TECHNOLOGIES USED IN THE DEVELOPMENT OF ARTIFICIAL INTELLIGENCE SYSTEMS

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K E Y W O R D S

artificial intelligence, smart systems, intelligent machines, robots, expert systems, chatbots, customization, platforms, software

A B S T R A C T

This article focuses on the technologies and approaches utilized in creating artificial intelligence programs and systems, emphasizing their distinct characteristics, functionalities, and advantages. It also reviews statistical data on AI systems and provides an analysis of the currently trending smart technologies.

Introduction. In order to establish the widespread use of artificial intelligence (AI) technologies, collect digital data, store it, and further develop its advanced applications, several initiatives are currently being undertaken in our country. These include training highly skilled and experienced specialists, as well as supporting scientific and practical projects in this field. Additionally, the development and dissemination of AI not only among the youth but also across the broader population is not just a requirement of the government to increase the number of dedicated professionals in this field, but also a demand of the modern world. At the same time, studying and analyzing the operating principles of these technologies, along with the methods and technologies used in their development, is considered one of the key tasks. Currently, the specialization of "Digital Technologies and AI" has been included in the nomenclature of scientific and scientific-pedagogical specialties for training highly qualified personnel in our country, and a passport has been created for it. Postgraduate education in "Digital Technologies and AI" has also been established at Tashkent University of Information Technologies named after Muhammad al-Khwarizmi and the Research Institute for the Development of Digital Technologies and AI. We believe that all these efforts will contribute to ensuring that young people become the most professional experts in this field [1].

Problem Statement. It is well known that digital technologies are rapidly penetrating various fields today. Among them, analyzing the technologies used in the development of AI tools and examining how these technologies are applied across different sectors—more specifically, determining in which fields AI delivers the most effective results—represents one of the primary tasks we have set before us.

While some fields are just beginning to adopt AI, others are already experienced users. Both have their own pathways to integrating AI into their practices. In any case, it is difficult to overlook the impact of AI on our daily lives. Below, we will examine the application of AI in specific fields:

In Education: AI is used to digitize textbooks, support human teachers with virtual tutors at the initial stages, and analyze students' emotions using facial recognition technology to better identify whether they are struggling or feeling bored, enabling more effective teaching strategies.

In Healthcare: Diseases are diagnosed more quickly and accurately, the process of discovering and developing medications is accelerated and simplified, and virtual nurse assistants monitor patients. Additionally, through the analysis of big data, healthcare benefits from collecting individualized analyses of patients.

In Transportation and Logistics: Modern automated self-driving vehicles, although their development may take some time, will eventually transport us without the need for human intervention.

In Manufacturing: Robots powered by AI are proving to be highly effective in operations such as assembly. This can be considered the field where AI delivers the greatest efficiency, without exaggeration.

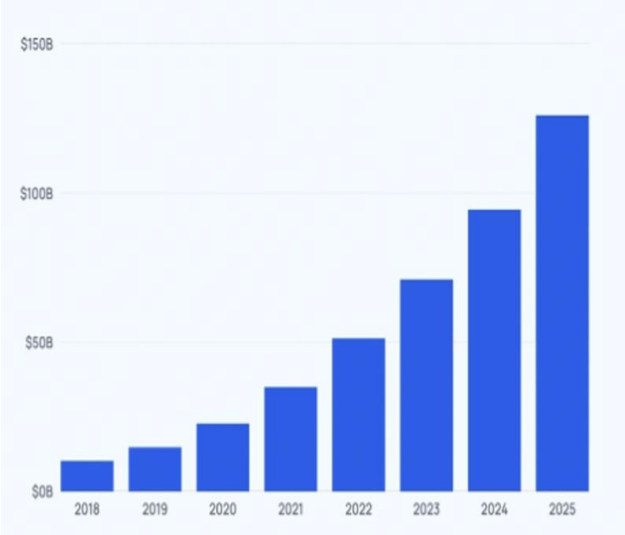

Figure 1. *Revenue of the Global AI Market [4].*

In Customer Service: By integrating AI into production lines, it is possible to optimize production processes, reduce downtime, and increase overall efficiency. Machine learning algorithms are used to detect potential equipment failures before they occur.

To develop an AI system, a variety of modern programming languages and algorithms are used, enabling the creation of intelligent machines that can learn, reason, and perform tasks like humans. The main technologies and methods used in the development of AI systems are outlined below [2]:

- Machine Learning (ML): A subset of AI that involves using algorithms to allow machines to learn from data and make predictions or decisions without being explicitly programmed.
- Natural Language Processing (NLP): A branch of AI that enables machines to understand, interpret, and generate human language.
- Deep Learning: A part of machine learning that involves using artificial neural networks to model and solve complex problems.
- Computer Vision: A branch of AI that enables machines to interpret and analyze visual information from the surrounding world.
- Robotics: A field that involves the use of robots and AI systems to perform tasks that are dangerous, difficult, or tedious for humans.
- Cognitive Computing: A branch of AI that involves using algorithms and technologies to mimic human thought processes and decision-making.

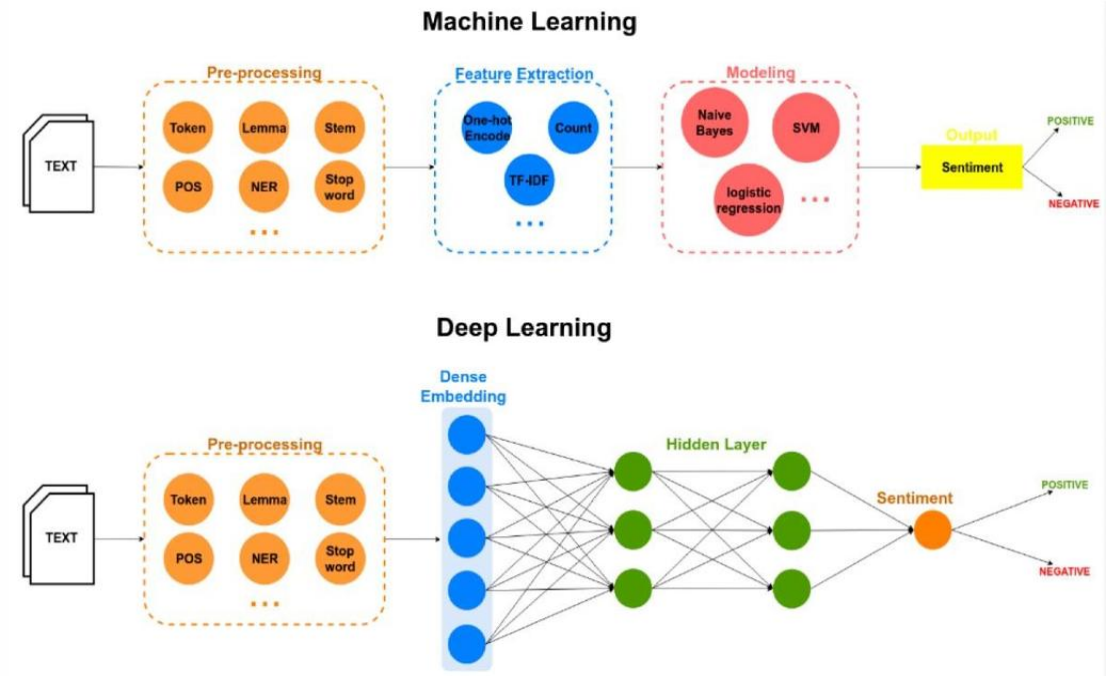

Figure 2. *Difference between Machine Learning (ML) and Deep Learning (DL) Technologies in Text Recognition [5].*

- Expert Systems: AI systems designed to provide advice and guidance in specific fields by applying knowledge and reasoning methods.
- Natural User Interfaces (NUIs): Interfaces that allow users to interact with AI systems using natural language, gestures, and other intuitive methods.
- Cloud Computing: Provides AI systems with access to large amounts of data and processing power from remote servers, enabling them to perform complex calculations and learn from and utilize large datasets.
- Internet of Things (IoT): A network of interconnected devices and sensors that enables data collection and sharing, allowing AI systems to gather information about the world in real-time.

In addition, Natural Language Processing (NLP) is also a branch of AI that enables machines to understand, interpret, and generate human language. NLP technology has significantly advanced in recent years and is now applied in a wide range of applications, from chatbots and virtual assistants to language translation and sentiment analysis. The most popular of these today is ChatGPT, which is based on natural language processing technology.

The development of AI systems and software generally involves several processes, which may vary depending on the specific program and domain. However, some common processes involved in the development of AI systems and software include the following [3]:

Stage I: Problem Identification and Technical Requirements. The first step in developing AI systems and software is to identify the problem or task that the system is intended to solve, and to understand the technical requirements that need to be met during the development process.

Stage II: Data Collection and Preprocessing. AI systems require large amounts of data for learning and making accurate predictions. This data must be collected from various sources and preprocessed to ensure that it is clean, consistent, and suitable for use by the system.

Stage III: Algorithm Selection and Model Training. After data is collected and preprocessed, the next step is to select suitable algorithms and models for the system. This involves testing and evaluating various algorithms to determine which one is the most effective for the task at hand, and then training the models using the preprocessed data.

Stage IV: Model Evaluation and Optimization. Once the models are trained, they need to be evaluated to determine how well they perform the task. If the performance is unsatisfactory, the models may need to be optimized by adjusting parameters or applying different algorithms.

Stage V: Review and Interpretation. Finally, the results of the AI system must be explained and interpreted for the end users and stakeholders. This includes developing methods to visualize and present the results in a clear and actionable way.

These are the main processes involved in developing AI systems and software. Of course, the application of AI may vary depending on the specifics of the field. However, the exact processes and actions may differ based on the particular program, domain, and technology used.

Conclusion

In conclusion, AI is penetrating nearly all sectors, and its impact is expected to intensify not only by the end of 2023 but in the following years as well. From healthcare to manufacturing, and from finance to transportation, AI is revolutionizing the way businesses operate, making them more efficient and customer-oriented. As technology continues to develop, we can expect AI to be applied in even more fields, many of which we cannot even imagine today. In the current globalized world, those involved in the development and application of AI technologies are increasingly aware of both the potential and risks of AI. Developing general concepts about the processes related to the use of AI and the issues that need to be addressed is an important task. Overall, it is important to highlight that as the number of AI systems processing personal data increases, this issue is becoming more and more significant. Therefore, closely familiarizing oneself with the technologies, methods, and

principles used in AI development remains a crucial and ongoing area of interest.

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