ARTIFICIAL INTELLIGENCE IN BIOLOGICAL SCIENCES: CURRENT APPLICATIONS AND JOB OPPORTUNITIES

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Abstract

Artificial Intelligence (AI) is transforming biology, enabling breakthroughs in research, healthcare, and biotechnology. Artificial intelligence is defined as the intelligence exhibited by artificially created systems. The application of artificial intelligence is quite extensive and can replace humans in various aspects of work, significantly enhancing efficiency in daily life and work. Artificial intelligence has a dual nature, as it could provide convenience to human society but could also bring about various adverse effects. This article aims to demonstrate the current application of AI in biological Science drug discovery, personalized medicine, genomics, and bioengineering. We also explore emerging job opportunities in this field, such as bioinformatics scientist, computational biologist, and data scientist in bioinformatics and job opportunities.

Keywords: *Artificial Intelligence, Biological Science, job opportunities, applications.*

1 Introduction:

Artificial intelligence is the capacity for thought, learning, and response in any machine or computer program. It belongs to the computer science subfield. Artificial intelligence holds significant importance and popularity not only in the computer science and information technology departments, but also in many other sectors. Applications of artificial intelligence have improved people's lives in several ways. Artificial Intelligence gives employment in the fields of machine learning and technology has increased significantly, as has the effectiveness and caliber of work. The use of artificial intelligence in books, both academic and non-academic, has a significant influence on many facets of life. With the advancement of technology, human understanding of life continues to deepen, and the field of life sciences has achieved a series of significant breakthroughs. As an emerging technology, artificial intelligence has provided robust support in the biological sciences [1][2].

2 Application of artificial intelligence in biological sciences

2.1. Gene Editing:

Gene editing technology refers to the artificial alteration of a specific gene in an organism to control its gene expression or function [3-4]. The implementation of modern artificial gene editing technology is based on the principle of DNA mutation. DNA, found in the chromosomes of an organism's cells, carries relevant proteins that control life processes. Currently, artificial gene editing technology primarily comprises three methods: gene knockout technology, gene activation technology, and gene modification technology.

Artificial intelligence technology has brought about a revolutionary impact on various industries, and gene editing technology is no exception [5-6]. The combination of gene editing technology with the powerful capabilities of artificial intelligence has opened up new possibilities and accelerated research advancements in gene editing. For gene editing technology, the application of artificial intelligence presents an exciting prospect [7]. Scientists can leverage the advantages of artificial intelligence to provide more theoretical support and design services for gene editing. Simultaneously, the application of artificial intelligence will minimize human-induced factors that affect experimental results, thereby enhancing the efficiency of gene editing.

2.2. Bioinformatics:

Bioinformatics is an essential subfield within the life sciences, involving extensive data analysis and model construction. The application of artificial intelligence technology in bioinformatics contributes to enhance the accuracy and efficiency of data analysis [10]. Bioinformatics can be broadly understood as the organic integration of computer science and biology, constituting an interdisciplinary field that encompasses research in molecular biology, genetics, mathematics, computer science, and statistics [9]. It facilitates addressing largescale and data-intensive biological problems from a computational perspective. It integrates technologies for collecting, storing, distributing, and analyzing biological information to support scientific research across various domains of biology. Through extensive data processing and analysis, as well as the construction and prediction of models, it addresses a range of issues in the biological sciences. The application of artificial intelligence technology injects new vitality and possibilities into this field.

2.3. Drug Development:
The application of artificial intelligence technology in the field of drug development can improve the efficiency of drug research. Drug design involves the integration of multiple disciplines, such as chemistry and biology, to develop new drugs that can effectively act on the human body. Traditional drug design methods are labor and resource-intensive, and their efficiency is limited [8]. By analyzing known drugs and compounds, as well as modeling and predicting drug effects, artificial intelligence technology can assist researchers in identifying new drug targets and candidate drugs.

2.4 DNA sequencing:
DNA sequencing, also known as genomic sequencing, is an experimental method scientists use to ascertain the precise nucleotide sequence of a DNA molecule. The machine methods for sequencing DNA have certain limitations and require much time. On the other hand, application AI can aid in data integration, sequencing variation, and the reduction of errors during the DNA sequencing process. This data variation aids in the discovery of customized medication to treat genetic illness (Chen et al., 2018; Qureshi et al., 2023; Vilhekar and Rawekar, 2024; Heather et al., 2016; Xu et al., 2019; Racovita and Jaramillo, 2020).

2.5 prediction of protein structure:
Different software tools were developed to analyze the protein structure. One of the most revolutionary protein structure detection software as a consequence of amino acid sequencing is AlphaFold. This is the leading software used for the first time to predict near-native protein folds from their genetic sequence. With the succession of AlphaFold software a few months later, the analog RoseTTAFold along with AlphaFold has contributed to their success in that anyone interested in experimenting with these programs can download them for free due to their open-source nature (Gomes et al., 2022; Jumper et al., 2021; Baek et al., 2021).

2.6 Drug target identification: AI may be used to find possible therapeutic targets for the treatment of illnesses by analyzing data from a variety of sources, including genomic and protein-protein interaction data. This may entail utilizing machine learning algorithms to find correlations and patterns that people might miss.

2.7 Image screening: AI may be used to diagnose illnesses and find anomalies in medical imaging, including MRI and CT scans. This may entail automatically segmenting and classifying structures in medical photos using DL algorithms (Janisch and Adelsmayr.,2022).

2.8 Genomic Medicine and Precision Healthcare: AI can assist in personalised medicine by leveraging DNA sequencing data. By integrating genomic data with patient health records, AI algorithms can identify genetic predispositions to diseases, predict treatment responses, and provide tailored healthcare recommendations.

2.9 Clinical Diagnostics: AI algorithms can be trained on large genomic datasets to assist in diagnosing genetic diseases. By comparing an individual's DNA sequence to reference genomes, AI systems can identify disease-causing mutations or genetic variations that contribute to specific conditions.

3 Job Opportunities:
AI (Artificial Intelligence) and computer science are related fields but have distinct differences. The primary objective of AI is to develop intelligent systems that can perform tasks traditionally requiring human intelligence, such as natural language processing, computer vision, problem-solving, decision-making, and pattern recognition. Bridging biology and computer science involves the integration of principles, techniques and tools from both fields to address complex biological problems and develop innovative solutions. This interdisciplinary approach, often referred to as computational biology or bioinformatics, has become increasingly important as biological data has exploded in volume and complexity.

3.1 Genomics Analyst: Genomic analysts specialise in analysing genomic data, such as DNA sequencing and microarray data. They use various bioinformatics tools and statistical methods to identify variations, study gene expression patterns and investigate the relationship between genotype and phenotype.

3.2 Bioinformatics Scientist: As a bioinformatics scientist, designing and implementing computational algorithms and tools to analyse biological data.

3.3 Computational Biologist: Computational biologists focus on applying computational techniques to solve biological problems. They develop and use algorithms and software to analyse and interpret biological data, such as DNA and protein sequences, gene expression data and protein structures.

3.4 Clinical Bioinformatics Specialist: Clinical bioinformatics specialists work at the intersection of bioinformatics and clinical research. They analyse genomic and clinical data to identify genetic markers associated with diseases, predict treatment responses and assist in personalised medicine initiatives

3.5 Data Scientists in Bioinformatics: Data Scientists in bioinformatics apply machine learning and data mining techniques to analyse large scale biological databases.

3.6 Research Scientist in Computational Biology: They focus on developing novel computational approaches to answer biological questions. They design experiments, analyse data and collaborate with experimental biologists to gain insights into biological systems.

3.7 Biomedical Image Analyst: Builds AI models to detect diseases early, classify cells, and track outcomes

3.8 AI Research Scientist: Develops novel AI approaches to answer biological questions.

3.9 Synthetic Biology and AI Engineer: Uses AI to design organisms for fuels, medicines, and sustainable products.

Conclusion:

Today, the term artificial intelligence (AI) is used extremely broadly to refer to almost anything where a digital information processing system analyses data. So, the foundation of any AI application is digitization and digital transformation. The applic ation of Artificial Intelligence (AI) in biological sciences has revolutionized the field, enabling breakthroughs in drug discovery, personalized medicine, genomics, and bioengineering. The integration of AI has not only enhanced research capabilities but also opened up new avenues for interdisciplinary collaboration and innovation. As AI continues to evolve, it is expected to play an increasingly important role in shaping the future of biological sciences. This review highlights the current state of AI applications in biological sciences and identifies emerging job opportunities that require a unique blend of biological knowledge, computational skills, and data analysis expertise. As the field continues to grow, it is essential to develop and nurture talent that can effectively leverage AI to drive innovation and discovery in biological sciences.

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