RESEARCHİNG THE FUTURE OF BİTCOİN MARKET WİTH MACHİNE LEARNİNG METHOD: ANAPPLİCATİON ON THE CASE OF TURKEY

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Abstract

It is seen that money takes different forms in line with the changing needs and technological developments throughout the historical process. Recently, cryptocurrencies have been included in our lives with Bitcoin. Bitcoin is a digital currency that functions using cryptographic techniques and without the need for the control of a central authority. As a result of technological developments, it is seen that the interest in Bitcoin, which has entered our lives as a new monetary tool and is predicted to be an alternative to currencies, is increasing. In this article, the machine learning method, which is a branch of artificial intelligence, is used as a method. In the example of Turkey, the daily closing data of bitcoin for 2016 were used. The machine learning method is aimed to predict the closing prices of the bitcoin market.According to the analysis findings, it is seen that the closing prices realized in the 4th quarter are higher than the closing prices realized in the 1st quarter. If the volume USD is higher than 5517.34 then it is Q1. Some rules have been produced with the Machine Learning method.It is aimed to contribute to the literature by using themachine learning method for predicting Bitcoin closing prices.

Keywords: Money, Cryptocurrency, Bitcoin, Artificial Intelligence, Machine Learning.

Jel Codes: C1, C01, C29, E40

Makine Öğrenme Yöntemi ile Bitcoin Piyasasının Geleceğinin Araştırılması: Türkiye Örneğinde Uygulama

Öz

Tarihsel süreç içerisinde değişen ihtiyaçlar ve teknolojik gelişmeler doğrultusunda paranın farklı şekiller aldığı görülmektedir. Son zamanlarda kripto para birimleri hayatımıza dahil olmuştur ve Bitcoin bu para birimlerinden birisidir. Bitcoin, kriptografik teknikler kullanarak ve merkezi bir otoritenin kontrolüne ihtiyaç duymadan çalışan dijital bir para birimidir. Teknolojik gelişmeler sonucunda yeni bir parasal araç olarak hayatımıza giren ve para birimlerine alternatif olacağı tahmin edilen Bitcoin'e ilginin arttığı görülmektedir. Bu makalede yöntem olarak yapay zekânın bir dalı olan makine öğrenmesi yöntemi kullanılmıştır. Türkiye örneğinde bitcoinin 2016 yılı günlük kapanış verileri kullanılmıştır. Bu çalışma ile Makine öğrenmesi yöntemi kullanılarak, Bitcoin piyasasının kapanış fiyatlarının tahmin edilmesi amaçlanmaktadır. Makine öğrenmesi yöntemi Bitcoin piyasasının nasıl şekilleneceğine dair bazı kurallar üretilmiş ve analiz kısmında bu sonuçlara yer verilmiştir.

Anahtar Kelimeler: Para, Kripto Para, Bitcoin, Yapay Zekâ, Makine Öğrenmesi.

Jel kodları: C1, C01, C29, E40

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1. Introduction

Bitcoin is an open-source, peer-to-peer digital currency. Among other things, the feature that distinguishes Bitcoin from traditional payment systems is that it is the first decentralized electronic payment system. Therefore, Bitcoin is the first cryptocurrency. Bitcoin came to the fore in 2008 with the article "Bitcoin: A Peer-to-Peer Electronic Cash System" published by a person/group known by the pseudonym Satoshi Nakamoto. Nakamoto defined Bitcoin as a new electronic payment system based on mathematical proofs that enable transactions between parties without the need for intermediaries (Nakamoto, 2019).

This new payment system is called Bitcoin. The unit of account of the bitcoin system is bitcoin, which is written with a lowercase b. The fact that the Bitcoin system has its unit of account serves two purposes. First, bitcoin represents a value by using it as a medium of exchange in transactions made by system participants. The second purpose is to reward network participants who ensure the smooth functioning and security of the network (Franco, 2015). Bitcoin gets its value not from state sovereignty like fiat currencies, but from the value people give it.

A database technology called distributed ledger is used to record and verify transactions performed on the Bitcoin network. This database technology is also known as a blockchain. Every transaction made on Bitcoin is recorded in a distributed ledger called the blockchain. In other words, the blockchain represents a digital ledger where all transactions made on the Bitcoin network are kept chronologically. All Bitcoin transactions are public and every computer connected to the system, also known as a node, has a copy of these transactions. Anyone who has just joined the network can see all the transaction records until that date (Brito & Castillo, 2013).

This blockchain or distributed ledger allows digital currency to be used in a peer-to-peer payment system (Stern, 2017). Transactions in the Bitcoin network are not made in nominal currencies as in traditional payment systems, but in "bitcoin" (BTC), the payment system's unit of account (Brito & Castillo, 2013)
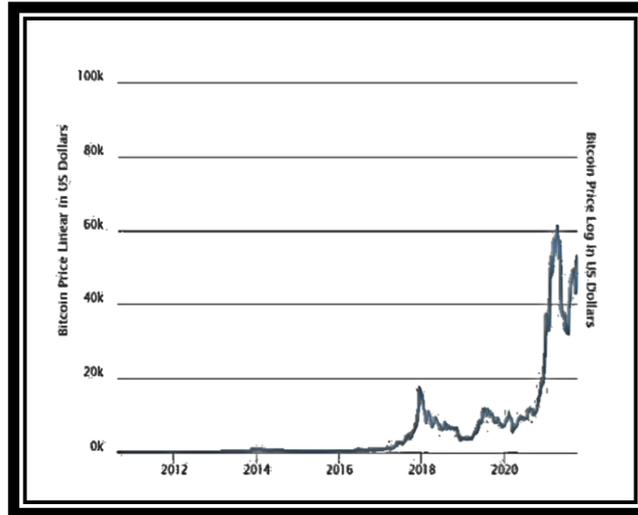
Figure 1. *Bitcoin market price (Usd) 2010-October 2021*

Source: https://www.buybitcoinworldwide.com/price/ (09/10/2021)

When the figure above is examined, it is seen that at the end of 2017, Bitcoin reached its highest value until then. On 17.12.2017, one BTC was traded at approximately $20,000. After this rise, as a result of intense sales in 2018, the value of one BTC decreased to $ 6,117, and in 2019 to $ 3,527. It was traded at 1 BTC= $61,035 on 12 April 2021. This price is read from the chart as the highest price level Bitcoin has ever reached. As of 2019, it is seen that the Bitcoin market transaction volume has increased and its price has increased. It can be stated that the demand for cryptocurrencies has increased during the Covid 19 pandemic process.

Bitcoin's rules are designed by engineers (Böhme et al., 2015). Bitcoin currency first appeared in 2009. Bitcoin has survived to this day and has become the most popular cryptocurrency in the virtual market. As a result of being the internationally accepted and preferred currency over time, the Bitcoin economy has emerged (Ceylan, 2019).

Bayesian Networks have been used by Lee et al to predict bitcoin price. It is concluded that Bayesian Networks perform well in predicting bitcoin prices (Jang & Lee, 2017).

In the study carried out by Pham et al., anomaly detection in the bitcoin network was studied using unsupervised learning methods. Thieves and illegal activities are often abnormal in financial networks. There are many machine learning techniques to solve these problems, some results have high accuracy but one method is not superior to other methods (Pham & Lee, 2017).

In the study carried out by Gencer et al., bitcoin price was estimated by Artificial Neural Networks method. As the data set of the research, daily bitcoin closing prices from January 2015 to April 2018 were included in the analysis. The closing prices of each day were taken and the averages of each month's closing prices of bitcoin were calculated and the data were normalized. The data were analyzed using the Matlab 2013a program. Levenberg-Marquardt back propagation algorithm was used

for network training. The result of the prediction is that the price of bitcoin in May 2018 will be $ 80955. The average bitcoin prices for the previous three months were $9,472 in February, $9,040 in March, and $8,033 in April, making the estimate quite high. The actual May 2018 average price was $7,487. Because of this big difference, the algorithms and methods used in this study have concluded that bitcoin is useless in price prediction (Sakız & Gencer, 2018).

2. Research Method: Machine Learning

Machine Learning is the development of automated techniques to learn how to make accurate predictions based on previous observations (Schapire, 2003). According to another definition, it is the development of computer systems that perform the automatic learning process based on experience (Ayodele, T. O., 2010). Data is very important in machine learning. Learning algorithms are used todiscover the information and features of the data (Chao, 2011).

The data used is divided into two groups; labeled dataset and unlabeled dataset. The labeled dataset is used to train the algorithm. Unlabeled data is used to test the trained algorithm. For this reason, it is seen that these data types are also called training and test sets. Systems created using machine learning generally use two different learning models. These two models are supervised and unsupervised learning models (Gentleman vd., 2008).

2.1. Supervised and Unsupervised Machine Learning

In the supervised machine learning process, the system is trained and learned by using labeled data in the system. During the training of the system, the inputs and outputs of each sample in the data set are given to the system. In-text classification studies, the input stage represents the content of the text, and the output represents its category. The test dataset is used to validate the system. During the validation of the system, the learning algorithm category assigns any of the outputs in the training data to unknown test data (Kotsiantis vd., 2007). The realization stages of the supervised learning model process are presented in Figure1 (Afrin & Nahar, 2015).

Bayesian Networks: Bayesian networks (BN) have reached the application area in differentfields, from the discovery of gene regulatory networks to water resources management. It can be seen that the BN learning task is divided into two subtasks: structured learning and parametric learning. Structured learning is the description of the topology of Bayesian networks. Parametric learning is the estimation of numerical parameters of particular network topology. The most challenging task for both is to learn the structure of a BN (Yavuz, 2021).

Gaussian Functions: The most important uses of Gaussian functions are the creation of neuralnetworks, the representation of probabilities, and the verification of experimental results. Therefore, Gaussian functions are an integral part of the LogicPlum platform. Its approach to machine learning-based modeling is the most important advantage of this platform. It allows users to test and

evaluate hundreds of different models and choose the most efficient one. It also generates automatically generated reports that reveal the modeling process in depth. (Yavuz, 2019).
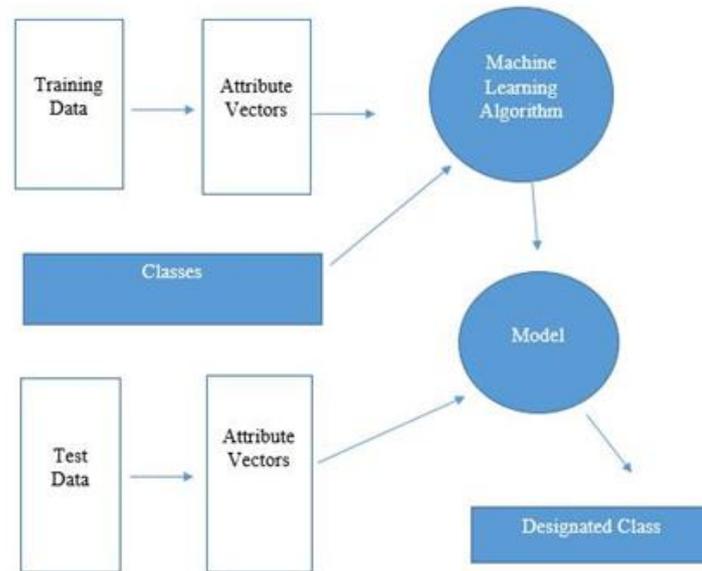

Figure 2. *Supervised learning model process weka*

It is known that the Weka application was developed by the University of Waikato. It has been developed as open-source code on the Java platform and is constantly updated. By using WEKA, it is possible to classify, transform, cluster, create and display a relation rule of data. WEKA is an open-source data mining tool developed in the Java language, declared under the general public license (Witten & Frank, 2005).

Research Ethics

This study titled "Researching the Future of Bitcoin Market with Machine Learning Method: Anapplication on the Case of Turkey" has been prepared in accordance with publication/research ethics. In the preparation of this article, academic research rules and principles were adhered to. I declare that this study has been prepared in accordance with research ethics.

3. Findings

In the analysis conducted supervised and unsupervised, machine learning algorithms have been applied with associated classification and clustering approaches. 66 percent of the data has been used to train the model whereas the remaining part of the data has been used with the testing of the model. Later predicted and actual results of the bitcoin closing market values compared.

Table 1. *Assesment of performance indicators*

	J48	JRip	Part	OneR Method	Multilayer Perceptron	Bayesian Networks
Method Indicator						
RMSE	**0.0635**	0.0898	0.0635	**0.0635**	0.0947	0.2205
Precision	**0,992**	0,985	0,992	**0,992**	0,977	0,889
Correctly Classified %	**99.1935**	98.3871	99.1935	**99.1935**	97.5806	88.7097
Incorrectly Classified %	**0.8065**	1.6129	0.8065	**0.8065**	2.4194	11.2903

J48 and OneR methods have been the top performers among other algorithms based on the performance metrics considered. In the evaluation RMSE, precision, Correct classification rate, misclassification rate has been considered as the key performance indicators in the assessment. J48 and OneR have been the algorithms with the highest correct classification rate and with the lowest RMSE which indicates that they can be used as an effective and efficient approach in supervised forms of machine learning in such problem sets and problem domains (Karahoca & Yavuz, 2013).

Table 2. Rules Discovered with Machne Learning Algorithms

If date is less than 42551 then it is Q1
If the date is greater than 42551 then it is Q2.
If date is less than 42463 then it is Q3.
If the date is greater than 42463 then it is Q4
If the BTC open price is 672,8875 than it is Q4.
If the BTC open price is 423,8528 than it is Q1.
It is observed that the closing prices realized in Q1 are lower than the closing prices realized in Q4.
If volume BTC ≤ 2624697.92 than it is Q1.
If volume BTC > 2448940.42 than it is Q2.
If volume BTC > 2624697.92 than it is Q3.
If volume BTC > 2796115.29 than it is Q4.
If the Volume USD > 5517.34 than it is Q1.
If the Volume USD > 3652.44 than it is Q2.
If the Volume USD > 4029.84 than it is Q3.
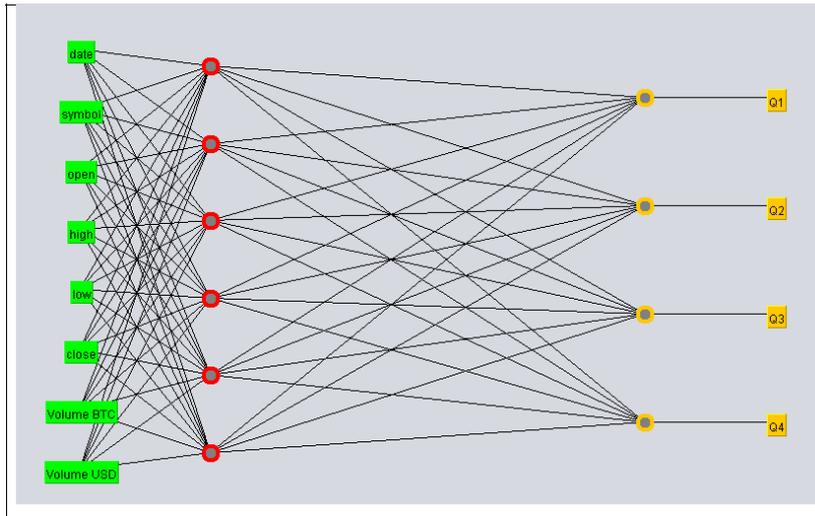If the Volume USD ≤ 4029.84 than it is Q4.

Figure 3. *A multilayer perceptron (a form of neural network) view of the model*
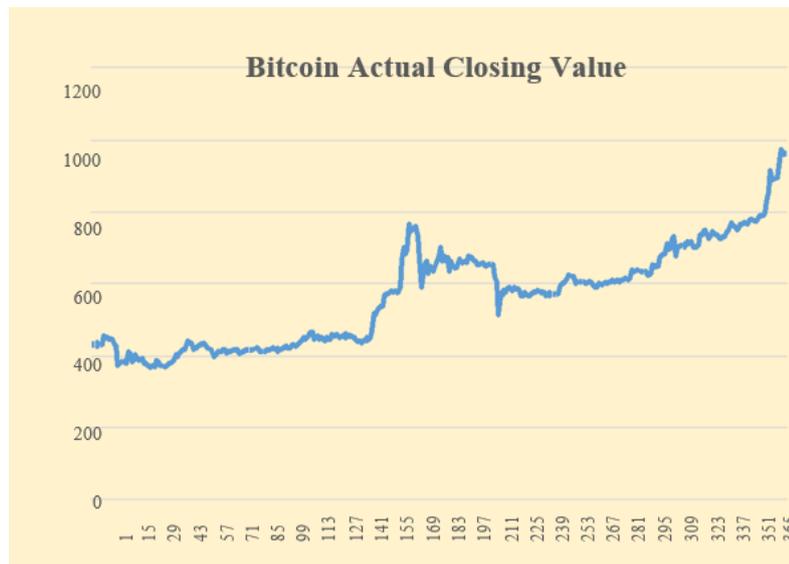

Figure 4. *Bitcoin actual closing value*

Figure 5 above, Bitcoin Actual Closing values are presented. In figure 6 below, Bitcoin Predicted Closing values are presented.
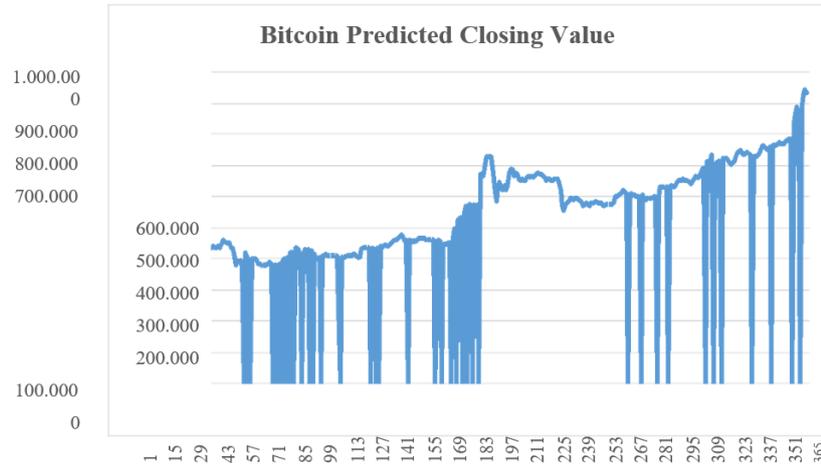
Figure 5. *Bitcoin predicted closing value*

4. Conclusion and Recommendations

It is seen that money takes different forms in line with the changing needs and technological developments throughout the historical process. Recently, cryptocurrencies have been included in our lives with Bitcoin. Bitcoin is a digital currency that functions using cryptographic techniques and without the need for the control of a central authority. As a result of technological developments, it is seen that the interest in Bitcoin, which has entered our lives as a new monetary tool and is predicted to be an alternative to currencies, is increasing.

When the literature was searched, it was seen that bitcoin prices were predicted by machine learning method. In this study, it is aimed to investigate the future prediction of the Bitcoin market using the machine learning method. In the study carried out by Kadiroğlu et al., a detailed literature review was conducted on studies using machine learning methods to predict the future price of bitcoin. Basic and current information about bitcoin is included in the study. In addition, the theoretical knowledge of the machine learning methods used is also explained. As a result of the literature review, the findings have shown that machine learning methods can achieve successful results for bitcoin price prediction (Kadiroğlu vd., 2019).

Analysis revealed that the closing prices realized In Q1 are lower than the closing prices realized In Q4. It Is observed that the closing prices realized In Q1 are lower than the closing prices realized In Q4. If the Volume USD > 5517.34 then It Is Q1. If the Volume USD > 3652.44 then It Is Q2. If the Volume USD > 4029.84 then It Is Q3. If the Volume is USD ≤ 4029.84 then It Is Q4. If the date is greater than 4/3/2016 then It is Q4. If the BTC open price Is 672,8875 then It is Q4. If the BTC open price Is 423,8528 then It is Q1. J48 and OneR methods have been the top performers among other algorithms based on the performance metrics considered. In the evaluation RMSE, precision, Correct classification rate, misclassification rate has been considered as the key performance indicators in the assessment. J48 and OneR have been the algorithms with the highest correct classification rate and with

the lowest RMSE which indicates that they can be used as an effective and efficient approach in supervised forms of machine learning in such problem sets and problem domains. Studies of this type can be considered for exploratory and confirmatory understanding for similar phenomena.

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