Application of Artificial Intelligence in a Digital Platform

Tereshkin Sergey Ivanovich[1][a], Malyshevsky Pavel Vasilyevich[2][b]
and Babkin Vladimir Andreevich[3][c]

[1]General Director of ORG-Market LLC, 115419, Moscow, 115419, Moscow, municipal district Donskoy vn.ter.g., st. Ordzhonikidze, 11, building 10

[2] Information Technology Director of ORG-Market LLC, 115419, Moscow, 115419, Moscow, municipal district Donskoy vn.ter.g., st. Ordzhonikidze, 11, building 10

[3]Candidate of Economics, specialist in Research/R&D of ORG-Market LLC, 115419, Moscow, 115419, Moscow, municipal district Donskoy vn.ter.g., st. Ordzhonikidze, 11, building 10

mail@res-rs.ru, itdir@res-rs.ru, research@org-market.com

Keywords: Data analysis, Econometric software, Economics of commodity exchange and production, Comparative analysis of costs and results, Criteria for decision-making under conditions of risks and uncertainty, Extractive industry.

Abstract: The team of authors analyzed and studied four solutions for the analysis of big data based on artificial intelligence technology within the framework of this research work. Such as: machine learning, data mining, artificial neural networks and predictive analytics. The methodology of the study included the collection, analysis and generalization of data on the selected solutions. We have considered their disadvantages and advantages, studied in detail the data formats that are suitable for use in the above solutions. In addition, a comprehensive analysis of the experience of practical application of each of them in various digital platforms and companies in various spheres of the national economy was carried out. Based on the results of our scientific work, we determined that the most promising and suitable solution for further integration into the "Multidirectional Platform for instant purchases and sales in commodity markets" is machine learning. It is one of the most popular ready-made offers on the market and has the greatest theoretical elaboration, which allows, if necessary, to refine it to perform specific applied tasks. The analysis of practical application experience indicates a high potential for using any digital platform aggregating big data. The scope of its application is quite wide. Starting from forecasting the price dynamics for various categories of products sold on the digital platform, ending with the collection and analysis of analytical information on the use of various site functionality by users. The combination of expanding opportunities in the application of information and telecommunication technologies, along with the growing expectations of consumers regarding technologies and their added value for our society, requires interdisciplinary research and a research program in the field of artificial intelligence and machine learning technology.

1 INTRODUCTION

The digital economy penetrates into the most diverse aspects of society's life every year. Ubiquitous access to high-speed Internet, revolutionary achievements in science and technology – all this increases the importance of the digital economy in general and digital platforms in particular. The trend chosen by the Government of the Russian Federation to digitalize the prevailing number of spheres of life in the country is only confirmation of the fact that the future will be closely intertwined with the digital economy, and a variety of ecosystems will be actively developing.

Digital platforms act as a kind of intermediaries connecting two or more market participants through ecosystems, and simplifying their direct interaction with each other, which allows them to organize

[a] https://orcid.org/0000-0002-4313-1110
[b] https://orcid.org/0009-0005-5967-7774
[c] https://orcid.org/0000-0002-9124-7329

effective cooperation in the future. In the case when the seller and the buyer work through the platform, a large amount of data is aggregated, which is suitable for subsequent analysis (Spiekermann, 2019). For example, according to forecasts of various analytical agencies, by 2025 the total volume of data from around the world will be 163 zettabytes. Which, in turn, is 10 times more than the same indicator for 2016.

The use of technologies and tools for processing and analyzing big data in order to obtain valuable relevant information becomes a unique competitive advantage of organizations, allowing them to significantly increase the efficiency of their activities and the accuracy of forecasting trends in the markets they are interested in (Yudina, Geliskhanov, 2018).

Scientific research is focused on the study of big data analysis processes aggregated during the operation of the "Multidirectional Platform for instant purchases and sales in commodity markets" (hereinafter referred to as the Multidirectional Platform) (Tereshkin, 2021). On their basis, predictive models of customer behavior will be developed, the first experimental and practical approaches to the use of artificial intelligence technology will be formed. Colleagues in their work put forward the following idea: "... big data analytics turns into a tool for making operational decisions in almost all spheres of human activity and becomes a unique competitive advantage that provides a significant increase in the efficiency of various systems and processes" (Yudina, Geliskhanov, 2018). In turn, Tucker C. notes that many new business models of platforms include the collection, storage and analysis of big data (Tucker, 2019).

The Multidirectional Platform in its development aims to become one of the most technologically advanced among existing analogues in the market of petroleum products and petrochemicals of the Russian Federation (Tereshkin, 2021). This is explained by the fact that the development team in its activities focuses not only on the most modern achievements in the field of technology and information technology development, but also carries out a whole range of scientific activities (Tereshkin, 2021).

The team of authors decided to analyze only those solutions that are based on artificial intelligence technology. This is due to the following reasons:

- the amount of aggregated information is growing every year, respectively, the increase in the volume of data exponentially makes it difficult to clean, process and analyze them manually;

- the development of science and technology makes it possible to move from theoretical modeling of the use of artificial intelligence technology to its practical application for solving specific tasks;

- due to the increasing competition in the market, a Multidirectional Platform should have serious competitive advantages over existing analogues in the market.

Accordingly, the potential costs on the part of the Multidirectional Platform developer organization in the future may pay off many times after the introduction of the analytical module into operation, its training and adaptation to the specifics of the oil market.

2 LITERATURE REVIEW

Modern achievements in the field of big data analysis using artificial intelligence technology are based on a powerful theoretical basis laid down by the geniuses of their time. Most experts consider the Swiss scientist of German origin Jürgen Schmidhuber (2010) to be a pioneer in the study of artificial intelligence technology. He figured out how to endow artificial intelligence systems with memory, also taught neural networks to highlight important information, ignore unnecessary information and find patterns in data arrays. Yoshua Bengio, Yann LeCun & Geoffrey Hinton are rightfully considered the founding fathers of such a direction as machine learning, for their achievements they were awarded the honorary Turing Award (Jin, 2021).

G. Pyatnitsky-Shapiro is the founder of data mining, which is at the junction of such areas as artificial intelligence, mathematical statistics and database theory (Fan, 1998). Artificial neural networks are one of the main areas that are actively developing at the moment. Such scientists as S. Haikin, T. Rashid, K. Bishop are engaged in the development of this field of knowledge (Bitzer, 2012). The problems of studying predictive analytics are dealt with by E. Siegel (Li, 2020).

The basic foundations of artificial intelligence technology were laid in the middle of the XX century, which can be directly related to the development of personal computers. Unfortunately, the technical and scientific achievements of that time limited scientists and did not allow them to test their theoretical developments in practice. However, the current situation gives researchers more opportunities to implement the most daring theories and assumptions. Some of them, for example: machine learning, data mining, artificial neural networks and predictive analytics, are already actively used in everyday activities.

The modern development of science and technology allows research scientists to more actively immerse themselves in the problems of practical use of artificial intelligence technology. A significant number of scientific publications in various foreign and domestic high-ranking journals are devoted to the use of machine learning. For example, machine learning can be used to monitor business processes within a company (Kratsch, 2021). It is aimed at predicting the behavior, performance and results of business processes. This helps to identify problems before they arise and to reallocate resources before they are wasted. Demand modeling for various kinds of products is carried out thanks to machine learning (Antipov, 2020). Machine learning has also found its application in the healthcare sector to predict COVID-19 outbreaks (Khakharia, 2021). The model predicts the number of new cases that may occur over the next 5 days using 9 different machine learning algorithms.

One of the most popular ways to use machine learning is to conduct research on various market segments using big data analysis (Hruschka, 2021). Domestic researchers are also considering the use of machine learning in a wide variety of areas of the national economy. The growing processes of digitalization and datafication in the Russian economy, the increase in the volume of transmitted and stored data, the growing need of the state for up-to-date and reliable analytical information for decision-making impose new requirements on the system of state statistics [Prokhorova, 2020]. Machine learning is becoming an important link in the digitalization of federal executive authorities (Buryakova, 2019), and is also actively used in training (Shevtsova, 2020).

Data mining has found wide application in the field of business modeling and management decision-making (Breur, 2004). Its models are being developed to find new useful patterns in big data and for their further use (Osei-Bryson, 2009).

Forecasting can often be improved by preparing big data. The right preparation method can reveal important information hidden in them and reduce uncertainty. In this case, data preparation will not reduce the perceived uncertainty to such an extent that a comprehensive forecasting method can be used (Maaß, 2014). Data mining serves as a decision support tool for customer service managers (Reutterer, 2017). Russian scientists consider it as a tool for the study of big data obtained from a variety of sources and spheres of the national economy (Veligura, 2020; Nikulina, 2017).

Space is data-oriented and relies heavily on it. One of the most important concepts is the processing of information obtained from various resources in space. The adoption of data mining in space physics has been slow due to the steep learning curve, methods and/or requirements of having practical knowledge of statistics (Nischhal, 2018).

Artificial neural networks predict financial time series. In general, the time series of the stock market demonstrate high volatility due to their sensitivity to economic and political factors (Teixeira Zavadzki de Pauli, 2020; Zehtab-Salmas, 2021). The use of artificial neural networks to predict the performance of various renewable energy sources is also one of the promising areas of activity (Sridharan, 2020). The use of artificial intelligence technology in solving management problems always implies an understanding of the relevant problem from the point of view of these methods. In our case, from the point of view of a specific neural network (Klüver, 2012). In the Russian scientific school, artificial neural networks are studied in terms of image segmentation of the biofluid fraction obtained by wedge-shaped dehydration (Semenov, 2019).

Currently, the introduction of computer networks with dynamic topology is becoming a ubiquitous phenomenon. As a result of the practical implementation of the technique, it is possible to obtain a properly trained neural network that will allow timely detection of security threats in real time (Klyuev, 2021). Artificial neural networks are used in the process of data transmission and methods of software implementation (Vergun, 2016).

The final solution in the framework of our research work is predictive analytics. Russian and foreign scientists agree that one of the most relevant and effective ways to use predictive analytics is to help in making managerial decisions in conditions of uncertainty (Tien, 2017; Chugreev, 2016). Forecasting changes in stock market trends using predictive analytics is another subject of future scientific research (Kumar, 2021). The introduction of intelligent systems at various industrial facilities encourages development teams to determine the most appropriate solution for big data analysis. The use of predictive analytics is the most objective solution for many areas of the national economy, including oil production (Kim, 2020).

3 RESEARCH METHODOLOGY

The research methodology includes the collection, analysis and generalization of data on existing big data analysis solutions used in digital platforms and companies.

In the course of the research work, the team of authors was assigned a list of scientific tasks, the achievement of which will allow identifying the best solution for big data analysis based on artificial intelligence technology. In the end, it will be necessary to choose the most effective solution from the selected solutions. It will be further integrated into the functionality of the digital platform. To achieve this goal, we need to implement a set of scientific tasks:

1. Identification of four solutions for prospective use on digital platforms for commodity markets. The modern development of science and technology allows developers to choose from a wide range of ready-made solutions used for big data analysis. We have identified the following of them: machine learning; data mining; artificial neural networks; predictive analytics. Each of them has certain characteristics that make it expedient to introduce them into the activities of digital platforms for the further development of various analytical tools;

2. Conducting research on selected solutions used for big data analysis in digital platforms:

2.1. Identification of their disadvantages and advantages that can influence the quality of the final results;

2.2. Determining the format in which it is advisable to aggregate big data for their further use in the analytical module.

The implementation of the above set of research activities will allow us, in addition to conducting an in-depth analysis of each of the selected solutions, to obtain intermediate results. They, in turn, will tell you which of the four selected solutions should be given increased attention when implementing subsequent scientific tasks.

3. Conducting a comprehensive study of the experience of practical application of each of the selected solutions for big data analysis in various digital platforms and companies. At this stage of the research work, the most important results will be obtained. They will allow you to determine with the greatest probability the most effective solution for integration into a Multidirectional Platform.

4. Identification of one of the four solutions that is most adapted to implementation in the digital platform for commodity markets.

The implementation of this set of scientific tasks will allow the team of authors to prepare the necessary theoretical basis for further development of an experimental model of artificial intelligence for analyzing the existing array of big data.

The Multidirectional Platform is at the stage of active operation. From the end of 2020 to the present, a significant number of transactions have been made in this ecosystem, large-scale work is being carried out to increase their number. At the same time, a volume of data is already being collected and aggregated, which can be used to build an experimental model of artificial intelligence (Tereshkin, 2021).

4 RESEARCH RESULTS

The development of digital platforms for various spheres of the national economy is carried out in a continuous mode and includes measures to integrate various technological and technical innovations. The involvement of federal government authorities and domestic IT companies in the comprehensive development of the digital economy in the Russian Federation is a stimulating factor in the development and implementation of digital platforms.

The central place in any intelligent information system is given to big data as one of the key aspects affecting the development of the platform. In modern ecosystems of the digital economy, automatic collection and registration of big data is used. To do this, the following tools are used:

1. Web scraping. With its help, it is possible to analyze and compare prices for various goods for their subsequent adjustment, monitoring competitors and evaluating their capabilities (Sakharovsky, 2021).

2. Website parsing is a syntactic analysis of websites performed by a program (Afanasyev, 2019).

3. The Internet of Things is a network to which any object can connect via an Internet connection, provide a constant and uninterrupted exchange of information, maintain communication, etc. (Yan, 2018).

4. Getting statistical information directly from the digital platform. The presence of a separate module in it, responsible for collecting and registering big data received during the operation of the platform on special servers protected from external influence, will allow aggregating significant amounts of information. The expediency of developing and implementing such a module is due to the following aspects:

1. The information will be located on a secure server that only verified users will have access to;

2. The development team will have at its disposal big data that can be used for the following purposes:

- refining the capabilities of the digital platform to a level that will fully meet the needs of both sellers and buyers;
- building experimental and practical models of artificial intelligence that can significantly increase the efficiency of buying and selling processes.

It is noted that there are several possible features of the use of big data platforms by users that cause concern among scientists, antimonopoly authorities and others (Katz, 2019):

1. User data is an important asset and will become a tool for competing in the market.

2. The collection and analysis of user data will help the company to build a strategy of behavior in the market.

3. The data is used to comprehensively improve the quality of products and services provided.

4. Big data affects the conditions under which the purchase and sale of products will be carried out.

Our task was to identify the current trends that are present at this stage of the development of big data analysis solutions. As noted above, the total amount of data increases exponentially every year. Thanks to this, solutions for their analysis will be developed, modified and more actively used in practice.

In order to determine the most suitable solution for big data analysis, we considered: machine learning, data mining, artificial neural networks, predictive analytics. The research part will be structured as follows: a brief description of each of the above solutions is given, advantages and disadvantages are analyzed, the format of data presentation is determined, and practical application is considered.

4.1 Machine Learning

With the rapid development of cloud technologies, the coverage of big data is gradually expanding, and they have become used in many areas of the national economy. Big data and machine learning are the main technological challenges in the modern information world, and they have had a significant impact on all spheres of society (Hou, 2020).

There are different types of machine learning algorithms: supervised, unsupervised, partially supervised learning, and reinforcement learning. In addition, deep learning, which is part of a broader family of machine learning methods, can intelligently analyze larger-scale data (Sarker, 2021).

Automatic machine learning methods play a crucial role in working with a huge amount of data and are used in almost all spheres of the national economy. The use of automatic machine learning tools in applied big data analysis tasks allows you to extract new knowledge from the source information, identify relationships within the data and solve classification, clustering, regression, forecasting, etc. (Bolodurina, 2021).

Machine learning is a data analysis technique that will allow the system to learn independently by solving an array of similar tasks (Fig. 1) (Pisarev, 2020). There are three varieties:

1. Training with a teacher. If there is data in the form of examples with labels, they will be sent to the artificial intelligence algorithm, wait for the forecast and give feedback: whether it predicted correctly or not. Data with certain target points is delivered to the machine learning algorithm. Feedback will come in response: whether the solution predicted the result or not.

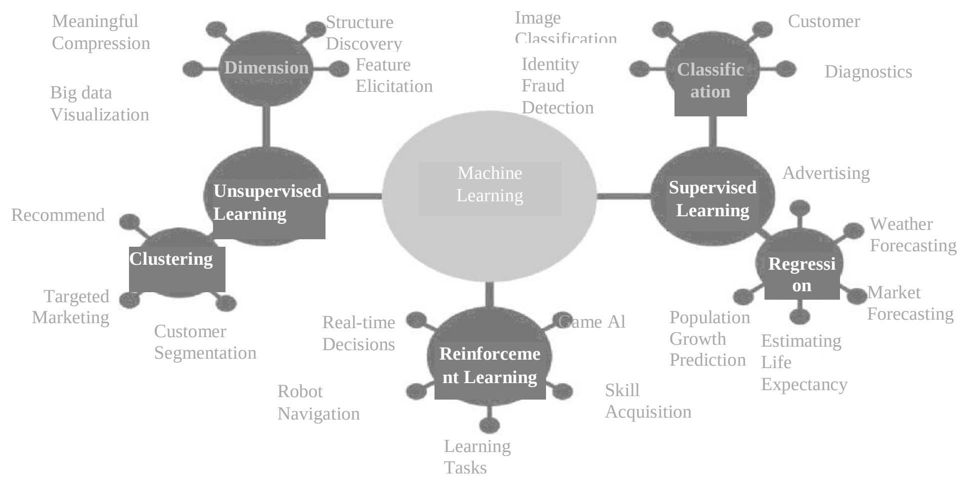

Figure 1: Machine learning and its varieties.

2. Learning without a teacher: the machine learning algorithm receives big data and various tools for their interpretation and processing.

3. Reinforcement learning: The machine learning algorithm does not have information about the information system, but can work in it.

3.1.1 Data format

Preprocessing and cleaning of big data should be carried out before the selected data set is used in the process of machine learning model training. Raw big data can be distorted and unreliable, and it may contain missing values. They can lead to distorted results.

Big data for the algorithm to work correctly must be in the following format:

- TSV or CSV format;
- HTML or XML format.

4.1.2 Advantages and Disadvantages of Machine Learning

The following disadvantages of machine learning are highlighted:

1. In the process of implementing a machine learning algorithm using software development services, it will take considerable time to complete the entire set of necessary procedures.

2. Time and resources. During the execution of the machine learning procedure, algorithms are used that help coordinate all functions for data management and their use in the process of correcting any errors. But it all takes time.

3. Interpretation. The data output must be checked for errors and a correction operation must be performed to obtain the desired accuracy.

4. High error tolerance. In the process of machine learning, a large amount of data is used, and on the other hand, many algorithms are used and tested. Accordingly, there are huge changes that can lead to a lot of errors.

The following advantages of machine learning are highlighted:

1. Identification of trends and patterns. Machine learning helps you manage big data and understand trends and patterns.

2. Human intervention in the process of big data analysis is not required.

3. Continuous improvement. The machine learning algorithm helps the system to constantly understand errors and eliminate them.

4. Machine learning copes best with tasks for processing multidimensional and large amounts of data. The machine learning algorithm helps in managing and improving multidimensional and large amounts of data, in improving their skills without errors using artificial intelligence technology.

4.1.3 Examples of Practical Application of Machine Learning

The practical application of machine learning in a wide variety of spheres of the national economy is a fairly stable modern trend. For example:

- minimization of downtime in production. To do this, various big data are aggregated from all production nodes, which allows you to plan their future inspections, followed by troubleshooting;
- development of an intelligent production process management system that allows aggregating and analyzing big data in real time;
- creation of a comprehensive industrial safety system aimed at controlling production processes and preventing man-made emergencies;
- exploration and development planning of new mineral deposits. The machine learning algorithm, analyzing big data on past developments, offers possible options for the expected deposits.

Within the framework of this scientific research, the experience of practical application of machine learning in retail and marketing is of particular interest. For example:

- forecasting customer actions, developing personalized offers and advertising. By analyzing big data about past purchases, the machine learning algorithm will be able to predict customer actions. Based on these results, it will be possible to develop a stimulating program that will return the customer and help him make new purchases;
- planning of procurement activities and forecasting of demand for various product categories. The machine learning algorithm will plan inventory expenditure and demand. This forecast will allow you to optimize stocks in warehouses and pre-order the necessary goods.

With regard to the subject of the Multidirectional Platform, it is necessary to focus on the experience of using machine learning by the Russian company MegaInsight LLC. The organization offers several solutions based on artificial intelligence technology aimed at increasing the sale of fuel and related products at gas stations. One of the most successful examples is the "RosaMira Case". RosaMira gas station has 13 gas stations in Samara and the Samara region. Due to the limitations of the local market, the tasks of retaining the existing customer base come to the fore. MegaInsight LLC was faced with the task of ensuring the return of lost customers due to personal fuel prices, as well as increasing their average check through individual offers for related products. To achieve this task, MegaInsight LLC has developed a solution consisting in connecting the RosaMira gas station network to the MegaInsight platform, developed and launched a new mobile application that allows you to form individual price offers for fuel and goods, as well as provide advanced customer analytics for the formation of target groups. The result of the work was the organization of constant monitoring of the condition of customers, which made it possible to give a price only to customers focused on it and, as a result, to keep sufficiently high prices of the pylon (the business card of the gas station on which the current fuel prices are indicated). In the end, it was achieved to maintain the overall marginality without a drop in sales volumes. Unfortunately, at the present time there are a small number of domestic companies engaged in the practical application of artificial intelligence technology in the purchase and sale of petroleum products. MegaInsight LLC, effectively implementing its solution in a significant number of domestic organizations, is one of the leaders in the above-mentioned direction of economic activity, and has experience in successfully integrating machine learning.

Machine learning at this stage of research is the most promising solution for use in a Multidirectional Platform. But to determine the best of them, it is necessary to study the three remaining solutions.

4.2 Data Mining

The development of data mining is closely related to the development of the field of big data obtained from the processing of transactions for the purchase and sale of goods and services, data analysis in real time. A significant number of organizations are gradually moving from the simple collection and storage of big data to their in-depth analysis using modern tools and approaches, which is opened by artificial intelligence technology. Data mining differs not only in the size of the data, but also in the purpose: not the allocation of general information, but a point study of the problem (Kriegel, 2007).

Due to the growing availability and complexity of big data recording methods, a variety of information sources and distributed computing are becoming important trends in modern information intelligent systems. The use of intelligent methods for analyzing big data is becoming increasingly important, especially for users who are not familiar with engineering and computing sciences. Data mining in practice should be intelligent, complete and operational (Wu, 2009).

Data mining is the integration of many methods from various disciplines, such as statistics, machine learning, pattern recognition, neural networks, image processing systems, database management (Fig. 2) (Tukova, 2019).

4.2.1 Data Format

The data format that is used for data mining is divided into two groups. They differ from each other by the principle of their preparation for further use. For example:

1. Big data is aggregated in a detailed form and can be used in an artificial intelligence algorithm without further processing and cleaning. In this case, the number of potential errors increases, and the final result may be distorted. This, in turn, will encourage the company to attract specialists to refine the algorithm.

2. The information used before being transmitted to the artificial intelligence algorithm undergoes a cleaning procedure, which will allow for more reliable results.

4.2.2 Advantages and Disadvantages of Data Mining

The following disadvantages of data mining are highlighted:

1. To implement the data mining algorithm, significant time and labor costs are required with the involvement of highly qualified personnel.

2. Privacy and data security. There is a possibility that a third party will gain access to the collected big data. This may lead to a violation of the confidentiality of the data of users of the digital platform or the company's customers.

The following advantages of data mining are highlighted:

1. Transactions made on the Internet, which in themselves mean nothing, can be interpreted and transformed into valuable information. In the future, products and services based on big data may be created that will meet the needs of people.

2. A better and customer-oriented understanding of service is developing. You can experiment with a sales process in which both the seller and the buyer are satisfied. Based on the analysis of big data collected from the target audience, it becomes possible to predict sales of various product categories.

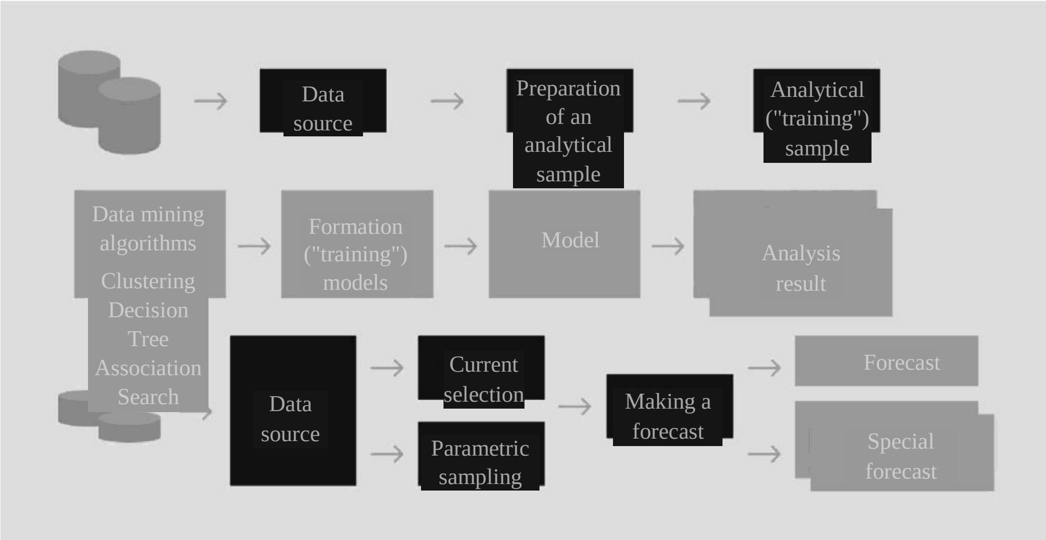

Figure 2: Diagram of the functioning of the data mining mechanism.

4.2.3 Examples of Practical Applications of Data Mining

There are several areas of practical use of data mining:

1. The distribution of customers into different groups based on certain characteristics. This will allow you to form specialized offers for each of the groups of buyers of goods and services.
2. The analysis of the consumer basket will allow to identify seasonal or increased demand for various categories of products and services.
3. Fraud detection. Data mining contributes to the development of artificial intelligence models that can detect various illegal schemes.
4. Identification of interrelated or template solutions in the production process allows you to organize and design a highly efficient industrial site.

Data mining has found wide application in various spheres of the national economy. Its use in retail suggests that a significant number of ready-made solutions have been developed that can be used in a Multidirectional Platform.

4.3 Artificial Neural Network

Artificial neural networks are nonlinear models that can be trained to extract hidden data and relationships, as well as to carry out the process of managing big data (Fig. 3). They are used to analyze the relationships between economic and financial phenomena (Witkowska, 1999; Andreou, 2006).

Colleagues separately note that: "In recent years, the theory of artificial neural networks has received significant development, but methods of system design and analysis of high-speed modular neural networks of high dimension and related fast tunable transformations have not yet been sufficiently developed. The main problem of designing large neural networks is solving the problem of optimal choice of the structure and topology of a neural network" (Kostin, 2013).

The following are the most actively used types of artificial neural networks:

1. Neural networks of direct propagation and perceptrons. The information inside them is transmitted sequentially from the input to the output.
2. The Hopfield neural network is a fully connected neural network with a symmetric matrix of connections.
3. The Boltzmann machine is a stochastic network. The training takes place according to the method of back propagation of the error or according to the algorithm of comparative divergence.

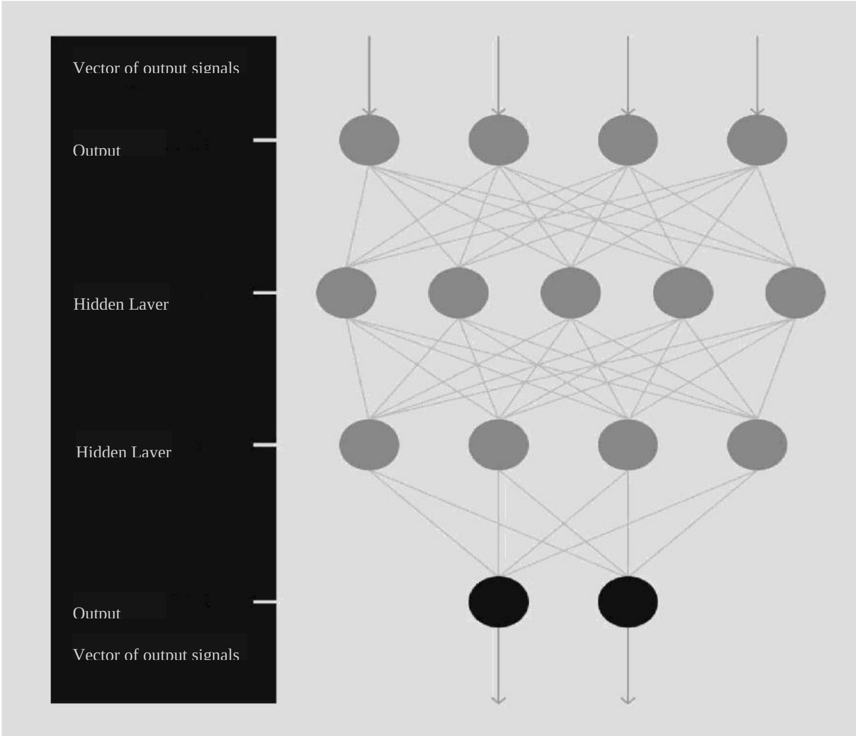

Figure 3: Artificial neural network.

4. Convolutional neural networks and deep convolutional neural networks are used to analyze a wide variety of graphical images. A striking example is the use of this type of artificial neural networks for the interpretation of CT and MRI images.

4.3.1 Data Format

Big data for their application in artificial neural networks must be preprocessed and cleared of secondary and erroneous values. To achieve this goal, there is an algorithm consisting of the following steps:

1. Definition of the object of analysis. In this case, in addition to specialists involved in the preparation and cleaning of data, the development of an artificial intelligence algorithm, it is necessary to involve analysts to build a sequence of data analysis and determine the object of future analysis.
2. Determination of indicators characterizing the object of research. It is necessary to determine from a significant amount of aggregated big data exactly those indicators that will allow you to achieve the specified analysis results.
3. Determination of the required number of indicators characterizing the object of analysis. It is worth remembering that with an increase in their number, the necessary computing power increases and the total operating time of the artificial intelligence algorithm increases.

4.3.2 Advantages And Disadvantages of Artificial Neural Networks

The following disadvantages of artificial neural networks are highlighted:

1. The development of an artificial intelligence algorithm based on artificial neural networks requires a well-developed and consistent configuration of all internal elements among themselves, checking connections;
2. There is currently a shortage of training algorithms for artificial neural networks. The current situation leads to the fact that the number of errors and incorrect results increases;
3. In some cases, the process of learning an artificial intelligence algorithm does not give the expected results, which may reduce the interest of researchers in artificial neural networks;
4. The current level of development of artificial neural networks, due to significant material costs, does not allow it to be used in real time. This leads to the fact that a fairly significant layer of problems cannot be solved using this algorithm.

The following advantages of artificial neural networks are highlighted:

1. Artificial neural networks after the completion of the learning process show quite high performance. At the same time, only the indicators that were originally laid down for solving the problem are perceived and analyzed;

2. The high level of adaptability of artificial neural networks makes this algorithm extremely stable and in demand for solving a certain pool of problems.

3. Due to the special structure, when an artificial neural network consists of thousands of neurons, the solution of the problem distributed between them is carried out faster than with other artificial intelligence algorithms.

4.3.3 Examples of Practical Application of Artificial Neural Networks

Artificial neural networks are used in most of the spheres of economic activity. For example:

1. In business, artificial neural networks have become a tool for regulating the company's financial activities, controlling inventory, and assessing the value of assets.

2. In the field of healthcare, artificial neural networks allow you to interpret images from various medical devices. They become a doctor's assistant in making the correct diagnosis, evaluating the results of the treatment, etc.

3. Artificial neural networks are becoming indispensable elements of intelligent information systems being developed every year, aimed at automating production processes.

4. They have found wide application in the field of analysis and processing of audio, video and graphic information.

Artificial neural networks are actively used in the field of healthcare. The analysis of CT and MRI images is carried out. There are ready-made solutions in the field of trading and risk assessment. However, we decided not to consider artificial neural networks for use in a Multidirectional Platform in the future.

3.4 Predictive Analytics

Predictive analytics is the application of advanced methods of analysis using big data for past periods in order to obtain valuable information in real time and predict future events (Fig. 4). The use of predictive analytics is an important step in expanding the scope of analysis systems, which consists in combining classical methods of statistical analysis with new artificial intelligence technology.

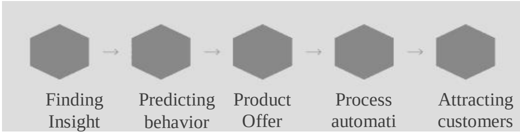

Figure 4: Predictive analytics.

There are several types of predictive analytics:

1. Supervised learning. It implies the construction of a model based on the initial data and the output results.

1.1 Regression. It is used to obtain quantitative answers or numerical values.

1.2 Classification. This method is associated with assigning an object to a class according to certain parameters.

2. Unsupervised learning. In this type of predictive analytics, training is carried out based on incoming data without reference to a specific answer.

2.1 Clustering. This method includes the following tasks:

- design of typology and classification;
- analysis of effective data grouping schemes;
- the birth of hypotheses based on research;
- verification of hypotheses of belonging of one object to the tested group.

2.2 Research analysis

4.4.1 Data Format

The quality of the received contextual information affects the tasks of predictive analytics, especially when working with uncertain data and with data containing missing values. A systematic error is introduced into the induced knowledge, for example, in classification and decision-making. To alleviate this situation, a progressive time-optimized mechanism is proposed, taking into account data quality, which tries to deliver high-quality contextual information to predictive analytics mechanisms, gradually introducing a certain controlled delay (Anagnostopoulos, 2016; 2018).

Predictive analytics uses a variety of methods from statistics, data mining, analyzes both current data and data for past periods. Based on them, it makes forecasts about future events.

4.4.2 Advantages and Disadvantages of Predictive Analytics

The following disadvantages of predictive analytics are highlighted:

1. The correct approach and data collection requires the involvement of significant forces and

resources, which directly affects the cost of obtaining the final result.

2. The susceptibility to errors in the presentation of the final results. Since big data, on whose basis predictive analytics will be based, may have unreliable values, this directly affects the final result.

The following advantages of predictive analytics are highlighted:

1. Improving the accuracy of market segmentation. Predictive analytics methods help companies build a more accurate image of the target customer.

2. Increase conversion. Based on information about previous sales, it is possible to find new potential buyers more efficiently.

3. Increase the effectiveness of sales forecasting. Based on accurate sales forecasts, companies will be able to plan production loads and profits more efficiently during the financial year.

4. Customer segmentation. Predictive analytics mechanisms allow you to divide a lot of customers into groups (segments) in order to detect similar needs and offer them the most relevant goods and services.

5. Identification of hidden potential. Predictive analytics helps companies create fertile ground for future development.

4.4.3 Examples of Practical Application of Predictive Analytics

The following examples of practical use of predictive analytics are highlighted:

1. Optimization of production. Information is collected about the parameters that affect the operation of the equipment.

2. Fraud detection. If there are statistics on unscrupulous clients, for example, by their gender, age, profession and other characteristics, then it becomes possible to filter them out at the questionnaire stage.

3. Risk management. If there is a risk, then with the help of predictive analytics of past negative events, you can influence their prevention in the future or it is better to insure against them.

4. Marketing and customer analysis. If information is collected about customers, their behavior, the size and frequency of purchases, then it becomes possible to simulate the future behavior of customers.

5. Sales. Thanks to analytics in sales, there is information about direct and indirect indicators that affect the revenue and profitability of the business

Predictive analytics, along with machine learning, are the most promising solutions for integration into a Multidirectional Platform. As part of our innovative development path, we decided to choose machine learning for further study.

4 DISCUSSION OF RESULTS

Machine learning is used to speed up the process of defining patterns and applying them to new datasets. By finding correlations in data sets, employees can make more informed decisions.

Another problem is that algorithms don't create themselves. Traditionally, obtaining accurate and useful algorithms was based on having a large data set, determining their creation, and a data scientist who could train a machine learning algorithm to use them.

Today, more companies than ever are creating big data sets for analytics. However, in order for this data to be useful, a different approach is required than relying on data scientists. Machine learning automation is aimed at making data convenient for use by a wide and non-specialized audience. By simplifying data analysis — and, most importantly, to see the relationship between data sets — machine learning automation can potentially allow all employees to use highly professional analytical capabilities.

The effectiveness of strategic planning of commercial activity determines whether it is able to achieve the set goals and increase the level of effectiveness of its activities. Building a machine learning model with the ability to provide interested users with the necessary analytical information will allow them to solve various tasks more effectively in the future, develop strategic plans for the development of a particular sphere of the national economy.

For commodity markets, including for the sphere of trade in petroleum products, there are quite significant prospects for the use of machine learning. Competition among digital platforms is increasing every year. Project teams carry out a colossal set of measures aimed at achieving such technical and technological development of their own solutions. It will allow you to achieve a serious advantage over competitors.

One of the possible ways to use machine learning in the work of a Multidirectional Platform is marketing. Colleagues note: "Machine learning, with its ability to turn huge arrays of arbitrary format data into a clear numerical analysis of the specified parameters of the consumer into buyers, becomes an ideal tool for such analysis and, thus, saves a huge number of man-hours of analysts' work, allowing for close to realistic checks of a particular marketing strategy without product withdrawal, conducting a marketing company, limited only to surveys of the target group" (Lobin, 2019).

Advertising helps companies introduce potential customers to the product line. The main goal is to convince you to purchase a product or use services. Advertising is crucial, as it gives customers information about the product and creates an opportunity for sale. Companies inevitably face changes, and an example is the evolution of advertising methods. Advertising is now done with the help of artificial intelligence and one of its approaches – machine learning. In the future, artificial intelligence and machine learning will give companies more control over advertising (Shan, 2020).

Another application of machine learning in a digital platform is the creation of personalized offers for a specific user. It will allow you to point-to-point offer specific users exactly the products that match their preferences (Lobin, 2019). In this case, a convenient ecosystem of the digital economy will be created, contributing to the attraction and retention of users in a Multidirectional Platform. The availability of such a tool will allow the developer company to have serious competitive advantages in the market.

Less expensive in terms of resources for machine learning, however, chatbots, or machine communication with a client, are much more obvious applications. It allows you to save the working time of sales managers, simplifies and reduces the cost of interaction with the client, slightly reducing the quality (Lobin, 2019). However, one should not rely heavily on this tool in the company's activities. Users of a Multidirectional Platform need to be able to discuss and solve various problematic issues directly with a representative of technical support or sales department.

Machine learning is one of the effective tools that helps users of the digital platform to successfully make transactions for the purchase and sale of petroleum products. At the same time, the results of the analysis obtained using this approach with elements of artificial intelligence will also allow the development team to obtain the necessary information that contributes to the further successful development of the Multidirectional Platform. For example:

1. Artificial intelligence methods are widely used to predict oil prices as an alternative to traditional methods. Machine learning is the most suitable of them.

Information about the number of products sold in real time, together with analytical conclusions, will allow you to determine which categories are in demand in different seasonal periods during the calendar year. Also, which of the product categories are not popular, and which on the contrary are extremely popular. This information will allow you to optimize the product range, determine the "seasonality" of each type of petroleum products, understand in which regions certain categories of goods are most in demand, which manufacturer's products are most popular among users of the digital platform.

Obtaining this information is also possible through the use of various manual analytical tools. However, the use of machine learning will allow: firstly, to automate the analytics process; secondly, to significantly speed it up; thirdly, to reduce the number of possible errors.

2. Analytical information on users of the digital platform. For the full functioning of the digital platform and its further development, it is necessary to receive up-to-date information about various aspects of its use to customers. For example, to aggregate and analyze how actively various functionality of a Multidirectional Platform is being used. This will allow the development team to understand which of the presented functions need to be improved or removed altogether, for the reason that less than 10% of customers use them. Thanks to machine learning, it is possible to receive unbiased feedback from users, which will allow us to refine the bottlenecks and make the digital platform convenient for customers. This is directly related to the efficiency of the digital platform.

3. Forecasting prices for various product categories presented on a Multidirectional Platform. An artificial intelligence algorithm, analyzing an array of big data containing information on price changes for various categories of petroleum products, will be able to predict the dynamics of their changes.

It is possible that with the further development of science and technology, machine learning will receive wider application and opportunities in various spheres of the national economy. A significant increase in the amount of collected information obtained from the operation of the Multidirectional Platform will serve as a favorable factor that will contribute to the introduction of other methods of big data analysis based on artificial intelligence technology.

At the same time, one cannot completely rely on machine learning as an ideal solution that can find the right way in various problematic situations. An important key to the success of integrating artificial intelligence into a Multidirectional Platform is the presence of highly qualified specialists in the development team with significant experience in the development and training of artificial intelligence algorithms.

Artificial intelligence is changing the way we live, study and work. Until recently, it was a fantastic concept, more closely related to science fiction than to real life. However, driven by unprecedented advances in complex information and communication technologies, artificial intelligence today is synonymous with technological progress (Sarirete, 2021).

The combination of expanding opportunities based on information and telecommunication technologies, along with the growing expectations of consumers regarding technologies and their added value for our society, requires interdisciplinary research and a research program in the field of artificial intelligence and machine learning.

5 CONCLUSION

The active development of science and technology makes it possible to use various intelligent data analysis methods based on artificial intelligence technology. Its basic provisions were developed and formed in the middle of the last century, but the previous level of scientific and technological development did not allow it to be applied in practice.

We reviewed four big data analysis solutions used in digital platforms: machine learning, data mining, artificial neural networks and predictive analytics. All of them are implemented in practice and are fully used by various companies and digital platforms.

After analyzing and studying the above solutions for big data analysis based on artificial intelligence technology, it becomes possible to conclude that machine learning is the most suitable solution for a Multidirectional Platform. This is due to the following reasons:

1. Machine learning is one of the most developed solutions for big data analysis, which is actively used by various digital platforms and companies in the Russian Federation and abroad.

2. Machine learning uses the most optimal data format, which coincides with those planned to be used for aggregating information during the operation of a Multidirectional Platform.

3. The availability of ready-made software and hardware solutions for the use of machine learning in the future will allow not to spend financial and material resources on the development of an analytical module for a Multidirectional Platform, but to concentrate the available forces and means for its integration and further training.

4. Machine learning is adapted to solve various tasks in the field of marketing and retail. The potential results of using this artificial intelligence method for big data analysis will increase the efficiency of making purchase and sale transactions in various commodity markets represented on a Multidirectional Platform.

At the stage of trial operation, the digital platform aggregates a sufficient amount of data with which it is advisable to train an artificial intelligence algorithm. The potential benefits of using this solution will affect the efficiency of transactions for the purchase and sale of petroleum products, the adaptation of the user interface to the wishes of customers.

Information in the modern world is given an increasingly significant place in the life of various spheres of society every year. Purchasing power data from social networks and various digital platforms are gradually becoming the tool that has a predominant influence on the development of a particular company. Data collection, storage and processing is a tool that can give a company or a digital platform a serious advantage over competitors.

REFERENCES

Afanas'ev, N.O., Saubanov, V.S., 2019. Avtomatizaciya sbora informacii s raznyh sajtov-istochnikov, v sbornike: Innovacii v nauke i praktike. Sbornik statej po materialam XV mezhdunarodnoj nauchno-prakticheskoj konferencii. pages 44-52.

Bolodurina, I.P., Parfenov, D.I., SHuhman, A.E., Zabrodina, L.S., 2021. Avtomatizirovannoe mashinnoe obuchenie: obzor vozmozhnostej sovremennyh platform analiza dannyh. *Sistemnaya inzheneriya i informacionnye tekhnologii,* T. 3, № 1 (5), pages 50-57.

Buryakova, A.O., Varnavskij, A.V., 2019. Cifrovizaciya deyatel'nosti schetnoj palaty Rossijskoj Federacii. *Upravlencheskie nauki,* T. 9, № 4. pages 98-114.

Veligura, A.V., Musaeva, E.K., 2020. Analiz sushchestvuyushchih metodologij intellektual'nogo analiza dannyh dlya proizvodstvennyh system. *Vestnik Luganskogo nacional'nogo universiteta imeni Vladimira Dalya*, № 5 (35). pages 45-50.

Vergun, Ya.Yu., 2016. Upravlenie set'yu peredachi dannyh na ryborazvodnom komplekse s ispol'zovanie iskusstvennyh nejronnyh setej. *Dinamika sistem,* *mekhanizmov i mashin*, № 3. pages 8-10.

Kim, N.I., 2020. Predposylki vnedreniya prognoznoj analitiki v neftedobyvayushchej kompanii. *Studencheskij*, № 16-1 (102). pages 24-26.

Klyuev, S.G., Trunov, E.E., 2021. Problemy obucheniya glubokih nejronnyh setej dlya obnaruzheniya ugroz narusheniya bezopasnosti v setyah s dinamicheskoj topologiej. *Modelirovanie, optimizaciya i informacionnye tekhnologii*, T. 9, № 1 (32). pages 15-16.

Kostin, N.S., 2013. Mesto modul'nyh nejronnyh setej v klassifikacii iskusstvennyh nejronnyh setej, Intellektual'nyj potencial XXI veka: stupeni poznaniya, № 19. pages 91-95.

Lobin, M.A., Filippova, I.A., 2019. Mashinnoe obuchenie v ekonomike. *Vestnik UlGTU*, № 3. pages 68-71.

Nikulina, YU.V., 2017. Analiz rynka nedvizhimosti s pomoshch'yu metodov intellektual'nogo analiza dannyh. *Vestnik Saratovskogo gosudarstvennogo social'no-ekonomicheskogo universiteta*, № 4 (68). pages 126-129.

Nishchkhal, Fink V.A., 2018. Primenenie intellektual'nogo analiza dannyh v kosmose. *Journal of technical and naturals sciences*, № 9. pages 22-27.

Pisarev, N.S., Aref'ev, R.O., 2020. Perspektiva primeneniya mashinnogo obucheniya v aviacionnyh radioelektronnyh sistemah, Reshetnevskie chteniya. Materialy XXIV Mezhdunarodnoj nauchno-prakticheskoj konferencii, posvyashchennoj pamyati general'nogo konstruktora raketno-kosmicheskih sistem akademika M. F. Reshetneva. V 2 ch. pod obshch. red. YU. YU. Loginova. Krasnoyarsk. pages 347-348.

Prohorova, M.M., 2020. Osnovnye napravleniya sovershenstvovaniya metodiki statisticheskogo analiza cifrovoj ekonomiki. *Vestnik Evrazijskoj nauki*, T. 12, № 5. pages 1-9.

Saharovskij, N.V., 2021. Metody i instrumenty avtomaticheskogo sbora informacii s Veb-resursov [Elektronnyj resurs]. Rezhim dostupa: http://math.isu.ru/ru/students/docs/studconf2020/s4/Sakharovskiy.pdf (data obrashcheniya (16.05.2021 g.).

Semenov, M.E., Zablockaya, T.YU., 2019. Vybor modeli biologicheskoj nejronnoj seti dlya segmentacii izobrazhenij biozhidkostnoj poverhnosti. *Vestnik KRAUNC. Fiziko-matematicheskie nauki*, T. 26, № 1. pages 78-93.

Tereshkin, S.I., Nefyodov, A.YU. Babkin, V.A., 2021. Preimushchestva mul'tinapravlennoj platformy dlya mgnovennyh pokupok i prodazh na tovarno-syr'evyh rynkah. *Sovremennaya ekonomika: problemy i resheniya*, № 7 (139). pages 95-103.

Tereshkin, S.I., Nefyodov, A.YU., Babkin, V.A., 2021. Cifrovye platformy dlya neftyanogo rynka v Rossijskoj Federacii i za rubezhom. *Vestnik samarskogo gosudarstvennogo ekonomicheskogo universiteta*, № 4 (198). pages 17-23.

Tukova, A.S., Kondrasheva, P.P., 2019. «Data mining». Zadachi, reshaemye metodami Data Mining, Tendencii razvitiya nauki i obrazovaniya, № 55-2. pages 27-30.

CHugreev, V.L., Badanin, D.A., 2016. Ispol'zovanie prognoznoj analitiki v informacionno-analiticheskih sistema podderzhki prinyatiya reshenij. *Molodoj uchenyj*, № 6 (110). pages 49-52.

SHevcova, I.V., 2020. Metodika obucheniya rabote s cifrovymi dannymi. *Otkrytoe obrazovanie*, T. 24, № 4. pages 32-40.

YUdina, T.N., Geliskhanov, I.Z., 2018. «Ekonomika dannyh»: Big Data, cifrovye platformy i cifrovaya renta, V sbornike: Innovacionnye klastery cifrovoj ekonomiki: drajvery razvitiya. Trudy nauchno-prakticheskoj konferencii s mezhdunarodnym uchastiem. Pod redakciej A.V. Babkina. pages 218-226.

Anagnostopoulos, C., 2016. Quality-optimized predictive analytics. *Applied Intelligence*, № 45. pages 1034–1046.

Anagnostopoulos, C., Savva, F., Triantafillou, P., 2018. Scalable aggregation predictive analytics. *Applied Intelligence*, № 48. pages 2546–2567.

Andreou, P.C., Charalambous, C., Martzoukos, S.H., 2006. Robust artificial neural networks for pricing of European options. *Computational Economics*, № 27. pages 329–351.

Antipov, E.A., Pokryshevskaya, E.B., 2020. Interpretable machine learning for demand modeling with high-dimensional data using Gradient Boosting Machines. *Journal of revenue and pricing management*, №. 19. pages 355–364.

Bitzer, S., Kiebel, S.J., 2012. Recognizing recurrent neural networks (rRNN): Bayesian inference for recurrent neural networks. *Biological cybernetics*, № 106. pages 201–217.

Breur, T., 2004. Business modeling and data mining — supporting business decisions with data. *Journal of Targeting, measurement and analytics for marketing*, № 12. pages 389–390.

Fan, J., Li, D., 1998. An overview of data mining and knowledge discovery. *Journal of computer science and technology*, № 13. pages 348–368.

Hou, R., Kong, Y., Cai, B. et al., 2020. Unstructured big data analysis algorithm and simulation of Internet of Things based on machine learning. *Neural computing and applications*, № 32. pages 5399–5407.

Hruschka, H., 2021. Comparing unsupervised probabilistic machine learning methods for market basket analysis. *Review of managerial science*, № 15. pages 497–527.

Jin, Y., Yuan, S., Shao, Z. et al., 2021. Turing Award elites revisited: patterns of productivity, collaboration, authorship and impact. *Scientometrics*, № 126. pages 2329– 2348.

Katz, M.L., 2019. Multisided platforms, big data, and a little antitrust policy. *Review of industrial organization*, № 54. pages 695–716.

Khakharia, A., Shah, V., Jain, S. et al., 2021. Outbreak prediction of COVID-19 for dense and populated countries using machine learning. *Annals of data science*, № 8. pages 1–19.

Klüver, C., 2012. Solving problems of project management with a self-enforcing network (SEN). *Computational and mathematical organization theory*, № 18. pages

175–192.

Kratsch, W., Manderscheid, J., Röglinger, M. et al., 2021. Machine learning in business process monitoring: a comparison of deep learning and classical approaches used for outcome prediction. *Business and information system engineering*, № 63. pages 261–276.

Kriegel, H.P., Borgwardt, K.M., Kröger, P. et al., 2007. Future trends in data mining. *Data mining and knowledge discovery*, № 15. pages 87–97.

Kumar, B.S., Ravi, V., Miglani, R., 2021. Predicting Indian stock market using the psycho-linguistic features of financial news. *Annals of data science,* № 8. pages 517–558.

Li, L., Li, X., Qi, W. et al., 2020. Targeted reminders of electronic coupons: using predictive analytics to facilitate coupon marketing. *Electronic commerce research.*

Maaß, D., Spruit, M., de Waal, P., 2014. Improving short-term demand forecasting for short-lifecycle consumer products with data mining techniques. *Decision analytics*, Vol. 1, № 4.

Osei-Bryson, K.M., Rayward-Smith, V., 2009. Data mining and operational research: techniques and applications. *Journal pf the operational research society*, № 60. pages 1043–1044.

Reutterer, T., Hornik, K., March, N. et al., 2017. A data mining framework for targeted category promotions. *Journal of business economics*, № 87. pages 337–358.

Sarirete, A., Balfagih, Z., Brahimi, T. et al., 2021. Artificial intelligence and machine learning research: towards digital transformation at a global scale. *Journal of ambient intelligence and humanized computing.*

Sarker, I.H., 2021. Machine learning: algorithms, real-world applications and research directions. *SN computer science journal,* № 2. pages 160.

Schmidhuber, J., 2010. The new AI is general and mathematically rigorous. *Frontiers of electrical and electronic engineering in China*, № 5. pages 347–362.

Shah, N., Engineer, S., Bhagat, N. et al., 2020. Research trends on the usage of machine learning and artificial intelligence in advertising. *Augmented human research,* № 5. pages 19.

Spiekermann, M., 2019. Trends and monetization of data goods. *Intereconomics,* № 54. pages 208-216.

Sridharan, M., 2020. Application of generalized regression neural network in predicting the performance of solar photovoltaic thermal water collector. Annals of data science.

Zavadzki, T., de Pauli, S., Kleina, M., Bonat, W.H., 2020. Comparing artificial neural network architectures for Brazilian stock market prediction. *Annals of data science*, № 7. pages 613–628.

Tien, J.M., 2017. Internet of things, real-time decision making, and artificial intelligence. *Annals of data science,* № 4. pages 149–178.

Tucker, C., 2019. Digital data, platforms and the usual [antitrust] suspects: network effects, switching costs, essential facility. *Review of industrial organization*, № 54. pages 683–694.

Zehtab-Salmasi, A., Feizi-Derakhshi, A.R., Nikzad-Khasmakhi, N. et al., 2021. Multimodal price prediction, Annals of data science.