TITLE

Artificial Intelligence in Drug Discovery and Repurposing: A Revolution in Modern Biotechnology

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To

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Abstract

The application of Artificial Intelligence to drug discovery and repurposing is revolutionizing in modern biotechnology by increasing the efficacy and precision, Traditional drug development is limited by high cost and long-time scale but AI driven approaches utilizes more extensive biological, chemical and clinical databases to speed up target selection, optimization and toxicity. AI driven technologies will improve identification of new target interaction and enable the repurposing of existing drug for alternative therapeutic use. This study will carefully analyze recent studies with AI applications in drug discovery pipeline, methodological frameworks and translational prospects. Results highlight AI ability to revolutionize pharmaceutical sector promoting coast effective and precision-oriented approaches to therapeutic innovation.

Key Words: Artificial Intelligence, Drug Discovery, Drug Repurposing, Modern Biotechnology and computational drug Design.

Introduction

The process of drug discovery and development has major role in modern pharmaceutical science, yet it remains one of the most complex, costly, and time-consuming trials in biotechnology. This advances through a linear sequence include target selection, preclinical testing, clinical trials (Phases I–III), regulatory approval, and post-marketing surveillance. This often requires 10 to 15 years and along with investments ranging from hundreds of millions to over a billion dollars for a single successful therapy. Preclinical and clinical stages, along regulatory demands, increases the burden of time and expense. These ongoing issues have prompted the implementation of Artificial Intelligence (AI) to optimize discovery, improve predictive precision, and development schedules (Food and Drug Administration: drug development process).

Artificial Intelligence (AI) in biomedicine involves computational models that use extensive biological and chemical data to replicate elements of human reasoning and decision-making.
In the context of drug development, AI systems including machine learning and deep learning algorithms are helping in finding best drug target interactions, improve lead compounds, and speed screening workflows by discovering candidates with attractive pharmacologic and toxicologic profiles. Change from empirical, trial-and-error techniques toward data-driven discovery marks a major step in biotechnology that allowing more efficient and predictive medicinal development (Reboredo *et al.*,2021) that will help to reduce the chances of drug fail before actually manufactured to reserve sources.

AI has emerged as a game changer in drug development which allows for the study of biological and chemical datasets to reveal complicated and non-linear correlations. Machine learning and deep learning models of AI can predict pharmacological qualities, optimize molecular structures, and predict unfavorable effects with more accuracy unlike traditional trial-and-error procedures. By combining of AI and big data the time and cost of finding most fit medication candidates have greatly decreased. Furthermore, by merging other data like omics data, cheminformatics, and computational modeling, AI facilitates data-driven precision medicine and speeds up rational drug design (Tripathi *et al.,* 2021).

In this study the revolutionary impact of artificial intelligence (AI) in changing medication discovery and repurposing in the biotechnology industry will be investigated. The major goal is to better understand how AI-powered machine learning and deep learning, improve the efficiency, speed, and accuracy of selecting treatment possibilities that allows for predicting modeling of drug-target interactions, toxicity, and effectiveness by evaluating biological, chemical, and clinical variables. This will help to understand how AI helps with medication repurposing by identifying new therapeutic uses for existing molecules and helps in lowering their development costs. This research seeks to show how the incorporation of AI into current biotechnology can alter pharmaceutical innovation environment toward a more data-driven and result-oriented future.

Methodology

Research Design

This project follows a qualitative and descriptive research design, aiming to synthesize correct evidence on the integration of AI in drug discovery and repurposing.

Data Collection

Data will be collected from authentic databases, including PubMed, Scopus, Google Scholar, and Science Direct, from the most recent studies. Only peer-reviewed original research articles, reviews, and authoritative reports.

Data Analysis and Synthesis

The selected studies will be critically analyzed to identify major findings, including AI methodologies, applications, and major outcomes.

Ethical Considerations

As this study is based on secondary data, no human or animal testing is involved, so no ethical approval is required. All sources of data will be cited correctly.

Conclusion

Today new technology is using in every aspect and made for specifically humans to reduce their work load and help them to spend time on important tasks. AI on daily basis using in almost every task when this comes to healthcare it needs to be used responsibly and ethically so no misinformation can lead to disaster, AI in drug designing and repurposing is very important in biotechnology and this is modern approach for saving expensive resources and time before starting designing the new drug in lab. This study will focus on more recent studies on role and implementation of AI in biotechnology for drug development and repurposing and list all AI methods used recently for drug development or repurposing. And will show possible shortcomings that happened during process.

Continued multidisciplinary collaboration and ethical monitoring will be required to fully achieve promised results in reshaping global healthcare settings by using AI.

References

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