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DEEP LEARNING: DEFINITION AND DISTINCTIVE FEATURES

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Abstract: *Artificial intelligence, machine learning, deep learning are words that many people know. However, not everyone can clearly formulate the differences between the listed terms. The ambiguity of interpretations creates confusion. Therefore, it seems justified to characterize each of the elements. This article contains information about all three technologies mentioned above, while the emphasis is on the latter, because it is the most relevant at the moment.*

Keywords*: artificial intelligence, machine learning, deep learning, neural network, deep neural network.*

INTRODUCTION

Deep learning is a field of machine learning related to algorithms based on the structure and function of the brain, called artificial neural networks.

As larger neural networks are created, trained on ever larger amounts of data, their performance continues to grow. Most other machine learning methods have reached the performance limit: their complexity and the use of large amounts of data for training do not increase the speed of work. Deep learning is the first class of algorithms that allows scaling.

Artificial intelligence is the future. Artificial intelligence is science fiction. Artificial intelligence is already a part of our daily lives. All these statements are true, it only depends on what kind of artificial is meant.

For example, when the Google DeepMind AlphaGo program defeated South Korean master Lee Sedol in the game of go (2016), the media used the terms AI (AI, artificial intelligence), machine learning and deep learning to describe how DeepMind won. And all three are one of the reasons AlphaGo wins. But it's not the same thing.

The easiest way to imagine them as concentric circles: artificial intelligence is the idea that arose first (the largest diameter, the 50s - 80s of the last century), then machine

learning, which became popular later (the 80s of the last century – the first decade of the 21st century), and finally deep learning, which is located in in leading positions during the current decade.

Thus, it seems justified to clarify the concepts "artificial intelligence", "machine learning" and "deep learning", in order to avoid this confusion, focusing on the features of the last element in the list, because it is currently the most relevant and in demand.

Differences between artificial intelligence, machine learning and deep learning

As a first approximation, we can say that artificial intelligence is human intelligence demonstrated by machines.

There are many ways to simulate intelligent behavior. Some methods are more intelligent than others.

Artificial intelligence can be a set of rules in the format "IF-THEN" or a complex statistical model. A "classic" system of this level can be likened to an accountant processing information based on a static set of rules and issuing an amount taxes to be paid One of the aspects that separates machine learning from classical artificial intelligence methods is its ability to self-modify, based on processing large amounts of data; that is, machine learning is dynamic and does not require human intervention to make certain changes. This allows us to significantly get rid of the subjectivity of expert people.

It is said that a computer program learns from the experience of E in relation to a certain class of tasks T and an efficiency indicator P if its The efficiency in completing tasks in T, as measured by P, improves with increasing E. Thus, instead of "manually" written programs with a given set of instructions to perform a specific task, the machine "learns" using large amounts of data and algorithms that give its the opportunity to learn how to perform a specific task.

The "learning" part of machine learning means that algorithms try to optimize for a certain dimension; as a rule, they try to minimize the error or maximize the probability of forming a true forecast.

One way to minimize the error is to create a structure with multiple inputs to make assumptions about the nature of the input data. Various conclusions/assumptions are the result of the algorithm working with the input data. Usually the initial assumptions are completely wrong, but if a certain value of the output (target) parameter is associated with each set of input values, you can measure

how wrong the guesses are, and then use this error to make a change to the algorithm. This is how neural networks work. They cyclically fix the error and adjust their parameters until they achieve (if possible) the required error value.

Typical machine learning algorithms are decision trees, clustering, Bayesian networks, inductive logic programming, reinforcement learning, neural networks, etc.

The area where machine learning has performed best over the years is computer vision, although the proportion of manual coding has been quite large. Over time, this disadvantage has been largely eliminated.

Deep learning, in turn, is a technique for implementing machine learning. It is based on the use of artificial neural networks.

Usually, when the term "deep learning" is used, deep artificial neural networks are meant, and somewhat less often, deep reinforcement learning.

Unlike the biological brain, whose neurons can connect to any other neurons in some area, their analogues differ in a discrete number of layers, connections and the direction of data propagation.

"Deep" is a technical term. The main distinguishing feature the peculiarity of deep learning lies in the greater number of hidden layers than in the "classic" single-layer neural networks. If there are more than three layers (including input and output), then they talk about deep learning.

In other words, "deep neural network" = "neural network with more than one hidden layer". Each of the "levels" of the neural network is trained to a specific set

of functions based on the results of the previous level. The larger the sequence number of the layer, the more complex objects can recognize the nodes (neurons) forming it, since the latter combine and recombine objects of the previous level.

This approach to data processing is called the "feature hierarchy". This is a hierarchy of increasing complexity and abstraction, which makes it possible to use deep learning networks to process large multidimensional datasets with billions of parameters.

Here are examples of some tasks that can be solved through deep learning. Classification

Implies the use of labeled datasets (learning with a teacher): each row in the dataset contains a target feature (label), which allows you to unambiguously attribute the first one to a certain class. Knowing the correlations between the input data and the label, you can train a neural network. This allows you to solve practical tasks such as: face recognition (identification of people in images, determination of facial expressions); identification of objects in images; recognition of gestures in a video sequence; identification of a person by voice; speech to text conversion; spam filtering, etc.

CLUSTERING

It is a procedure for detecting similarities between objects in the set. It does not require the use of labeled datasets (unsupervised learning). Unlabeled data is the majority of data in the world. One of the laws of machine learning says: the more data has been used to train an algorithm, the more accurately it will work. Therefore, this type of training is able to create effective models. This allows you to solve practical tasks such as: comparison of documents, images, sounds or any other objects; detection of anomalies, etc.

PREDICTIVE ANALYTICS: REGRESSION

With the help of classification, deep learning is able to establish a correlation between, for example, pixels in an image and a person's name. You can call it statistical forecasting. Similarly, if there is a sufficiently large amount of data suitable for processing,

deep learning is able to establish a correlation between current and future events, that is, in other words, to form a regression between the past and the future. A future event is a label. For deep learning, the time or the fact that the event has not yet occurred It happened, it doesn't matter. With a time series at its disposal, the deep learning algorithm is able to "read" a string and predict the number that will appear next with the highest probability. This allows us to solve practical tasks such as: forecasting equipment failures; identifying possible health problems; predicting the outflow of customers and employees, etc.

Thus, deep learning is a direction in the field of machine learning designed to solve a fairly wide range of tasks. Deep learning algorithms can automatically, without human involvement, to detect patterns in large unstructured and unlabeled volumes of data, which distinguishes them from most traditional machine learning algorithms. This type of training allows you to bypass time constraints and expand

the capabilities of small groups of researchers in processing non-scalable data. When using "classical" approaches , it may take years to solve the mentioned problem.

REFERENCES:

1. A Beginner's Guide to Neural Networks and Deep Learning [Электронный ресурс]. URL: https://pathmind.com/wiki/neural-network (дата обращения: 11.03.2020).

2. Artificial Intelligence (AI) vs. Machine Learning vs. Deep Learning [Электронный ресурс]. URL: https://pathmind.com/wiki/ai-vs-machine-learningvs-deep-learning (дата обращения: 11.03.2020).

3. What is Deep Learning? [Электронный ресурс]. URL: https://machinelearningmastery.com/what-is-deep-learning (дата обращения: 11.03.2020).

4. What’s the Difference Between Artificial Intelligence, Machine Learning and Deep Learning? [Электронный ресурс]. URL: https://blogs.nvidia.com/blog/2016/07/29/whats-difference-artificial-intelligencemachine-learning-deep-learning-ai (дата обращения: 11.03.2020).

5. Tojiyev, Toxir Halimovich, and Axrorjon Numonjonovich Boynazarov. "DORI MODDALARNING INSON ORGANIZMIGA YUBORISHNING 4 MATEMATIK MODELIDAN BIRINCHI HOLATI." IJODKOR O'QITUVCHI 3.29 (2023): 108-113.

6. Ortiqovich, Rahimov Quvvatali, Yusupov Mirsaid Abdulaziz o‘g‘li, and Umirjonov Lazizjon Akmaljon o‘g‘li. "DATA SCIENCE ASOSIDA MA’LUMOTLARNI QAYTA ISHLASH." INNOVATIVE DEVELOPMENTS AND RESEARCH IN EDUCATION 2.18 (2023): 251-255.

7. Tuychiboyevich, Karimov Shaxobiddin. "SOBOLEVNI JOYLASHTIRISH TEOREMALARINING AYRIMALI ANALOGLARI VA ULARNING TATBIQLARI." INNOVATIVE DEVELOPMENTS AND RESEARCH IN EDUCATION 2.18 (2023): 303-312.

8. Karimberdiyevich, Onarqulov Maqsad, Yoqubjonov Alijon Mahamadamin o'g'li, and Yusupov Mirsaid Abdulaziz o'g'li. "MASHINALI O'QITISH ALGORITMLARI ASOSIDA BASHORAT QILISH USULLARINI YARATISH." Journal of new century innovations 22.2 (2023): 165-167.