DEVELOPMENT OF ARTIFICIAL INTELLIGENCE AND ITS EFFECTIVE TOOLS

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Kalit so'zlar: sun'iy intellekt, mashina tarjimasi, o'yin intellekti, kompyuterli ko'rish, ma'lumotlarni ajratib olish, timsollarni tanish, ekspert tizimlari, evristik dasturlash, periferik hisoblash, model, algoritm.

Ключевые слова: искусственный интеллект, машинный перевод, игровой интеллект, компьютерное зрение, извлечение данных, распознавание образов, экспертные системы, эвристическое программирование, периферийные вычисления, модель, алгоритм.

Keywords: artificial intelligence, machine translation, gaming intelligence, computer vision, data mining, pattern recognition, expert systems, heuristic programming, edge computing, model, algorithm.

Annotatsiya: Ushbu maqolada sun'iy intellekt tushunchasi, uning mohiyati, tasniflanishi va qo'llash sohalari yoritilgan. Ilovalarni ishlab chiqish jarayonini tezlashtirish yoki sun'iy intellekt va mashinali o'rganish algoritmlarining umumiy ishlashini yaxshilashga yordam beradigan samarali vositalar ta'kidlandi.

Shuningdek, periferik hisoblashda sun'iy intellekt va mashinali o'rganish imkoniyatlaridan foydalanish kompaniyalarga operatsion samaradorlikni oshirish va sanoat ilovalari uchun xavflarni kamaytirish imkonini berishi bo’yicha tavsiyalar taqdim etilgan.

Аннотация: В данной статье описано понятие искусственного интеллекта, его сущность, классификация и область применение. были отмечены эффективные инструменты, которые помогают ускорить процесс разработки приложений или повысить общую производительность алгоритмов искусственного интеллекта и машинного обучения.

Также приведены использование возможностей искусственного интеллекта и машинного обучения в граничных вычислениях позволяет компаниям повысить операционную эффективность и снизить риски для их промышленных приложений.

Abstract: This article describes the concept of artificial intelligence, its essence,

classification and scope of application. Effective tools have been highlighted that help speed up the application development process or improve the overall performance of artificial intelligence and machine learning algorithms.

The use of artificial intelligence and machine learning capabilities in edge computing allows companies to increase operational efficiency and reduce risks for their industrial applications.

The development of products and services based on artificial intelligence (AI) requires an unambiguous interpretation of the concepts used by all market participants [1].

The field of AI is extremely heterogeneous. There are various areas of research in it, which are distinguished either by the task (or subject area) requiring intellectual analysis, or by the tools used, or by the model of thinking being developed (Fig.1.).

The areas identified on the basis of the problem being solved include:

- Machine translate;
- automatic abstracting and information retrieval;
- speech communication systems;

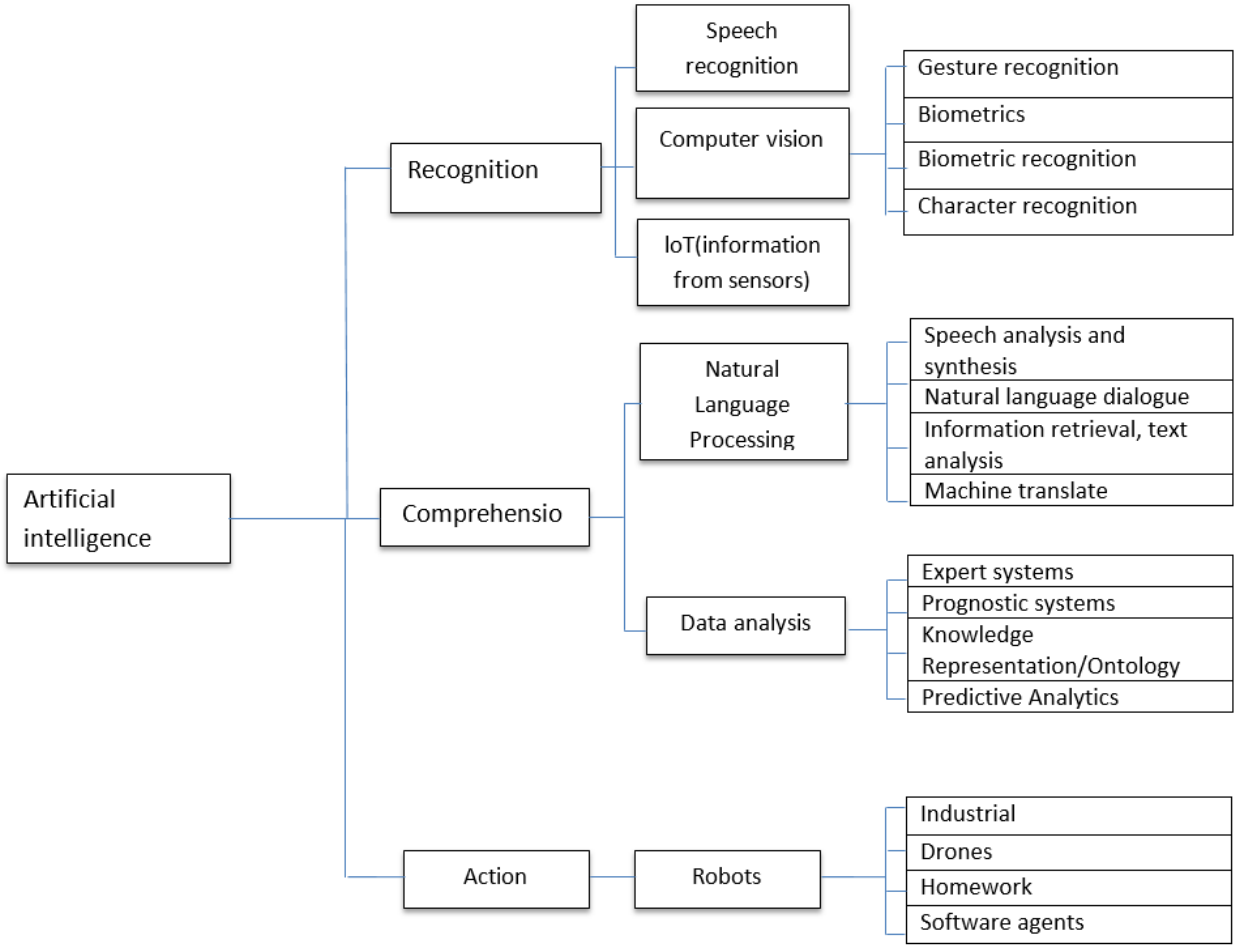

Fig.1. Areas of application of artificial intelligence.

- *gaming intelligence, theorem proving and automation of scientific research;*
- *computer vision;*
- *data extraction;*
- *composing texts and music, etc.*

The listed areas are characterized by the fact that a significant part of the research conducted in them is devoted not to thinking processes, but to the subject of intellectual analysis.

Areas of AI, identified by the tools they develop, include:

- artificial neural networks;
- evolutionary calculations;
- pattern recognition;
- expert systems;
- heuristic programming;
- multi-agent approach, etc.

The concept of AI includes machine learning, which allows systems to automatically learn and improve based on the experience they receive, without being programmed to do so, using various algorithms and neural networks. The concept of computer vision, in turn, includes a related term – "deep learning". Deep learning refers to neural networks that are trained on huge amounts of data. Since AI is an extremely broad discipline, in our article we will focus specifically on the application of the above technologies in industry.

AI in industry is used in a variety of applications - from remote monitoring, equipment prevention, vehicle identification, traffic signal control to smart harvesters in the agricultural industry. The use of such intelligent computer vision and video analytics systems can improve the productivity and efficiency of industrial applications [2].

The number of industrial devices connected to the Internet in one way or another is growing rapidly and is expected to exceed 40 billion points by 2025. Even the most basic sensors on a production line generate such a huge amount of data that manual analysis can take a lifetime. In fact, currently less than 1% of unstructured data is analyzed or even used by companies when making decisions [3].

To select a suitable hardware platform for an AIoT application, a number of factors must be taken into account [4]:

- AI requirements for hardware performance;
- level of edge computing;
- supported development tools;
- operating conditions of the device.

There are three phases of creating AIoT applications: data collection, training, and inference (data processing followed by inference).

AI is divided into edge computing levels [5]:

Low end edge computing

Mid-tier edge computing

High Performance Computing Layer

Bottom layer: The simplest layer that includes sensors and actuators connected to the cloud via the Internet of Things (IoT).

• Characteristics:

- Limited computing capabilities.
- Minimal data processing on the periphery.
- The main focus is on collecting and transmitting data to the cloud.

Examples: Temperature and humidity sensors; Motion sensors; Lighting control devices.

Mid-Tier: Tier that includes more computing power and local data processing.

• Characteristics:

- Some calculations are performed at the edge before the data is sent to the cloud.
- Use of microcontrollers or embedded systems.
- Optimized for real-time data processing.

Examples: Devices for predictive analytics; Machine learning systems for pattern recognition; Devices for controlling industrial processes.

High-Performance Tier: The most advanced tier that includes high-performance computing and complex machine learning workloads at the edge.

• Characteristics:

- Large amount of processing power and memory.
- Processing large amounts of data at the edge.
- Use of graphics processing units (GPUs) and specialized hardware.

Examples: Autonomous vehicles; Robotics; Virtual and augmented reality systems.

Several tools are available for different hardware platforms to help speed up the application development process or improve the overall performance of AI and machine learning algorithms.

Of course, one of the most important criteria for choosing a device for edge computing with AI is the operating conditions of the device itself. Computers deployed in harsh industrial environments must have a wide operating temperature range and efficient heat dissipation mechanisms to ensure reliability in hot weather.

Modern machine learning algorithms, neural networks and deep learning are significantly superior to previous technologies, allowing AI to solve increasingly complex problems.

Powerful tools have been developed and continue to be improved, such as language models, computer vision algorithms, speech recognition systems and others, which are widely used in various fields.

Leveraging the power of AI and machine learning in edge computing allows companies to improve operational efficiency and reduce risk for their industrial applications. At the same time, we can also talk about reducing production costs with the proper use of AI with properly trained models.

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