



THE DEVELOPMENT OF ARTIFICIAL INTELLIGENCE IN MOBILE APPLICATIONS AND ITS EFFECTIVENESS IN THE EDUCATION SYSTEM

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Annotation: This article discusses the development of artificial intelligence (AI) in mobile applications and its effectiveness in the education system. It presents scientific insights and reflections on how AI is becoming increasingly influential not only in education but also in various other fields. The paper highlights the growing relevance and wide-ranging applications of AI in modern society.

Keywords: Interactive textbook, education, government, society, multimedia technologies, virtual laboratories, innovation, presentation, outcomes.

Introduction

Artificial Intelligence (AI) in mobile applications—also referred to as intelligent tutoring systems or machine learning-based tools—is a rapidly developing technology used to enhance learning programs, analyze data, and achieve various educational objectives. The formation and implementation of AI in mobile apps have become critical for many sectors, including education and entrepreneurship.

Data Analysis: AI is widely used in mobile apps to analyze user data. This analysis helps understand user preferences and emotions, which improves personalization, reduces information loss, and enhances recommendation systems for better user experiences.

Training for Mobile Interfaces: Mobile applications utilizing AI can offer more intuitive and user-friendly interfaces. For example, by learning and understanding user speech or behavior, the app can offer functionalities tailored to individual needs and preferences.

Application of AI in Education: The integration of AI in mobile educational applications plays a vital role in creating active and personalized learning environments. It allows for adapting educational content to the specific needs of each learner, thereby offering individualized and inclusive learning experiences.

The following efficiencies can be ensured through the application of artificial intelligence (AI) in mobile applications within the education system:

Personalized Learning Paths: AI analyzes information about each student and identifies personalized learning paths. It also determines students' learning characteristics and specific study times. As a result, an individual study schedule is created for each student, along with

personalized recommendations aimed at enhancing their learning experience.

Data Analysis for Teachers: AI is also beneficial for educators. It collects data on students' learning processes, questions, and mistakes, providing teachers with insights to develop optimal teaching strategies based on this data.

Personal Recommendations and Additional Insights: Mobile applications use AI to provide personalized advice and recommendations for students. By analyzing learning characteristics, AI offers suggestions to enhance the learning process and increase its overall effectiveness.

Adaptation and Monitoring: AI monitors students' learning levels and progress. Based on this data, the education system adapts itself to each learner's individual responses, reconfiguring the learning program to identify the most beneficial and effective learning pathway.

Individualization of Learning Materials: AI is applied to design and deliver customized learning materials for students. This allows learners to engage with lessons, exercises, and assessments that are best suited to their needs and abilities.

Significance of AI in Education: The use of artificial intelligence in mobile applications plays a crucial role in offering personalized, efficient learning and guidance based on individual student data. This method can be a valuable assistant in helping students improve their knowledge and performance.

Automated Responses for Inquiries: AI is used in mobile apps to analyze inquiries, retrieve relevant information, and deliver results automatically, enhancing the responsiveness of educational systems.

In accordance with the “Digital Uzbekistan – 2030” Strategy, the rapid implementation of artificial intelligence (AI) technologies and their widespread adoption across various sectors of the country are set as priorities. This includes ensuring access to high-quality digital data and creating favorable conditions for training qualified specialists in the field of AI.

Furthermore, the document outlines the main directions and principles of AI application, as well as the development of a comprehensive Artificial Intelligence Development Strategy for the near and long-term future. This includes the establishment of a normative and legal framework that defines unified requirements, accountability, security, and transparency for the development and use of AI technologies in sectors of the economy, social sphere, and the state governance system. It also envisions improving the quality of public services in the interests of citizens.

In addition, the strategy calls for the widespread use of AI technologies by public authorities to enhance the efficiency of data processing, promote fundamental and applied scientific research aimed at developing effective technological solutions, and stimulate the commercialization of innovative developments in the field of AI by creating a national ecosystem for innovation. The resolution clearly defines the specific sectors and methods in which AI technologies are to be applied, along with the associated strategic objectives.

After understanding what artificial intelligence (AI) means and why this group of technologies is so important, it is necessary to outline the possible types of AI. According to specialized literature in computer science, the following types of AI are commonly mentioned:

- Automated AI – capable of performing routine tasks;
- Assistive AI – optimizes decisions made by humans;
- Augmented AI – supports human reasoning in non-standard situations;
- Autonomous AI – performs activities independently, like a human being.

This classification demonstrates the predictable expansion of AI capabilities. Therefore, based on their level of complexity, AI is commonly divided into three main types:

1. Narrow or Weak AI (Artificial Narrow Intelligence) – designed to solve specific or relatively small problems;
2. General or Strong AI (Artificial General Intelligence) – a universal intelligence equivalent to human cognitive abilities, capable of solving a wide range of tasks;
3. Artificial Superintelligence – surpasses the intellectual capabilities of an individual or even all of humanity.

Based on environmental perception, artificial intelligence systems can be classified into four types:

1. Reactive Systems – these can perceive the environment and respond accordingly.
2. Systems with Limited Memory – they can adjust their behavior based on past experiences.
3. Theory of Mind Systems – these systems have the capability to recognize thoughts and emotions.
4. Self-aware Systems – capable of forming a model of themselves and possessing cognitive abilities comparable to humans.

This classification aligns closely with the previous typology. The first two types refer to weak AI, which is currently the only category that has been successfully implemented. The emergence of the third type of AI indicates that we are approaching the development of strong AI.

Weak AI is capable of performing functions such as data search to determine the best solution, but it lacks human-like consciousness and emotions, and operates only within predefined boundaries. Nevertheless, such systems can process information and perform tasks much faster than humans, making them useful for increasing overall efficiency and improving quality of life.

Reactive systems, as the simplest form of a

It does not form memory, meaning it does not rely on past experiences to make decisions. A notable example of such artificial intelligence is the famous Deep Blue chess computer, which defeated world champion Garry Kasparov at the end of the 20th century. Structurally, Deep Blue consisted of two main parts: a software component developed on a general-purpose computer that calculated the first several chess moves, and a hardware component composed of specialized chess microprocessors that accelerated and deepened the search for data available in the system.

The computer searched for solutions using a chess move tree, but it was unable to assess future moves based on a grossmaster game database or predict outcomes beyond the data input.

The next stage of evolution is AI with limited memory, which takes into account already accumulated data — the acquired experience — and enhances the pre-programmed model of the world with it. This type of system adjusts its future behavior by considering experience that was not originally embedded in its programming. A good example of such a system, which still falls under weak AI, is the autonomous vehicle.

Thus, weak AI is capable of analyzing data and choosing the best solution, performing such tasks faster than humans. However, it lacks human-like emotions and consciousness. The current development level of AI systems allows them to take accumulated information into account and adjust their behavior based on the experience gained.

Strong or general artificial intelligence (AGI) — the type of intelligence comparable to human thinking — does not yet exist. Many corporations, governments, developers, and research teams are working toward the creation of such advanced AI. The development of artificial intelligence technologies has been declared one of the top strategic priorities in countries like Russia, China, the United States, the United Kingdom, and the European Union, where building "strong AI" is presented as a major national goal.

Hypothetical examples of such systems are often portrayed in films, where machines with human-like emotions and consciousness interact with people (typically represented by android robots).

Human intelligence allows for abstract thinking, strategic reasoning, and the generation of creative ideas. Understanding and artificially reproducing such complex processes remains a significant challenge and is currently the missing link in creating strong AI.

A truly strong artificial intelligence would possess:

- Consciousness
- The ability to make judgments under uncertainty
- The capability to incorporate learned knowledge into decision-making
- The power to propose innovative ideas

Although artificial intelligence is fundamentally a set of algorithms — or more precisely, a combination of many techniques and algorithms that allow machines to acquire certain skills —

these skills are typically narrow and task-specific, unlike the general abilities of a human. However, algorithms are constantly evolving, becoming more complex and capable of learning. One of the prerequisites for the emergence of machine consciousness in AI systems is the ability to perform multimodal behavior, which means integrating information from various sensory modalities (text, image, video, sound, etc.). This enables the AI to construct a holistic and consistent model of the world, similar to a human's perception of reality, and to use diverse representations of surrounding phenomena.

Results and Discussion

Individual learning paths are study plans and directions formed based on each student's personal needs, characteristics, and learning methods. This is one of the widely used methodologies aimed at providing personalized learning tailored to learners' individualities and capabilities. The following aspects of individual learning paths were examined:

Identifying Personal Learning Directions

The determination of learning paths begins with identifying each student's personal needs and goals. It is important to understand what the student wants to learn, which skills and competencies they aim to acquire, and in which areas they wish to develop. Conducting interviews and surveys with students in educational institutions plays a key role in this process.

Analysis and Independent Learning

Students should be encouraged to explore educational processes that allow them to analyze their learning styles, experience failures, and examine their mistakes. This helps them adapt their learning strategies and improve overall effectiveness. Such an approach enables learners to become more independent and reflective in their educational journey.

Verification and Reinforcement of Inquiries: During the learning process, students must verify and reinforce inquiries that are tailored to their individual needs in order to avoid unnecessary changes in the learning trajectory. This helps learners to reassess their learning goals and determine new, suitable directions for their development.

Personalization and Individualization: The education system should incorporate individualization when designing personal approaches for students. Customized lessons, activities, and assessments must be developed based on each student's learning needs and characteristics.

Personal Expressions and Learning Aids: During the learning process, students can enhance their enjoyment of learning through the use of personalized expressions and learning tools. To gain satisfaction from learning, students should have opportunities to express their thoughts, explain their understanding, and articulate their personal opinions.

Individual learning paths play a crucial role in making learning more personalized and effective for students. Each student, by following a learning path developed according to their personal development, goals, and needs, can shape a learning process that is efficient and goal-oriented.

Conclusion

To date, artificial intelligence (AI) has become one of the most prominent and influential fields. This direction offers numerous advantages—for example, such methods are easy to use and do not require specialized mathematical knowledge. Moreover, the use of neural networks allows for the generalization and identification of hidden dependencies between input and output data. Ultra-deep multimodal neural network models are already referred to as foundational models. Their further development is seen as a direct prospect for transitioning to strong artificial intelligence—by increasing the number of parameters to enhance the system's intellectual capabilities (just as the human brain benefits from the abundance of its neurons). These models also incorporate perceived modalities (including modalities not available to the human body) and are trained on large-scale datasets that are physically unreachable for humans.

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