ROLE OF ARTIFICIAL INTELLIGENCE IN BIOTECHNOLOGY

Abstract

Despite its futuristic sound, artificial intelligence (AI) is already present in many modern devices. For instance, it enables voice and facial recognition on our mobile devices. In biotechnology, where it has proven crucial to many facets of drug discovery and development, AI is also starting to become more noticeable. Drug target identification, drug screening, image screening, and predictive modeling are all examples of AI uses in the biotech industry. Additionally, clinical trial data is managed and the scientific literature is searched using AI.It's possible that artificial intelligence will change biotechnology. Biotech companies may utilize AI in a variety of ways to enhance their operations, spur innovation, and explore new business models.

Keywords: Artificial Intelligence, Biotechnology, Machine Learning, In Vitro Diagnostics, Electronic Health Records.

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I. INTRODUCTION

Artificial Intelligence (AI) is a sound advanced approach that has recently appeared in many everyday advancements. In synthetic biology, automation's artificial intelligence is becoming more and more important. AI is also starting to show its value in the field of biotechnology. Search engines frequently employ AI to develop their ranking algorithms. This affects both the order in which the results display on the first page of an internet search. Even while developing and modifying algorithms still takes a lot of human effort, many search engines use AI to improve them. The creation of "intelligent" machines has a long history in computer science, yet the term "intelligence" lacks a clear definition, and measuring it is also quite challenging. Biotechnology is employed in a wide range of fields.

The area of biotechnology has advanced significantly in recent years, primarily due to breakthroughs in biology but most significantly due to developments in how artificial intelligence can support scientists. Biotechnology can be broken down into numerous categories, such as Agriculture Biotechnology, Medical Biotechnology, Animal Biotechnology, Industrial Biotechnology, and Bio Informatics. AI can sometimes seem like a magical answer to some of the world's hardest issues. The importance of exploring the use of AI in biotechnology is increasing [1–5]. Although artificial intelligence (AI) has an infamous image as something we should fear, it has also been identified as the key to unlocking a new class of therapies in fields like precision medicine and orphan diseases. Many businesses are developing AI technology to benefit the biotech sector. As outdated techniques like manual picture scanning and classical statistical analysis reach their practical limits, their services are quickly becoming indispensable [6].

Intense amounts of information, advanced genome editing methods, multi-part gene and genome assembly, genome scale metabolism, and high throughput phenotype analysis can all be overcome by AI. It can also empower virtual screening, break down enormous amounts of information, and take over unique clinical preliminary datasets. Other than this, computer aided design and analysis is always used as a design automation in the broad engineering sector. AI can speed up the process of improving medications [7–11].

II. ROLE OF ARTIFICIAL INTELLIGENCE IN BIOTECHNOLOGY

During a workshop at Dartmouth College in 1956, a group of computer scientists founded the area of artificial intelligence. The objectives were rather lofty. The research will proceed under the supposition that any aspect of learning or any other characteristic of intelligence can, in theory, be so precisely characterized that it can be stimulated by a machine. It will be tried to figure out how to make machines employ abstraction and notions from language to solve problems currently left to humans and advance humankind. Since its inception, AI has covered a huge range of topics, from philosophical questions to specific real-world applications. Since its official inception as an academic topic six decades ago, AI has gone through more ups and downs than any other subject. The first excitement surrounding artificial intelligence in the 1980s came to an end because there were far too high expectations that within 10 years, anything humans can accomplish, a computer will be able to achieve [12].

A few companies are developing artificial intelligence technologies for the biotech industry, and their services are soon becoming as important as more established methods like traditional measurable tests. Direct homogeneous information is increasingly being investigated using standard methodologies. It is not feasible to continue using the traditional methodology of drug discovery, which costs billions of dollars while still producing significant failure rates. A significant portion of the data will be provided by virtual preliminary work done by human preliminary by empowered AI [13].

III. THE GRAND GOAL OF ARTIFICIAL INTELLIGENCE

The main objective of AI is to give Machine Learning (ML) the theoretical foundations necessary to create software that can autonomously learn from the past without a human being in the loop. In order to construct and create algorithms that can learn from data in order to gather experience-based knowledge and gradually enhance their learning behavior, it is necessary to comprehend intelligence. Whether the rapid development and spread of AI is a desirable thing or not, it is a truth that AI will eventually pervade, impact, and alter almost every aspect of biotechnology. Biotechnology companies are now using AI and ML to create autonomous robots that can complete crucial agricultural jobs more quickly than people, like harvesting crops. Algorithms for computer vision and machine learning are used to process and examine the data that drones have collected. Finding the appropriate compounds, assisting with their synthesis in the lab, data analysis for effectiveness, and supply to the market. The application of artificial intelligence in biotechnology has allowed for the reduction of procedures that would typically take 5–10 years to just 2–3 years [14].

IV. ARTIFICIAL INTELLIGENCE IN AGRICULTURAL BIOTECHNOLOGY

Genetically modified plants are created using agricultural biotechnology to boost crop yields or add new traits to existing plants. Using this method, soil and plant health will be monitored. Various environmental changes, such as how climate change affects crop production, can be tracked and predicted with the aid of machine learning algorithms. Businesses in the biotechnology industry are now adopting AI-Ml solutions to build autonomous robots that can carry out important agricultural tasks more rapidly and assist humans with tasks like crop harvesting. This helps determine how well the soil and crops are doing. A range of environmental variables, such as weather variations that affect agricultural productivity, can be tracked and predicted with the help of ML algorithms [15].

Digital change is also having a significant impact on smart agriculture. This is where a "Agriculture Data Space" like the one used in the franchisers' well-known project "cognitive agriculture" may considerably improve the issue. Despite the fact that machine learning already incorporates multiomic approaches for system biology, there are still problems in environmental science. As conventional databases get bigger, things like using soil metaproteomics and connecting to other omic dataor simply the lack of itrequire greater processing time and resources. The coupling of omics data with bioinformatics and machine learning will enable moving from data of an explanation character to applications in areas like medicine, as machine learning is particularly useful for the prediction of huge datasets and human-in-the-loop can boost explanatory power by rejecting hits that are unlikely to occur in the ecosystem under study [16–19].

Agriculture biotechnology develops using artificial intelligence (AI) techniques, changing crop yields of plants genetically or giving existing plants new traits. The process includes conventional plant raising, tissue culture, micropropagation, sub-atomic reproduction, and plant genetic engineering. In the AI and ML techniques, robots that handle agrarian tasks including crop collection, harvesting, flowering, and planting are created and programmed. The information gathered by the robots using their eyesight is processed and examined using deep learning calculations. These robots are beneficial for inspecting the soil and harvest. AI calculations support economic development and ecological changes like a shifting climate and crop productivity. In the future, agriculture universities will utilize AI calculations extensively [20].

V. ARTIFICIAL INTELLIGENCE IN MEDICAL BIOTECHNOLOGY

AI consciousness and machine learning are frequently used in sedate revelation in the field of medical biotechnology. Because it uses living cells and also incorporates research into how DNA governs cells in a hereditary manner to create significant and beneficial features, medical biotechnology advances human health by delivering drugs and antitoxins. Finding tiny components that could provide therapeutic benefits for subjects of realized objective structure is made possible by AI technology. It typically makes use of the real data to enhance analytical procedures, reduce the need for radiation therapy, and enhance the EHR (Electronic Health Record) with clinically appropriate emotionally supportive networks and proof medications. These developments are widely used in imaging, personalized pharmaceuticals, and medicine for executives [21].

Drugs and antibiotics are created using living cells in medical biotechnology to enhance human health. Mechanical learning aids in the identification of tiny compounds that can offer therapeutic effects based on known target structures. AI and ML are commonly utilized in drug discovery. This technique is frequently employed in areas such as pharmaceutical management, radiography, genetic engineering, and personal medicine. The European In vitro Diagnostics regulation criteria specifically reference therapeutic biotechnology software and, by extension, AI algorithms. In vitro diagnostics (IVD) are tests carried out on specimens collected from the human body, such as blood or tissue. With the use of in vitro diagnostics, illnesses and other disorders can be found and treated or prevented. They can also be used to monitor a person's general health. Precision medicine may also make use of in vitro diagnostics to pinpoint patients who will likely benefit from particular medications or treatments. Next-generation sequencing tests, which scan a person's DNA to find genetic changes, can be a part of these *in vitro*diagnostics [22].

VI. USES OF ARTIFICIAL INTELLIGENCE IN MEDICAL BIOTECHNOLOGY

1. **Medication Discovery and Clinical Trials**: The most inspiring use of medicine discovery has been through artificial intelligence and machine learning. Finding small particles with potential for premedical benefits via machine learning is possible [23].

2. **Diagnostics:** Malignant growths are being identified using artificial intelligence. The pathophysiology is considered by machine learning applications for diagnosing rare diseases. ML is more accurate than cardiologists for identifying heart disease. Pharmaceutical research is substantially invested in the search for early indicators of

mental health conditions like depression and addictive behaviors. Because it can be challenging to decide which form of personalized medicine is ideal for a patient and because each person may require a different course of treatment [24].

3. **Radiotherapy and Radiology:** AI has contributed to the goal of reducing the scheduling of radiation treatments to only a few minutes, freeing up radiologists' time to focus on enhancing patient care. By separating healthy tissues from potentially dangerous ones, University College London Hospital and Deep Mind Health are working to improve the accuracy of radiotherapy planning. During cancer treatment, radiation therapy may be utilized at various times or for various purposes. This is referred to as the primary treatment because it is the only option for cancer. Ne oadjuvant therapy refers to the treatment given before to surgery to reduce a malignancy. Adjuvant therapy is used after surgery to halt the growth of any cancer cells that may remain. with additional therapies, such chemotherapy, to eliminate cancer cells. may alleviate the signs and symptoms of advanced cancer [25].

4. **Wearable Technology:** The term "wearable" refers to a class of "electronic devices" that can be implanted in the body, worn as accessories, or even tattooed on the skin. When it comes to wearable technology nowadays, a microprocessor and an internet connection are required. Wearable AI can track a user's heartbeat, evaluate their speech patterns, gauge their mood, and alert them to danger signs.

5. **Customized Medicine:** There is a lot of research being done in artificial intelligence technologies as well as sophisticated analysis of retrying treatments for people with outstanding success histories. A patient's risk is estimated using methods other than AI.

6. **Quality Control and EHR-Electronic Health Record:** The AI software considers quality control that manages the perplexed undertakings and preparing for quality alteration. Advanced computerization and artificial intelligence may also be practical for gaining an overview of the clinical records. The clinical histories of the patients will assist professionals make informed clinical decisions and will enhance the EHR framework [26].

7. **Medication Management:** Artificial Intelligence that has been configured to work with a mobile phone webcam and AI to oversee can be helpful for patients with chronic illnesses and clinical trial participants. Then, several applications are being developed to check patients' medical programs.

8. **Artificial Intelligence in Pharma and Biotech**: The pharmaceutical and biotech industries are currently experiencing disruption. The latest applications of AI and ML range from molecular design to models that anticipate patient reactions. in biotech and pharmaceutical AI.In order to stay ahead of the curve as innovation reshapes the industry, AI can be used in biological and generational modeling, as well as to study the influence of ML on the design and management of clinical trials [27].

9. **Artificial Intelligence in the Bioinformatics**: With the aid of numbers, bioinformatics facilitates the acquisition, storage, handling, dissemination, examination, and translation of biological and organic data. The inherent note-worthiness of a variety of data to

understand software engineering and scientific apparatus. The information will increase the vast amounts of knowledge. The brainpower of AI uses ML to sequence DNA from the vast amount of data. AI and machine learning have the potential to advance the biotech industry over the course of several years. because the shift in the data closely resembles that of biotechnology. 44% of the participants in the AI and their recharges department exercise showed a review of pharmacists and life sciences experts.

To distinguish the areas of attributes, a certain level of mechanization is necessary. AI substantially identifies applications throughout the preclinical stages of the development of pharmaceuticals [28–30]. Utilizing mathematical techniques, computer science, and the biological relevance of various data, bioinformatics makes it easier to collect, store, process, distribute, analyze, and understand biological and biological information. The data must be utilized to create an incredible understanding. Due to the extensive data gathering required for protein categorization and the promising relationship between proteins and biological activity, AI and machine learning are applied in DNA sequencing. Genetic analysis, genetic annotation, computer-assisted medication development, etc. [31]. A specific amount of mutation is required to identify a genomic location.

VII. ARTIFICIAL INTELLIGENCE IN ANIMAL BIOTECHNOLOGY

When genetic traits are selected between animals and such animals are bred, the branch uses cellular biological techniques to create genes or mutations for animals to improve their sustainability for medical, industrial, or agricultural purposes. ML is used to interpret large datasets of genomic data and to interpret a wide variety of genomic sequence [32]. Animal biotechnology is employed in a variety of fields, including medicine and research. The art and technology of creating genetically modified livestock consumes the most land worldwide, with roughly 80% of the area used for feed production.In animal biotechnology, mice, rats, pigs, sheep, and cows are studied using the animals. Animals supply a variety of products in daily life, including milk, leather, wool, eggs, meats, etc. In recent years, the productivity of the livestock production system has increased because to advances in animal biotechnology and artificial intelligence (AI). Along with affecting customer acceptance, the intensification of various animals raises concerns about the safety of food and nutrition, as well as other societal issues [33–38].

VIII. ARTIFICIAL INTELLIGENCE IN FOREST BIOTECHNOLOGY

Natural forests are of great ecological importance, and wood is a resource on which society is increasingly dependent. However, even slowly growing forests are unable to meet current demand, which results in the depletion and degradation of forest resources. At this stage, forest biotechnology, especially genetic engineering, can be helpful. This is important since, for example, growing forests is very necessary to sustainably meet the world's demand for wood [39]. There are numerous applications for AI, including: AI can evaluate data from satellite photos, drone imagery, and other sources for predictive modeling. Using these data sources, one may predict the development and productivity of different tree species in different regions. This may make it easier to plant and maintain forests to their full potential [40].

IX. ARTIFICIAL INTELLIGENCE IN INDUSTRIAL BIOTECHNOLOGY

Nowadays, there is a growing understanding of the factors that affect human health, and the idea of one health holds that healthy communities depend on everyone's environment and the functioning of the ecosystems around them. Industrial biotechnology aims to replace biopolymers currently used in a variety of fields, such as automotive parts, fuel, fibers, new chemicals, and the manufacturing process [41].Since soils are a possible source of new antibiotics for use in human therapeutic applications, these ecosystem functions also include the provision of clean water, fresh air, dependable access to food, and medicine. 60 percent of the world's population heavily relies on traditional medicine, which is made from plants and used to treat illnesses, and the 30th wild and domesticated population ecology is utilized for both cultural and medical purposes.

X. CONCLUSION

The term "artificial intelligence" is used today in a very broad sense to refer to any situation in which any digital information processing system processes any data. Any use of AI must start with digitization and digital transformation. AI ecosystems are the way of the future, and they will benefit everyone on the planet. Through the use of cloud computing, AI may help manage the proper distribution of the essentials required by the biotechnology industry. In the future, all biotechnology research will be dependent on the prospects and applications of the AI area. Many doctors have used AI in microbiology for illness diagnosis, functional genomics medication research and development, biomarker recognition, and medical imaging diagnostics. The development of biotechnology and our usage of AI as a potential source are already commonplace in the field of life science.

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