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ПРОГНОЗДУК МАСЕЛЕЛЕРДИ ЧЕЧҮҮ ҮЧҮН ЖАСАЛМА ИНТЕЛЕКТТИН МЕТОДДОРУ ЖАНА НЕЙРОНДУК ТАРМАКТАР

Аннотация. Белгилүү болгондой, акыркы он жылдыкта жасалма интеллект, машиналык үйрөнүү, терең машина үйрөнүү жана нейрон тармактары сыяктуу алдыңкы технологиялар эң ийгиликтүү жана интенсивдүү өнүгүп келе жатат жана алар заманбап информатика илиминин алдыңкы чегин көрсөтөт деп айтууга болот.

Жасалма интеллекттин жардамы менен ийгиликтүү чечиле турган көптөгөн көйгөйлөр бар. Бул жерде жасалма интеллекттин негизги бөлүмдөрү: машина үйрөнүү, күчтүү конволюциялык нейрон тармактары, терең машиналык үйрөнүү, булуттагы эсептөөлөр жана чоң көлөмдөгү маалыматтар, үлгү таануу теориясы, фото жана видеону чечмелөө, машина котормолору, текстти талдоо, маалыматтарды казуу, учкучсуз учуучу аппараттар башкаруу жана роботтор, ж.б.

Бул макалада болжолдоо маселелерин түзүү жана чечүү үчүн колдонулган заманбап машина үйрөнүү ыкмалары жана нейрон тармактары боюнча негизги кыскача маалымат камтылган.

Негизги сөздөр: жасалма интеллект, машина үйрөнүү, нейрон тармактары, машина үйрөнүү моделдери жана алгоритмдери, прогноздук көйгөйлөр

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МЕТОДЫ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА И НЕЙРОННЫЕ СЕТИ ДЛЯ РЕШЕНИЯ ЗАДАЧ ПРОГНОЗИРОВАНИЯ

Аннотация. Существует множество задач, которые успешно решаются с помощью искусственного интеллекта. Приведём основные разделы искусственного интеллекта: машинное обучение, мощные сверточные нейронные сети, глубинное обучение машин, облачные вычисления и огромные объёмы данных, теория распознавания образов, интерпретация фото и видео, машинный перевод, анализ текстов, Data Mining, беспилотное управление и роботы и т.д.

Настоящая статья содержит основные краткие сведения по современным методам машинного обучения и нейронным сетям, которые применяются для постановки и решения прогнозных задач.

Ключевые слова: искусственный интеллект, машинное обучение, нейронные сети, модели и алгоритмы машинного обучения, задачи прогнозирования

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ARTIFICIAL INTELLIGENCE METHODS AND NEURAL NETWORKS FOR SOLVING FORECASTING PROBLEMS

Annotation. It is no secret that in the past decade, advanced technologies, such as artificial intelligence (AI), have rapidly developed and are now at the forefront of modern computer science.

The applications of AI are vast and varied, with many complex problems being successfully solved using these technologies. Some of the main areas of AI include machine learning, robust convolutional neural networks, deep machine learning, cloud computing and big data, pattern recognition theory, photo and video interpretation, machine translation, text analysis, data mining, drone control, and robotics.

This paper discusses the latest state-of-the-art machine learning and neural network techniques to formulate and solve prediction problems. Whether you are a seasoned professional in the field or a newcomer, this paper will provide valuable insights and knowledge into the ever-evolving world of AI.

Keywords: artificial intelligence, machine learning, neural networks, machine learning models and algorithms, forecasting problems

From machine learning to convolutional neural networks and deep machine learning, AI has made it possible. Its potential is practically limitless, with the ability to interpret photos and videos, translate text, mine data, and even control drones and robots.

With AI's expanding applications, it can replace human labor in manufacturing and office environments. Pattern recognition theory and cloud computing make it possible for AI to perform complex tasks efficiently, and the possibilities for the future are endless.

Machine learning.

A large subclass of artificial intelligence theory is machine learning (Machine learning or ML). So, machine learning or ML is understood as a separate field. A computer programme examines files and compares them to find common patterns, patterns and models, thereby expanding the knowledge base. At the same time, the programme can compare snapshots, images, texts and other types of materials. During the machine learning process, the algorithm will compare the contents of the files with the established patterns and with each other.

It should also be noted that machine learning, as a class of artificial intelligence methods, does not involve direct problem solving, but rather a learning process that applies solutions to similar problems. Tools such as mathematical statistics, numerical methods, mathematical analysis, optimisation methods, probability theory, graph theory, etc. are used to build such methods.

As technology advances, we witness the partial or complete automation of solving complex problems in various fields. This is where machine learning comes into play, serving as the science of algorithms that can self-adjust to data. Machine learning methods are commonly utilized in prediction

tasks, mainly when predicting the output value based on the available input information or attributes needed. Seeing how far we have come in utilizing technology to simplify complex problem-solving processes is truly remarkable [1].

Models and algorithms of machine learning.

Machine learning theory encompasses several models, with the following three being the most commonly used:

1. Learning with a teacher: This model is used for classification and data regression tasks. This model's algorithms are designed to identify the dependencies and relationships between input and predicted output data.

2. Learning without a teacher: This model is used for clustering tasks. These algorithms identify patterns and model them without using data labels.

3. Reinforcement Learning: This model utilizes observations obtained through interaction with the environment. The reinforcement algorithm, or agent, is in a continuous learning phase and uses feedback from the environment to make decisions and take actions. This model is trained with no prior knowledge about the system, but the agent can take actions that move the system to a new state and receive a reward from the system [2].

Neural networks.

Neural networks are robust computing systems with interconnected elementary processors known as formal neurons. These networks are designed to produce output information based on input stimulus, making them an ideal tool for developing algorithms to solve complex problems. Neurocomputers, either digital or analog computers based on neural networks, utilize these networks as their primary operating unit to implement their algorithms. Formal neurons, the elementary processors used in these networks, can be represented by a mathematical equation that describes their mathematical model:

$$y = f(g) = f(\sum_{i=1}^{n} a_i x_i + a_0)$$

where y – neuron output signal; f(g) – neuron output function; ai – constant coefficient – weight of the i-th neuron; xi – i-th input signal; a0 – initial state (excitation) of the neuron: i = 1,2,3 ...n – neuron input number; n – neuron input number; n – number of inputs.

The following structural scheme can be put in accordance with this expression:

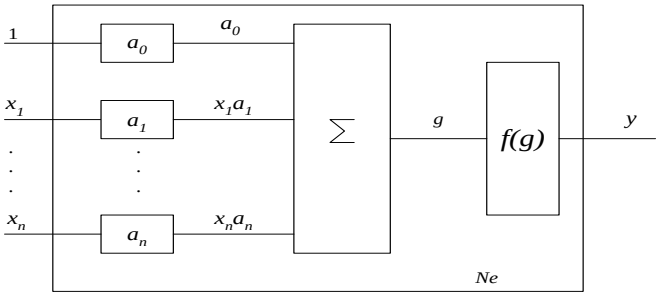

Figure. 1 Structural scheme of neural network.

The input unit in a neural network implements the activation function, also known as the excitation or transient function. The synaptic coefficients, also known as interneuron coupling coefficients, are represented by AI coefficients.

Learning involves consciousness development through interactions with the external environment and the organism's characteristics. This process is responsible for the emergence of new properties in biological and technical systems, such as new connections, improvements in the number of neurons, and new forms of interaction between the system's elements [3, 4].

The learning process is closely related to the system's functioning in the external environment, and as a result, the system interacts with the learning process.

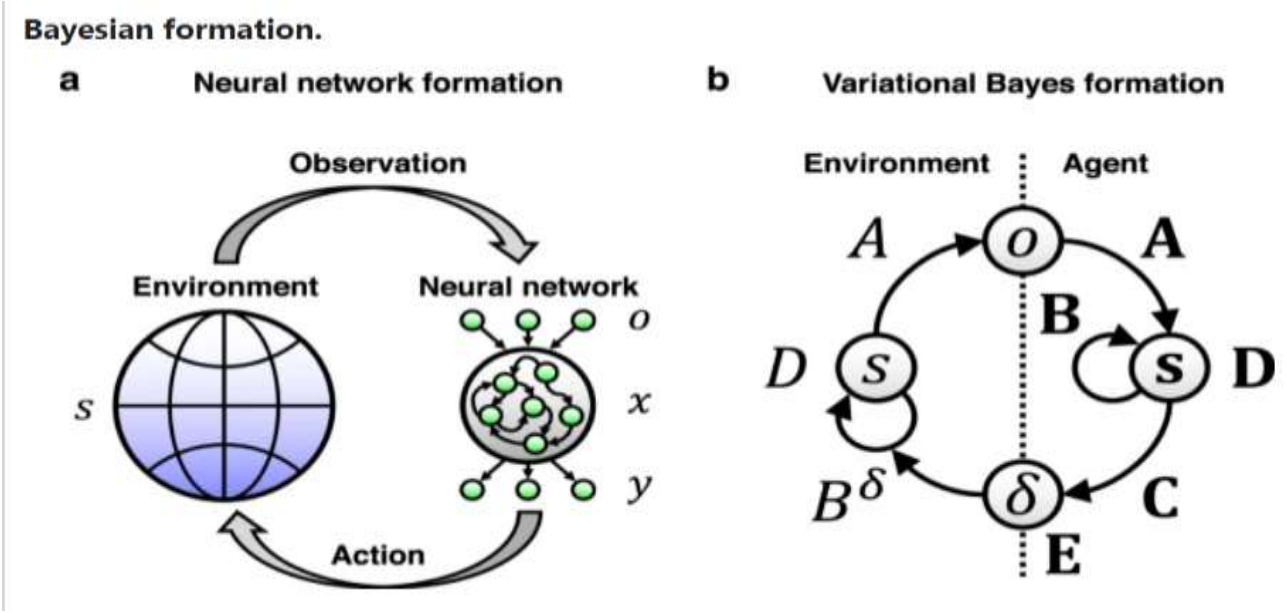

Figure 2. Scheme of the system interaction with the external environment.

The process of intelligent system interaction with the external environment involves several stages that must be carefully designed to achieve a state of equilibrium between the system's behavior model and the external environment. These stages include the identification of parameters characterizing the external environment, the selection of the learning algorithm, the implementation of a self-organization process based on learning results, the choice of a clustering algorithm for forming environment classes, adaptation, and generation of feedback signals. The final step involves constructing the behavioral model, where the external environment's reaction determines the chosen model's correctness [5].

The choice of an algorithm for building an object's behavioral model depends on its mode of functioning in the external environment, which can be online, reactive, or offline. The model of system interaction with the external environment forms the basis of any intelligent system that responds to environmental influences.

In the field of recognition problems, the stability-plasticity problem is of great importance. Correctly recognize new images, while stability retains old, previously memorized images when perceiving new ones. Solving this problem is challenging and requires careful consideration of various factors. The main task of NS training is to approximate the function realized by the actual network to the unknown function, which can be determined from the available set of examples or training samples.

Learning is a fundamental process that helps living beings and machines to adapt to their environment. There are two main mechanisms of learning: adaptation and self-organization.

Adaptation is the process of adjusting a system to the external environment, while self-organization is the dynamic rearrangement of a system to adjust it.

In the context of neural networks, one of the first learning rules is that if two neurons (i and j) are activated simultaneously during repeated presentations of the same image to the nervous system, the coefficient of synaptic connection wij between these neurons increases. This learning process involves feeding the system with multiple images and forming connections between neurons based on their activity during the learning process.

A set of neurons forms a neural network, and the connections between them have a higher permeability than the connections between the rest of the neurons in the network. This set of neurons is called an ensemble, and if a part of the neurons within the ensemble is excited, the whole ensemble is excited. Each ensemble of neurons corresponds to a specific concept and frequently repeated images lead to the formation of neuronal ensembles, which form a stable system of concepts in memory.

Conclusion.

We have been working towards a set goal of studying the fundamentals of artificial intelligence, machine learning methods, neural networks, and the corresponding algorithms. Artificial intelligence systems represent the most modern and relevant area in information technology.

In our quest for knowledge, we have explored central AI systems and the primary types of machine learning methods, including machine learning with a teacher, machine learning without a teacher, and machine learning with reinforcement. We have delved into the basic concepts of neural networks, studied their classification and algorithms in detail, and analyzed the technology of preliminary data analysis for various prediction problems.

Furthermore, we have applied our learning to practical forecasting problems, such as modeling medical issues using machine learning and developing web systems based on a PostgreSQL server. We have also leveraged convolutional neural networks and the Keras library for image recognition and utilized machine learning technologies to predict and solve applied tasks.

Throughout this journey, We have developed various applications using machine learning (ML), the Flask system, the Keras library, the PostgreSQL server, and the Python software toolkit. We have focused on using these tools to solve complex problems and create value for society.

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