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	Title of research article  Applications of Artificial Intelligence in Enhancing the Efficiency and Innovation of Scientific Research in Higher Education Institutions
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Abstract The integration of artificial intelligence (AI) into higher education and scientific research represents one of the most transformative developments of the twenty-first century. AI is increasingly recognized as a pivotal instrument in automating cognitive processes, optimizing research methodologies, and fostering innovation across academic disciplines. This study explores the conceptual foundations and functional applications of artificial intelligence within university contexts, focusing particularly on its contributions to the advancement of scientific research. The paper begins by delineating the definition, origin, and typology of AI systems, followed by an analysis of the ways AI technologies are currently employed in academic environments, ranging from administrative digitalization to pedagogical enhancement and research data processing. Special attention is given to models from global universities that have adopted AI-driven tools for managing data analytics, literature mapping, plagiarism detection, and predictive modeling in scientific research. Furthermore, the research discusses major AI-based applications—such as machine learning algorithms, natural language processing tools, automated literature review systems, and intelligent research assistants—that have significantly reshaped the academic landscape. The study also highlights the limitations and ethical dilemmas posed by AI deployment, including issues of data privacy, intellectual property, and research bias. By addressing these multidimensional aspects, the paper aims to contribute to the understanding of how artificial intelligence can serve as a catalyst for enhancing the quality, efficiency, and innovation of scientific research in higher education institutions.	
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1- Introduction

Our current era is witnessing many changes resulting from the development of various areas of life, perhaps technological development is the most attractive element of interest for researchers in various scientific disciplines, especially with the artificial intelligence revolution that has affected the majority of institutions of societies all over the world, it has become a necessity imposed on individuals to be employed and exploited to facilitate livelihoods and to survive.

The university as an educational institution is among those institutions that have employed and exploited artificial intelligence tools and software in order to develop its policy, educational curricula and even strategies to keep pace with this technical revolution, where it invested its advantages in the administrative field to transform the administration from paper to electronic, shortening both time and effort, and also benefited from it in the academic field through the application of a large number of learning-oriented software, and to provide a vast database of information, books and references that are easily accessible and used, it also exploited artificial intelligence to develop the education process from its traditional form based on recitation by the professor and reception by students, to an interactive learning process in which technology plays an important role in creating a vibrant learning environment.

Through this research paper, we try to introduce artificial intelligence and highlight how it is applied at the university, especially in the field of scientific research, we are also trying to answer a central question: How does artificial intelligence help in the development of scientific research?

To answer this question, we followed the following plan:

- ✓ Introduction.
- ✓ The concept of artificial intelligence: definition, origin, types and characteristics.
- ✓ Areas of employing artificial intelligence at the university.
- ✓ Models for some universities in the application of artificial intelligence.
- ✓ Artificial intelligence tools in scientific research.
- ✓ Application of artificial intelligence in scientific research.
- ✓ Challenges facing artificial intelligence in scientific research.
- ✓ Conclusion.
- ✓ References.

2-The concept of artificial intelligence (AI)

2.1- Definition of Artificial Intelligence (AI)

McCarthy (2007) defined AI as: The science and engineering of the intelligent machine industry, especially smart computer programs, and that it specializes in making devices that realize human intelligence and are not bound by methods that can be observed from a biological perspective.

As for Hassan (2020), he defined it as a science that is one of the programs that have a knowledge base that has been prepared in order to carry out many tasks that humans can do, but these programs differ in that they are characterized by speed and accuracy more than humans in cases of reaching the optimal solution to complex problems. (Farah & Belkaram, 2022-2023, p. 8)

Artificial intelligence is defined as the process of simulating human intelligence through computer systems and is done by studying human behavior by conducting experiments on their behavior, placing them in certain situations, and monitoring their reaction, thinking pattern, and dealing with these situations, and then try to simulate the human way of thinking across complex computer systems, for a machine to be AI, it must be able to learn, collect and analyze data, and make decisions based on an analysis process that simulates the way humans think. (Zerrougui & Fatta, p. 04)

It is a branch of computer science by which computer programs can be created and designed that simulate human intelligence, which enables the computer to perform some tasks instead of humans, which require thinking, perception, speaking and movement in a logical and organized manner. (Malik, Tayal, & Vij, 2019, pp. 407-417)

2.2- The emergence of artificial intelligence

The period between 1940-1950 is considered the first steps of artificial intelligence through the work of two neurologists Warden and Walter to a logical calculation of the basic ideas in human neural activity to come up with the first mathematical model of biological nerve and artificial nerve in order to work on the invention of modern computer machines that use in their principle of work neural networks that make them machines capable of perception, understanding, and linguistic communication.

In 1956, the Dartmouth Conference was held, where the term artificial intelligence first appeared by Johan Maccarthy, in the fifties, the first attempt began to develop automatic models capable of issuing simple behavior such as learning, but those models did not succeed in issuing any behavior, whether this behavior was for a human or an animal, these models relied on neural network simulations, and worked by performing a specific response based on the input inputs. That is, the concept of artificial intelligence in that period meant simulating the human mind, by creating a set of programs that simulate the work of neural networks in the brain and link them together, to carry out a specific process, these scientists thought it was the best way to build smart systems, but they couldn't achieve that goal.

In 1965, Herbert Simon predicted that machines would be able to do any work a human could do within the next twenty years, in 1967; Minsky predicted that within a generation artificial intelligence would be used heavily.

In 1974, AI research faced its first problems due to constant pressure from Congress to fund AI research, accordingly, the British and US governments cut funding for all exploratory research directed to artificial intelligence, and this is the first setback in AI research.

In the early eighties, AI research witnessed a new awakening through the commercial success of expert systems; it is an artificial intelligence program that simulates the knowledge and analytical skills of one or more human experts, by 1985, AI profits in the market had reached more than a billion dollars, and governments began funding it again.

In the nineties and early twenty-first century, artificial intelligence achieved great success, which means that artificial intelligence tools and systems have become available on a commercial basis, as an example, robots have emerged as one of the distinguished examples in artificial intelligence tools that are concerned with simulating the motor processes carried out by humans or animals in general. This field aims to carry out repetitive and dangerous operations or operations that humans are unable to perform by simulating human behavior. (Mohammed Al-Naana'a & Nashrwan, 2023, pp. 06-07)

2.3- Types of Artificial Intelligence

Artificial intelligence can be divided according to its capabilities into three main types:

- A. Narrow or weak AI: It is the simplest form of artificial intelligence, programmed to perform certain functions within a specific environment, his behaviour is considered a reaction to a particular situation, and he can only act in the conditions of his own environment, for example: IBM's "Deep Blue robot" that played chess with world champion Garry Kasparov and defeated him.
- B. Strong or general AI: It is characterized by the ability to collect and analyze information, and to accumulate experience from the situations it acquires, which qualifies it to make independent and intelligent decisions such as: Instant chatbots, self-driving cars.
- C. Superintelligence: These types of intelligence are still under experiments and seek to simulate humans, and two basic types can be distinguished: The first tries to understand human thoughts and emotions that affect human behavior, and has a limited ability to interact socially, the second is a model of theory of mind, where these models can express their inner state, predict and react to the emotions and attitudes of others. (Shelley, 2022, pp. 06-07)

2.4- Characteristics of Artificial Intelligence

Artificial intelligence is based on "making intelligent machines that behave like humans", it uses a method similar to the human method in solving problems, and in addition to that, it deals with hypotheses synchronously, accurately and at high speed, Artificial intelligence has many characteristics and advantages, including the ability to:

- ✓ Using intelligence to solve the problems presented in the absence of complete information.
- ✓ Thinking and perception.
- ✓ Knowledge acquisition and application.
- ✓ Learn and understand from past experiences and experiences.
- ✓ Use old experiences and employ them in new situations.
- ✓ Rapid response to new situations and circumstances.
- ✓ Dealing with difficult and complex situations.
- ✓ Dealing with ambiguous situations with the absence of information.
- ✓ Distinguish the relative importance of elements of known cases.
- ✓ Visualization, creativity, understanding and perceiving visual matters.

✓ Provide information for the attribution of decisions.

In addition, artificial intelligence creates a mechanism for solving problems within organizations that rely on objective judgment and accurate assessment of solutions, raising the level of knowledge of the organization by providing solutions to many problems that are difficult to analyze by the human element within a short period, artificial intelligence involves studying the logical thinking processes of the human element in an attempt to implement this through computers, thus, one of the most important features of its relative stability, as it is not exposed to the factors to which the human element is exposed to factors affecting its abilities, such as forgetfulness. (Ahmed Maher & Hijazi, 2023, pp. 60-61)

3- Areas of employing artificial intelligence at the university

The employment of artificial intelligence at the university is divided into two parts: the administrative field and the academic field:

3.1- Administrative Field

University administrations have employed artificial intelligence with the aim of improving educational outcomes through the quality of educational processes, to achieve this goal, there must be a conscious administration capable of increasing interaction between the university and the community through various and renewable programs and activities, it is a management that requires leaders who have the ability to face great changes and challenges and who have the ability and determination to succeed, therefore, the university must train administrators at all levels to be able to absorb artificial intelligence to employ it in their leadership work. In order not to weaken their ability to manage and supervise the work teams within the university, or to lack guidance, supervision and guidance for manpower with different directions and needs. From the above, it is clear that the employment of artificial intelligence by university administrations means converting all administrative processes of a paper nature into operations of an electronic nature using various electronic programs and technologies in the administration, artificial intelligence will change traditional management functions, and lead to the emergence of new functions such as: electronic planning, electronic organization, electronic guidance and electronic control.

3.2- Academic Field

The importance of artificial intelligence in the field of education lies in the provision of a large number of ready-made software directed to self-learning or teacher-assisted learning and based on the transfer of knowledge using the Internet, and on the huge numbers of research, studies and e-books available on the Internet that teachers can benefit from in developing themselves, teaching methods and skills, in addition to the possibility of using artificial intelligence programs to discuss and exchange views between the advertisers themselves, discuss their problems, and see modern educational methods, this is reflected in the development of the educational learning process as a whole, it follows from the above, the increasing interest of educators and those in charge of university education in the current era in modern changes through the employment of artificial intelligence technology in the educational process on the transfer and circulation of knowledge, the effectiveness of this technology has become a certainty that cannot be overlooked, and understanding the modern variables of communication and its technologies helps in providing appropriate environmental conditions for the educational process in which communication technologies are employed in proportion to the environmental conditions surrounding the learner outside the classroom, this increases the ability to raise the rate of achievement away from diction and narration of information, so the student's role turns from a receiver of information to an interactive with the educational environment through technology, taking advantage of its available capabilities. (Shelley, 2022, p. 07)

4- Models for universities in the application of artificial intelligence

4.1- Georgia Tech US University

Master's students in one of the computer disciplines studied a course, in which the problem of responding to the many concerns and inquiries of students (who were large compared to the teaching staff) appeared on the message board, here emerged the need to activate artificial intelligence. Jill Watson was created and given a large number of questions with their answers (i.e. he was trained in the scientific material in which he responds to the questions). In the beginning, this system encountered problems in responding to students' questions, because the artificial intelligence system relies on rule-based information, but with human intervention, a treatment method was found to monitor the answers and activate the delayed response feature before downloading them to students. One of the advantages of this electronic teaching assistant is that it responds to questions at all times (day and night - holiday...) and provides sufficient time for the teacher and his assistants to respond to students' inquiries and

concerns. Using smart software for routine questions saves valuable learning time for teachers burdened with other responsibilities. It gives the teacher time to do the following things: improve the quality of overall education, or engage more students. Thus Jill Watson did the educational process and made it easier by answering questions quickly and providing educational support.

4.2- University of Derby:

Located in the heart of England, it provides high-quality applied education, at all levels, providing its students with excellent teaching and adequate support. Ranked among the top eleven (11) universities in terms of post-graduate teaching according to the 2021 Graduate Experience Survey, it also comes from the top ten (10) universities in terms of international student experience through the Global Benchmark Group, the University of Derby has developed a system that monitors data to predict when students are likely to drop out of school to alert school staff to intervene as soon as possible.

4.3- Mohamed Zayed University of Artificial Intelligence Abu Dhabi

It is a university specializing in AI research, as it aims to unlock the exceptional capabilities of AI and enable students, businesses and governments to benefit from it. We find that this university has the elements of a real university library, as the university library is a source of a wide range of resources and services, and contributes to providing support in education and research. The library is located in a building where there is a space for interaction between faculty members and students, which encourages the development of creative ideas, and the library provides a calm atmosphere conducive to concentration, reading and study, with access to resources outside the library electronically. The advantages that the university provides to graduates are its endeavor to provide the best opportunities for students, through a platform that allows them to communicate with a network of strategic partners in the field of artificial intelligence as well as other sectors related to the field of specialization, allowing them to benefit from the opportunity to gain experience by giving them training opportunities in multiple fields such as healthcare, communications, technology, finance and others, this internship opportunity is a gateway to promising future careers for university students after graduation. (Yopp, 2022, pp. 08-09)

5- Artificial intelligence tools in scientific research

Recently, many artificial intelligence tools have emerged that researchers rely on in the field of their scientific research, and these tools varied as follows:

5.1- Tools for finding and obtaining references:

The multiplicity of these tools on which to collect and obtain references, among these tools most prevalent among researchers is the search engine Google Scholar, this engine searches a group of sites affiliated with scientific centers and provides the best results on research points that have attracted the attention of researchers. It also allows a range of multiple search options. As well as the notification feature that provides additional data on research interests, whether bibliographic data or quotations, and you can also create your library on "Google Scientific". It also provides documentation options according to the famous systems, in this context comes a set of smart engines such as (Elicit Ai Research- Publish or Perish (POP) - Chat GPT) and other artificial intelligence tools that are used to search and obtain references.

5.2- Intrafile and text search tools

There is a set of tools that specialists in libraries and information rely on in the so-called search tools within files and texts and grouping paragraphs according to keywords, the most important of these tools is Data search, a scientific search engine that provides data for groups of research in the form of extracts, reads PDF files from the web or computer, classifies and searches them with words and paragraphs, there is a set of tools that are used in that context, including (Text Generator- Talk To Books) and other tools that are used to search within files and texts.

5.3- Academic writing and paraphrasing tools

Can be relied upon in writing articles and scientific formulations of sentences and texts. These tools allow writing keywords and extract and write multiple articles about these research words and allow the most appropriate researcher. Among these articles, and the most famous of which are specialists in libraries and information (Essay Bot - Katteb - Rytr), these tools support the Arabic language, which facilitates the process of dealing with it, using it and benefiting from it.

5.4- Statistical data analysis tools

There are many artificial intelligence tools that contribute significantly to the statistical analysis of data, which specialists in all scientific disciplines rely on, among the most famous of these tools is Microsoft Excel, which

provides distinguished services in the field of statistical analysis, in addition to a set of distinguished tools in this field such as (IBM SPSS Statistics - SAS) and other tools that work in statistical analysis of data.

5.5-Mind maps, drawings, presentations, and pointers tools

There are many tools used in the field of mind mapping, drawings and presentations, which support the efforts of specialists in this scientific framework, among the most important of these tools are (Mindmaps.com- Context Minds - Microsoft Power Point) and other tools that allow specialists to represent their ideas and research output in the form of shapes and demonstrations that help clarify and represent data in a simplified and understandable manner. There are tools that support the provision of global indicators such as (World Bank Data), where this tool provides a set of general reports in the form of indicators that can be presented in a simplified form for benefit in the fields of scientific research.

5.6- Proofreading and spelling tools

There is a set of tools that have emerged on the digital scene that support linguistic and spelling of texts and words, the most famous of which are (Grammarly - Word- Heming Way editor) and other tools that are used in this context, it provides corrective options for texts and words that are intended to be validated and provides the most appropriate options spelling and grammar, and most of these tools support the Arabic language, which increases the demand of specialists to use and benefit from them.

5.7- Machine translation tools

Different researchers need those tools that contribute to the correct and codified translation of texts and foreign terms, allowing researchers to identify all issues in their fields of research specializations in all different countries and monitor developments in the field worldwide and benefit from this in the advancement of their scientific specializations, these tools include Google Translate, Wordfast, MemoQ, Translator Universal speech, and other tools that support this.

5.8-PDF file merging and formatting tools

One of the most popular tools among library and information specialists (pdfgo.com- smallpdf.com- llove PDF) and other tools through which PDF files can be dealt with from mergers, cutting, marking, signature, converting images to PDF and other services needed by researchers.

5.9-Reference and source management tools

One of the most famous of them is (Mendeley), which is one of the most important auxiliary tools for researchers, and its task is to collect all the research that the researcher wants to return to while writing, arranging and organizing scientific research according to the way he wants, and it is also characterized by arranging research according to the method preferred by the researcher, whether according to the subject of the research or according to the author of the research or according to the publishing authority or according to the year of publication, It also provides the ability to search within the reference and access paragraphs, and there are some other tools that are used in this framework, including (Zetero- End Note).

5.10-Publishing tools and choosing the right journal

In this context, a set of artificial intelligence tools works, including (Journal Finder- The University Arizana@) and these tools are used in the process of examining citation, documentation, proofreading and harmonization to improve the quality of research and these tools support the Arabic language and some institutions provide these services for a fee, another set of tools is also interested in providing assistance in choosing the most appropriate journal for publication according to the scientific field of research and works to provide a set of general statistics about scientific journals that help specialists in choosing the most appropriate journal for scientific publication. (Ahmed Maher & Hijazi, 2023, pp. 61- 64)

6- Application of artificial intelligence to develop scientific research

Higher education is defined as the education that comes at the top of the educational pyramid, as it is the last stage of education that the individual goes through and its finest, which gives him high qualifications and skills that help him later get a job, it also gives it a prestigious social status, which is the education that takes place within colleges or university institutes after obtaining a high school diploma. (Fard & Shatrabash, 2023, p. 233)

As for scientific research, it means collecting facts in various fields in a scientific manner for human knowledge, discovering or verifying new information or relationships, and seeking to benefit from them in the development path and solving societal problems. (Al-Asadi, 2008, p. 09)

There are many roles played by artificial intelligence and contribute to the development of scientific research skills such as:

6.1-Robots used in the educational process

They are an important part of artificial intelligence systems; it is software that simulates the conversational processes of real people, in addition to providing interaction between the learner and the prepared program, using text or voice messages as it is programmed to operate independently without human intervention, the use of this robot is intended to answer questions that may be posed to it, and provide answers in the databases stored in it, and summons them and answers the questions and inquiries of others as a real person.

6.2-Smart Teaching Systems

These systems provide specialized educational lessons for students in various subjects and sciences, where these systems are applied using artificial intelligence to match the teaching process carried out by the teacher in the classroom, in addition to providing classroom and extracurricular activities commensurate with the needs of the learner, this contributes to reducing the teaching burden on the teacher in the classroom.

6.3-Smart Content

It is intended to create digital content by robots with the same skill as humans, AI can help digitize printed textbooks and memoirs or create educational digital platforms for students of all ages and make them available anytime, anywhere, using the internet, this content also varies in the presentation methods of media including video, audio and online educational assistant, and virtual content such as digital lectures and virtual conferences has become a reality that resonated during the Corona crisis.

6.4-Expert Systems

They are specialized programs designed to match human behavior or skills, it tracks the capabilities of expert systems in that they can be used at any time to support, improve and enrich learning processes, it is a type of computer software system that contains many aspects of cognitive learning in a particular science.

6.5-Calendar

It evaluates students with artificial intelligence techniques from several aspects such as homework, language levels; compared to traditional assessment, the advantage of AI is to consider more aspects of learning in assessment processes as well as students' shortcomings. (Al-Sayyad & Al-Sal, 2023, pp. 264-265)

7- Challenges facing artificial intelligence in scientific research

Artificial intelligence in the field of scientific research faces a number of external and internal challenges, the first type can be divided into the challenges of technology and informatics, and the challenges of globalization and democracy, social, demographic, environmental and economic challenges, while internal challenges are represented by new patterns, academic cultural and class pluralism, labor pressures, the dominance of economic values over scientific research and labor market transformations, and the lack of completion of the infrastructure for digital transformation in universities, scientific departments and research centers.

These trends of reason are also a decisive and very necessary factor for the future of scientific research, as global forums emphasize the importance of foreseeing the future, developing future studies, and spreading future culture, and thinking about research institutions to increase interest in them with the technological and digital development shown by artificial intelligence applications to develop future plans, extrapolate priorities, benefit from scientific progress and knowledge accumulation, and draw realistic and ambitious scenarios that are able to interact and deal with the dominance of artificial intelligence.

Despite the importance and usefulness of artificial intelligence in the field of scientific research, it has disadvantages that prevent the optimal use of it in the field of scientific research, which can be referred to in:

- ✓ The high cost involved in using, modernizing and maintaining AI tools.
- ✓ Fear of the behaviors and practices related to human ethics and values that may result from relying on artificial intelligence tools.
- ✓ Losing the ability of artificial intelligence systems and applications to change and develop their work system if they receive the same data every time, which may make them useless at a certain stage.
- ✓ Many human workforce are laid off as a result of relying on artificial intelligence applications instead of humans, causing unemployment to expand as a result of reducing job opportunities.

- ✓ The applications of artificial intelligence in the field of scientific research require a digital infrastructure that is not available in most scientific research institutions, at the city level and its lack in villages. (Ahmed Maher & Hijazi, 2023, p. 66)

8- Conclusion

Artificial intelligence is a quantum leap in the history of technology, which seeks to simulate human intelligence and even compete with and overcome it, despite the positives he has achieved at all levels in various areas of life, however, it includes disadvantages that cannot be overlooked and overlooked, such as the high costs of its use and maintenance, he lacks some human features such as morals, feelings and emotion, and he cannot be creative like them because he works only according to the orders and directives he received.

With regard to scientific research, artificial intelligence does not achieve the necessary accuracy; it displays data without documentation, it also lacks the ability to interpret results, and falls into the error of bias for relying on information that may be culturally biased, in addition to what has been mentioned, artificial intelligence increases the laziness of humans because they are completely dependent on it, and decreases direct communication between them, hence from social interaction, which negatively affects their social relationships.

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