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Mainstreaming of Technological Development based on Artificial Intelligence

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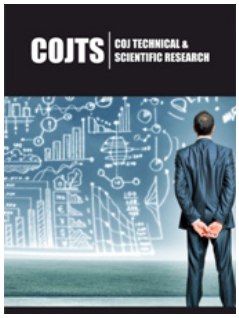
Abstract

Increasing the technological level of industrialization of production is the main task of States. Artificial intelligence fundamentally affects the technological basis of production, the functioning of equipment, as well as its delivery and organization of sales. The introduction of artificial intelligence into technological and industrial development is currently one of the most demanded areas. Artificial intelligence makes it possible to significantly increase the efficiency of various types of production, to make them smart with the help of intelligent digital twins and smart robots.

Keywords: Artificial intelligence; Systems and methods; Digital twin; Technological development; Industrial production



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Introduction

The development of artificial intelligence and machine learning technologies and their application in robotics is a prerequisite for the creation of really useful and smart robots. Statistical methods and machine learning, including artificial neural networks of deep learning, have had a huge impact on modern robotics. The architecture of networks is becoming more complex and capacity is increased while maintaining an acceptable learning speed, as well as the development of systems that will allow neural networks to operate with minimal energy consumption. An important task in improving the efficiency of machine learning is to reduce the learning sample while maintaining the speed and quality of learning. Training in action algorithms begins. A neural network trained on the example of a single labeled dataset can self-train and draw conclusions on unmarked datasets. As a result, learning becomes faster, large amounts of data are processed, and the quality of results is improved. Current robotics practice shows that the best results in increasing productivity can be achieved from the maximum efficiency of the bundle of robot teams and people working together to achieve a common goal. Increase. Social interaction between humans and robots in everyday and working life is the subject of numerous studies, some of which have become the basis of as many billions of industries. An example of successful implementation of social interaction technologies is voice assistants and chat bots. Robots can already both record human movement skills and copy them. Machine learning improves drive efficiency and mobility. As a result, more complex movements will be achieved by simpler means. Now the developments in this direction are carried out by Boston Dynamics and MITs with the robot Atlas. Researchers hope that if successful, the application of neural networks will find new variants of movements that will be more effective. In the coming years, the quality of training will improve, as will the degree of autonomy of robots.

Artificial Intelligence Methods, Systems and Techniques

Big data

The data collected automatically is too large for manual collection and processing to find new patterns and knowledge that cannot be derived from local data fragments.

Recommendation systems

(Collaborative Filtering) are systems that provide recommendations based on implicit patterns detected by AI algorithms using big data analysis. They can be aimed at interaction with the client (offer goods/services/dating), or used within companies (to support credit decisions, personnel decisions).

Predictive systems

Systems that capture relationships between variables in historical data sets and their outcomes. Based on these relationships, models are developed, which in turn are used to predict new results.

Biometrics

Removal and digitization of various biological characteristics of a person faces, gestures, gait, fingerprints, blood pressure, temperature, etc. Used for identification of people and human-machine interactions.

Knowledge management

Is the representation of knowledge about the world in the form of a hierarchy of concepts, such that the AI system can use knowledge to solve complex problems such as disease diagnosis, decision making, or human conversation?

Man-machine interface

Person-Device Dialog - A dialog (text or voice) in a client or technical support service. Entertainment robots. Dialogue with household appliances, car, disabled.

Virtual interlocutors (chatbota, Chatbots)

The programs communicating with the person in a natural language. Can work as promoters, account managers, help human resources, answer frequent questions in online technical support services, use in cars and home entertainment robots. Communication can be text (chat-like) or voice.

Machine learning (ML)

Is an AI area that creates algorithms that independently learn and predict the situation based on available data without requiring the intervention of a programmer?

Supervised learning

Is a type of machine learning where the learning algorithm is given pre-classified and sorted data consisting of examples of input data and desired results of its processing? The purpose of the training is to learn the general rules that link input and results and, based on these rules, to predict future events.

Unsupervised Learning

Is a kind of machine learning in which the learning algorithm does not include any classifications and labels, itself defines the structure and relationships of the input data? Uncontrolled learning can itself be a goal (detection of hidden patterns in data) or a means (extraction of features from an array of data). It is focused on the investigation of input data and recognition of the structure of untagged data.

Reinforcement learning

Is a type of machine learning in which an algorithm has a specific purpose for example, to control a robotic manipulator or play go? Every step on the way to the goal is marked by a reward or a fine. Given this feedback, the algorithm can work out the most efficient path to the target.

Deep neural networks

Is a multi-layer neural network in which "learned" data is passed through several layers of "neurons"; On each layer, the result of the previous layer is used as input information.

Convolutional neural networks

Multilayer neural networks with alternation of special curving (summing) and ordinary layers, most effective for image recognition.

Feed-forward networks

Is a neural network with many layers where data is propagated only forward.

Recurrent neural networks

Deep neural networks where data can propagate between layers forward and backward.

Neural network constructors/libraries

(Frameworks/Neural Frameworks, Deep Learning Frameworks). Neural network development environment "under task," allowing generate several dozen different types of neural networks and then train them on given datasets. There are only a few popular neural libraries, the main players of this market - TensorFlow (Google), PyTorch (Facebook), Keras (open-source), etc.

Graphics accelerators

(Graphics Processor Unit (GPU)). Graphic maps for displaying images on the computer screen, allowing to carry out ultra-fast and massive parallel calculations, due to this became the main carrier of calculations on neural networks. The main player of this market is Nvidia.

Neural chips

(Neural Processing Unit, Neuromorphic Processor, Tensor Processing Unit, ASIC). Highly specialized processors specifically optimized for fast parallel computing using neural networks.

Dataset (Training Set)

A set of precedents (objects, cases, events, subjects, texts, photographs, samples, etc.) selected to train an algorithm from a variety of all possible precedents, called a general set.

Mark-up

Processing a learning sample to assign properties to objects in it that the algorithm is learning to recognize.

Marking system

An automated workplace that allows many machine learning operators to quickly map learning samples. For example, manual

allocation of persons by the operator in photos, marking of letters on spam/non-spam, marking of search results or X-rays.

Open data

Archives, libraries of data, usually stored in cloud storage and available for download anywhere in the world to anyone.

Data processing center, data center

A special technical room, which houses special equipment (servers, server racks, network equipment, etc.) for processing, storage and transmission of large data arrays, with power supply and powerful communication channels. Modern data centers are complex engineering facilities and consume a large amount of electricity (up to hundreds of megawatts), most of which goes to cooling the equipment.

The data set

(Data set) represents a set of the data having identical structure and united on sense. The dataset can be both text, sound, visual and tabular information and all kinds of combinations thereof. The dataset may contain data annotated (marked) or unannotated (unmarked).

Tagged data

Containing structured information for all dataset instances that include meta-information to solve specific applications. The markup shall be unified, have the property of integrity and meet the requirements of meta content.

Julia

Is a high-level general-purpose programming language developed in 2009 with a focus on high-performance numerical analysis and computational science. Simple syntax and deep mathematical roots make Julia a friendly programming language for data analysts, offering the perfect way to express algorithms. It also includes Flux, the basis for machine learning and supports TensorFlow and MXNet.

Python is a widely used programming language and can be used to implement AI because of the simple and seamless structure it offers. Python syntax makes it easy to implement different AI algorithms, which also reduces development time compared to other available programming languages. Applying Python allows users to create neural networks with a set of useful libraries that can be used to develop AI. Other features include the ability to test algorithms without having to implement them.

Java

An extremely popular cross-platform programming language provides search algorithms and neural networks. It is an easy-to-understand language that offers graphical representation, debugging, and scalability. Its portability makes it the preferred implementation for different applications based on having different built-in types.

Tentorflow

Is an open software library for machine learning developed by Google to solve the problems of building and training a neural network with the aim of automatically finding and classifying images, achieving the quality of human perception. It is used for both research and development of Google ‘s own products. The main API for working with the library is implemented for Python, and there are also implementations for C, Haskell, Java, Go, and Swift. Continues a closed DistBelief project. Originally TensorFlow by the Google Brain team for internal use at Google, in 2015 the system was transferred to free access with an open license Apache 2.0. TensorFlow is well suited for automated image annotation in systems such as DeepDream. TensorFlow allows training of GANs.

PyTorch

Is an open-source Python machine learning library built on Torch. Used for natural language processing. It is developed predominantly by Facebook ‘s artificial intelligence group. Uber’s “Pyro” library for probabilistic programming is based on PyTorch. PyTorch provides two main high-level models: 1. Tensor computing (similar to NumPy) with advanced acceleration support on GPU, 2. Deep neural networks based on autodiff system.

Keras

Is an Open Neural Network Library written in Python? It is an add-on above the Deeplearning4j, TensorFlow and Theano frames. It is aimed at operational work with deep learning networks, while being designed to be compact, modular and expandable. According to the concept, Keras is an interface rather than an end-to-end machine learning system. Keras provides a high-level, more intuitive set of abstractions that makes it easy to form neural networks, regardless of the scientific computing library used as a computational backend. Microsoft is working on adding CNTK libraries to Keras and low-level libraries.

Caffe

Is the foundation of deep learning, created with speed and modularity in mind? Switching between the central and graphic processing unit on the computer, and then expansion on computing clusters or mobile ustroistvo. Speed makes Caffe ideal for scientific experiments and industry. Caffe can process 60 million the image˘ in day with one GPU NVIDIA.

Cuda

Is a parallel hardware and software architecture that significantly improves computing performance with Nvidia graphics processors. The CUDA SDK allows programmers to implement algorithms in special simplified dialects of the C, C and Fortran programming languages that are feasible on Nvidia graphics and tensor processors. The CUDA architecture gives the developer the option, at his own discretion, to organize access to the set of instructions of the graphic or tensor accelerator and to manage its memory. Functions accelerated with CUDA can be called from a variety of languages, including Python, MATLAB, etc.

Clouds

Computing services (servers, storage, network, software) accessible via the Internet. In fact, you can buy computing power or storage without thinking about what servers and where they are - somewhere "in the cloud." For example, to avoid storing personal documents and photos on a personal computer 's hard drive, most users now store them online.

Artificial intelligence (AI)

Is a scientific applied direction for the development and creation of technological and program cognitive complexes of the digital twin of human intelligence, capable of learning, retraining, self-realization and development on the basis of the criterion of preferences and to improve functional activity by qualitative selection and mastering of creative innovative high-tech professional and behavioral skills and competences. (International approach)

Digital Process Twins in Industrial Manufacturing

The term Digital Twins appeared in the early 2000s, but every year, as technology developed, it received new content. The basic concept is not difficult to understand monitoring of a physical object is carried out on the basis of a closed cycle of information exchange between it and its virtual model (thus a digital twin).

A digital twin is a virtual prototype of a real object, group of objects, or processes. It is a complex software product that is built from a wide variety of data. The digital twin is not limited to collecting data obtained during the development and manufacture phase of the product - it continues to collect and analyze data during the entire life cycle of the real object, including through numerous IoT sensors. A digital twin is a virtual reproduction of the operational state of a real physical object, process, system, or whole service. It can be a virtual twin of a part, product, equipment, process, production sites, workshops, or even factories. It is essentially a set of mathematical models describing the state of an object and all its elements. In general, a digital twin includes: a geometric model of an object; Set of calculated data of parts, nodes and object as a whole (mathematical models describing all physical processes taking place in the object); Information on manufacturing and assembly processes of individual elements; Some data on tests of the object, for example, readings of sensors, from which calculated data can be confirmed; A PLM system that links all of the above objects into a single structure. The digital twin is used in association with the physical throughout the life cycle: during the testing, rework, operation and disposal phase. The physical object uses sensors that collect real-time data about the state of the object, after which this information is sent to the digital twin. On the basis of the obtained data, the digital model is clarified, which, in turn, gives recommendations for optimization of the operation and maintenance mode of the real object. The digital twin allows you to simulate in virtual space the change in the state and characteristics of the entire product when the characteristics of any of its elements change. Its main task is to allow real-time management of all factors affecting the cost and quality of the product even before its production begins. Digital twins are created to significantly accelerate the time to market of new products, so you can present all stages of its life cycle in a virtual environment. Another function of the digital twin is to inherit product data when modifications are made to it. In other words, to maximize the use of previous experience in designing, manufacturing, and testing new product modifications. In this case, we take into account the peculiarities of the product operation and on the basis of the data obtained from the digital twin, we can improve the characteristics of the product modification.

The main advantage is the speed of making technical decisions and the cost of obtaining the required characteristics of the product. Having a digital twin, it is possible to reduce by an order of magnitude the number of natural tests, the number of attempts to work out technological processes, all that is connected with the production of a real material part and its tests, the cost of which is much higher than the cost of mathematical modeling. Another advantage is the possibility of collective work on the product of geographically remote collectives and engineering centers. At the same time, the necessary scientific potential and labor resources can be used than with manual design technology. If we consider the digital twin not of a specific product, but of the whole production, the advantage is the possibility to simulate in a virtual environment all processes, to determine the necessary quantity and optimal location of equipment depending on the volume and range of products produced. At the same time, if a digital twin is developed for the newly created production, it is possible to identify possible risks and shortcomings through simulation of its work, to correct the project.

The digital twin of existing production allows you to work out the implementation or change of technological processes without real interference with the work. Digital twins allow you to model a variety of situations that can occur in production. Thus, the digital twin allows you to select the most adequate process scenarios to avoid failures and force majeure. Digital twins help improve cloud platform efficiency, solve design problems early, train employees, support innovation, and more. Digital twins are starting to use companies of different industries, such as energy, transport, construction, but first of all it works in high-tech industry or service [1-20]. The most dynamic market where digital twins are used is the global automotive industry, which produces 100 million units annually.

Conclusion

Artificial Intelligence becomes scientific applied direction on development and creation of technological and program cognitive complexes of the digital double of intelligence of the person of technological and program cognitive complexes of the digital double of intelligence of the person capable to training, retraining, self-realization and self-improvement on the basis of criterion of preferences and to improvement of functional activity by the high-quality choice and development of creative innovative hi-tech professional and behavioural skills and competences.

There are a number of socio-economic issues related to human-machine interaction. Complex technologies are not credible on the part of citizens. The coming years will take to improve safety and standardize the creation, application of digital twins and behavior of robots.

References

1. (2017) Collaborative robots market. Markets and markets research.
2. (2017) The 2017 RBR50 list names robotics industry leaders, Innovators. Robotics business review.
3. Top robotics market by industrial robotics, service robotics -Global forecast to 2022.
4. (2017) Robots are already replacing human workers at an alarming rate. Gizmodo.
5. Bryndin E (2017) Cognitive robots with imitative thinking for digital libraries, banks, universities and smart factories. International Journal of Management and Fuzzy Systems 3(5): 57- 66.
6. Bryndin E (2018) Technological thinking, communication and behavior of androids. Communications 6(1): 13-19.
7. (2018) Top service robotics companies. Venture radar.
8. Domingos P (2016) Supreme algorithm. How machine learning will change our world. M: Mann, Ivanov and Ferber, Russia, p. 336.
9. Bryndin E (2017) Program hierarchical realization of adaptation behavior of the cognitive mobile robot with imitative thinking. International Journal of Engineering Management 1(4): 74-79.
10. Bryndin E (2019) Social cognitive smart robots: Guide, seller, lecturer, vacuum cleaner, nurse, volunteer, security guard, administrator. Communications 7(1): 6-12.
11. (2017) Report of COMEST on robotics ethics.
12. Bryndin E (2018) Technological, economic and social aspects of management by development of the digital industry 4.0. International Journal of Managerial Studies and Research (IJMSR) 6(4): 19-30.
13. Bryndin E (2018) Directions of development of industry 4.0, digital technology and social economy. American Journal of Information Science and Technology 2(1): 9-17.
14. Bryndin E (2019) Human digital doubles with technological cognitive thinking and adaptive behaviour. Software Engineering 7(1): 1-9.
15. Bryndin E (2019) System retraining to professional competences of cognitive robots on basis of communicative associative logic of technological thinking. International Robotics Automation Journal 5(3): 112-119.
16. Bryndin E (2019) Creative innovative transformational ecosystem of formation of humane technological society. International Robotics Automation Journal 5(3): 91-94.
17. Saravia S, Slen E, Pendse G (2019) Artificial intelligence & robotics: Industry report & investment case.
18. Zhang S, Yao L, Sun A, Yi Tay (2018) Deep learning based recommender system: A survey and new perspectives. Computer Science Information Retrieval.
19. Bryndin E (2019) Robots with artificial intelligence and spectroscopic sight in hi-tech labor market. International Journal of Systems Science and Applied Mathematic 4(1).
20. Galeon D (2019) Google's artificial intelligence built an ai that outperforms any made by humans.