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"Yosh olimlar, doktorant va tadqiqotchilarning onlayn ilmiy forumi"

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APPLICATION OF MACHINE LEARNING TECHNIQUES FORECASTING THE MOVEMENT OF UTILITY INDEXES

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***Аннотация**: В статье рассматриваются методы машинного обучения в биржевой торговле. Авторы решают задачу определения направления индекса на 5-минутном интервале и сравнивают схемы прогнозирования фондового индекса.*

***Abstract:** The article discusses machine learning techniques in stock trading. The authors solve the problem of determining the direction of the index on a 5-minute interval and compare stock index forecasting schemes.*

***Keywords:** Deep Learning, Committee Method, Random Forest, Gradient Boosting, Forecasting, Stock Market, Classification.*

***Ключевые слова:** Глубокое обучение, комитетный метод, случайный лес, градиентный бустинг, прогнозирование, фондовый рынок, классификация.*

There is a data set of the closing price of the stock index of the Moscow Stock Exchange for the period from 01/10/2018 to 01/10/2019. The total number of observations at a 5-minute interval is 26,922. Random forest method [1], a process of gradient boosting [2], overlay method [3], AdaBoost method [4], logistic regression [5], and k-nearest Neighbourhood methods are used on training samples. The results of applying the considered methods on the training sample from 10.01.2018 to 31.08.2019 (22734 observations) are presented in Table 1.

Table 1. The results of the accuracy of the methods on the test set for 7 variables (training set - the period from 10/01/2018 to 08/30/2019)

Method	Accuracy of the train sample	Accuracy of the test sample	Accuracy of the method forecast	
			Down	Up
KNeighbors	69,1%	49,26%	49,1%	49,4%
RandomForest	98,4%	50,09%	50,0%	50,2%
LogisticRegression	50,8%	50,09%	-	50,1%
GradientBoosting	57,5%	51,99%	53,0%	51,5%
Bagging	98,4%	50,14%	50,0%	50,3%
AdaBoost	53,1%	51,48%	51,9%	51,2%

The results obtained in the table. 1 shows that in the test sample, the accuracy of the gradient boosting method is 51.99%, the accuracy in predicting an increase in value is 51.5%, and the accuracy in predicting a decrease in value is 53.0%. This method has the highest accuracy among all forms. It's also obviously random [6]

the forest method and the bag method overfit the training set. In the period from 10/01/2018 to 31/08/2019 (22734 observations), different machine learning methods were used on the same training sample, but with 19 variables[7]. The results are presented in Table 2.

Method	Accuracy of the train sample	Accuracy of the test sample	Accuracy of the method forecast	
			Down	Up
KNeighbors	69,3%	50,79%	50,82%	50,75%
RandomForest	98,4%	49,95%	50,06%	49,89%

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LogisticRegression	50,8%	50,09%	-	50,09%
GradientBoosting	58,7%	50,83%	50,70%	51,09%
Bagging	98,6%	52,55%	53,03%	52,18%
AdaBoost	53,9%	50,28%	50,29%	50,25%

The results in Table 2 show that the accuracy of the gradient boosting method on the training set increased from 57.5% to 58.7%, and on the test set it decreased from 51.99% to 50.83% [8]. Random forest method and training sample bagging in the first case (with7 variables) and in the second case (with 19 variables) shows high accuracy on the training set [9]. However, in the second case in the test sample, the bagging method is the most accurate of all methods with a prediction accuracy of 52.55% [10].

The accuracy of the bullish forecast is 52.18%, and the anti-bullish forecast is 53.03% [11]. Therefore, the gradient boosting method is more accurate for fewer variables [12]. The coverage method is suitable for more variables. Increasing the number of variables did not improve accuracy [13]. So, the gradient boosting process was applied to training samples of different sizes. The results of the Gradient Boosting method on a test set with different train samples are presented in the periods of the training and test sets do not overlap [14].

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