Bitcoin

From some of the literature included in this paper, each algorithm requires a dataset as a test object. the dataset resulting from equations 2 to 9 is hereinafter referred to as the patterned dataset. In the future the patterned datasets can be tested using each of these algorithms and then the results are compared with the results using other forms of datasets. In this research, patterned datasets will be compared with displays on widely used crypto trading indicators such as MACD, RSI, Stochastic and Bollinger Band which are available on the indodax chart.

Various techniques and methods for predicting the price of Bitcoin and the next Cryptocurrency are possible Stochastic [2], Hybrid machine learning [5], Support vector machine (SVM) [9],[10], Multilayer perceptron (MLP) [9], Swarm Intelligence Approach [5], [9], Deep Learning [3], [7], Neural Network (NN) [8], Artificial Neural Networks (ANNs) [9], [10], Recurrent Neural Networks [2], Long Short -Term Memory (LSTM) [7], Bidirectional LSTM [7], Gated Recurrent Unit (GRU) [7], Bidirectional GRU [7], and also Sentiment analysis is used to get an overview of trends in the direction of bitcoin and currency price movements other cryptocurrencies, this data can be retrieved from various social media posts, such as Twitter[4],[6]. Prediction techniques that are also widely used include data mining, opinion mining, natural language processing (NLP), and knowledge management [4].

### 3 Methodology

In this research, we first study the API presentation structure of the Indodax Market [1],[11]. Next, we chose the patterned dataset for May 2022 as sample data. Then by using a web-based programming language which is also supported by the implementation of the Indodax API [1],[11], the patterned dataset is given minimum and maximum functions to get patterns to mark bitcoin price positions. the result is that the lowest price point is obtained, namely when the difference from the application of the minimum and maximum functions gets the lowest value. This is where the bitcoin price will be detected in the lower price area and become a reference when buying bitcoins for sale when the price has gone up or when the difference between the application of the minimum and maximum functions is getting bigger.

Then to further demonstrate the benefits of implementing this minimum and maximum function, the results of presenting the data will be compared by applying several statistical indicators that are commonly used by cryptocurrency traders around the world, namely Moving Average Convergence Divergence (MACD), Bollinger Bands, Stochastic, Relative strength index. (RSI), and MA/EMA Cross with examples of cryptocurrency asset price movements that often have the first and second largest capitalization, namely Bitcoin IDR, and Ethereum IDR. Finally, we present important information from the web application above which shows how the price is positioned, whether it has reached an important point in the indicator application. These dots are created as markers for cryptocurrency traders to prepare to buy or sell.

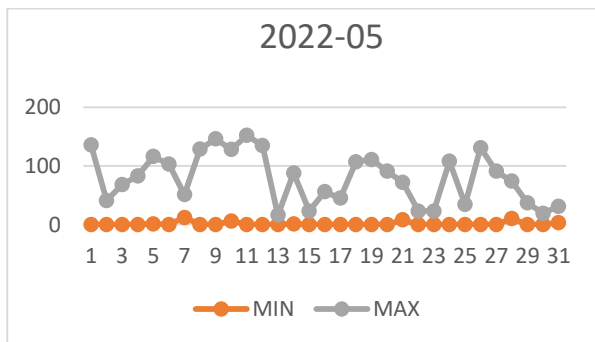
These signals can then be used by digital cryptocurrency traders to predict the likelihood that prices will next go up or down and compare to common patterns that often occur on statistical indicators when key points are reached or broken. By creating patterned datasets with the addition of minimum and maximum functionality, digital cryptocurrency traders do not need to constantly monitor market charts, which can lead to burnout and reduce focus. digital cryptocurrency traders simply wait for the notification on the chart that the difference between the minimum and maximum implementation is getting smaller. Furthermore, it is compared with statistical indicators such as MACD, Bollinger bands, Stochastic, RSI and MA/EMA. Each indicator has a lower limit and upper limit as a reference. With the addition of patterned datasets as a tool to add to decision considerations, it will further strengthen and confirm. Only then decide whether to buy, sell or wait for the next important signal to appear.

### 4 Results And Discussion

To build a patterned dataset, we first collect data on the movement of all cryptocurrency prices on the Indodax trading market. Then formulas 2 to 7 are applied. This implementation will classify into two conditions, namely which cryptocurrency is experiencing a daily lowest decline condition called a crash condition and which cryptocurrency is experiencing a daily highest increase condition which is called a moon condition. In this research, only patterned datasets are used for crash conditions in May

2022 as an example. Because the number of patterned datasets per month per day is quite a lot as shown in the count column in table 1, the minimum and maximum values are applied to all patterned datasets per day. To get patterned datasets, datasets are stored per minute. In every minute there will be a value of how many cryptocurrency assets experience daily crash conditions due to responses from bitcoin price movements. So that from the thousands of patterned datasets that are stored in one day, each data will have a value. Furthermore, in all data in one day, the minimum and maximum values are sought and then compared with the difference in distance. The smaller the difference between the minimum and maximum distance, the more it shows a decline in cryptocurrency prices, where examples of cryptocurrency assets used as case studies are bitcoin and ethereum. The results of implementing a patterned dataset (minimum and maximum) are then compared with 5 statistical indicators namely MACD, Bollinger Bands, Stochastic, RSI, and MA/EMA.

The data in table 1 is then formed into a graph as shown in Figure 1. The graph in Figure 1 is then compared to the MACD, RSI, Stochastic, Bollinger Bands, and MA/EMA Cross charts. The 2 cryptocurrency assets with the largest capitalization are bitcoin (BTC) and ethereum (ETH).



**Fig 1.** Patterned Dataset in month 5 of 2022 with filter equations 2 to 9

Furthermore, the graph in Figure 1 is compared to the graph of bitcoin and ethereum price movements using the MACD, RSI, Stochastic, Bollinger Bands and MA/EMA Cross indicators.



**Fig 2a** Bitcoin chart month 5 of 2022 with MACD



**Fig 2b** Ethereum chart month 5 of 2022 with MACD

From Figure 2a and 2b, when the graph in Figure 1 on May 13, 2022 shows the lowest minimum and maximum difference, it is validated in Figures 2a and 2b, where on May 13, 2022 there was a reversal after decline in the bitcoin price (figure 2a) and a reversal after decline in the price ethereum (figure 2b).



**Fig 3a** Bitcoin chart month 5 of 2022 with RSI



**Fig 3b** ETH chart month 5 of 2022 with RSI

From Figure 3a and 3b, when the graph in Figure 1 on May 13, 2022 shows the lowest minimum and maximum difference, it is validated in Figures 3a and 3b, where on May 13, 2022 there was a reversal after decline in the bitcoin price (figure 3a) and a reversal after decline in the price ethereum (figure 3b).



**Fig 4a** BTC chart month 5 of 2022 with Stochastic



Fig 4b ETH chart month 5 of 2022 with Stochastic

From Figure 4a and 4b, when the graph in Figure 1 on May 13, 2022 shows the lowest minimum and maximum difference, it is validated in Figures 4a and 4b, where on May 13, 2022 there was a reversal after decline in the bitcoin price (figure 4a) and a reversal after decline in the price ethereum (figure 4b).



Fig 6b ETH chart month 5 of 2022 with MA/EMA Cross

From Figure 6a and 6b, when the graph in Figure 1 on May 13, 2022 shows the lowest minimum and maximum difference, it is validated in Figures 6a and 6b, where on May 13, 2022 there was a reversal after decline in the price ethereum (figure 6b). The second table below shows a comparison of the application of the min max algorithm with the others

**Table 2. Comparison results of the minmax patterned dataset with 5 statistical indicators for month 5 of 2022 in a crash condition.**

Indicators	Crypto Bitcoin Price	Crypto Ethereum Price
<b>Patterned Dataset with MIN MAX Function</b> (Minimum difference is 16, as of 13/05/2022) <b>(Fig. 1)</b>		
<b>MACD</b>	reversal after decline <b>(Fig. 2a)</b>	reversal after decline <b>(Fig. 2b)</b>
<b>RSI</b>	reversal after decline <b>(Fig. 3a)</b>	reversal after decline <b>(Fig. 3b)</b>
<b>Stochastic</b>	reversal after decline <b>(Fig. 4a)</b>	reversal after decline <b>(Fig. 4b)</b>
<b>Bollinger Bands</b>	reversal after decline <b>(Fig. 5a)</b>	reversal after decline <b>(Fig. 5b)</b>
<b>MA / EMA Cross</b>	reversal after decline <b>(Fig. 6a)</b>	reversal after decline <b>(Fig. 6b)</b>



Fig 5a BTC chart month 5 of 2022 with Boll. Bands



Fig 5b ETH chart month 5 of 2022 with Boll. Bands

From Figure 5a and 5b, when the graph in Figure 1 on May 13, 2022 shows the lowest minimum and maximum difference, it is validated in Figures 5a and 5b, where on May 13, 2022 there was a reversal after decline in the bitcoin price (figure 5a) and a reversal after decline in the price ethereum (figure 5b).

The results of the comparison in table 2 show that when the patterned dataset with minmax shows the smallest difference, the five statistical indicators also show relatively low prices.



Fig 6a BTC chart month 5 of 2022 with MA/EMA Cross

For future research, patterned datasets can be used as test data on algorithms such as stochastic, hybrid machine learning, support vector machine (SVM), multilayer perceptron (MLP), swarm intelligence approach, deep neural network (NN), artificial neural networks (ANNs), recurrent neural networks, long short-term memory (LSTM), bidirectional LSTM, gated recurrent unit (GRU), and bidirectional GRU to predict price movements and fluctuations in bitcoin and cryptocurrency. The results can be validated by also being compared with sentiment analysis on social media sites such as Twitter. [2]-[10].

## 5 Conclutions

Indodax as one of the largest digital cryptocurrency trading markets in Indonesia, shares API Documents to access data on the movement of all cryptocurrencies on that market. Then using web-based programming languages such as PHP and Javascript, a patterned dataset algorithm is built on the basis of equations 2 to 9 to form a Patterned Dataset. The patterned dataset is then stored continuously in the MySQL database on the hosting servermysql

. Next, using an SQL query, the Patterned Dataset is grouped per month, then the maximum and minimum functions are applied to the daily patterned dataset. Furthermore, the pattern dataset is sampled for the 5th month of 2022 and then compared with commonly used trading indicators such as MACD, RSI, Stochastic, Bollinger Bands, and MA/EMA Cross on cryptocurrency assets with the largest capitalization numbers 1 and 2, namely Bitcoin (BTC) and Ethereum (ETHs). The result is when the difference between the minimum and maximum values on the daily patterned dataset gets smaller, then this indicates a potential price reversal after experiencing a price decline. This Patterned Dataset is a new way of presenting a pre-patterned dataset to show the effect of bitcoin price movements on the movement of other cryptocurrency assets which can show better buying points and potential profits, but in a simpler and easier way.

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