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Mini Review

# Integration of Artificial Intelligence in Pharmacological Research with Deep and Machine Learning Process

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## Abstract

Artificial intelligence (AI) is a science of machine capability to mimics human behavior with intelligent analysis of data. It covers two major groups i.e., applied and general. In addition, it has integrated subset functions like deep and machine learning process. This is completely functioning with specialized algorithm. Last few decades; deep learning has been reached tremendous success in the development of AI with machine learning process. It is evolved with multiple artificial neural networks and shown superior application in pharmaceutical sciences including pharmacological research. In pharmacological research deal with preclinical (laboratory animals) and clinical (in human). AI has wide variety of application like drug discovery/manufacturing process (prediction of lead compound with analysis of ligand-protein interactions), diagnosis of big data for disease identification/diagnosis, personalized treatment/behavioral modification, clinical trial research, radiotherapy, surgical robotics, smart electronic health records, and epidemic outbreak prediction. Moreover, AI also has specialized role in the pharmacological research. The current challenges of AI with machine learnings are recognized of the correct algorithms for the analysis/interpretation of image, voice, and natural language data. Recently, the AI application of wave in deep learning process of machine learning is employed in pharmaceutical research and it has ample scope of application in pharmaceutical sciences beyond bioactivity of lead molecules. Furthermore, AI plays a vital role in diagnosis of biomarkers and disease. Hence the integrated function of AI with deep and machine learning process can be a future tool for the better enhancement of pharmacological research.

***Keywords:*** *Big Data; Clinical Research; Laboratory Animals; Image Analysis; Surgical Robot*

## Introduction

The integrated function of AI is a multi-disciplinary approach and it has higher rate of success and serves mankind [1]. The implication of machine learnings is contributed to various sciences including drug discovery science and bioactivities of lead compounds (deals with pharmacological research) [2]. Now a day's machines are readily learning human behavior with suitable integrated algorithms and it is known as artificial intelligence [3]. This mini-review covers the details about integrated function artificial intelligence in pharmacological research. The primary aim of the AI implementation in pharmacological research is to support the lead molecules identification, supports

the précised analysis of disease, diagnosis of biomarkers, identify the personalized medicines, robotics surgery, neurobehavioral modification, channelize the electronic health records and prediction of epidemic outbreak [4].

The major core parts of AI function are based on the feeding, receiving and analyzing of big data. AI deals the input big data, maybe image, data, sound, language and video [5]. The high-performance computing system does the data science analysis of input big data. Hence, big data science is considered as part of machine learning (ML) [6]. ML process are performs based on big data without involvement of human interaction pattern. The ML is subset part of the AI. ML means the ability of auto-learning and improvements from past experience without the support of machine programming [7]. The primary goal of ML is development of computer programs to access the data and utilize themselves. Here, the primary feed of (Hadoop) i.e. data storage and processing technology are plays a key role in the function of ML-like two sides of a coin. Hadoop is open source technology and it arranges as distributed manner instead of centralized database [8]. The performance of smart function of AI is built with big-data and it provides the needed data for the creation and training of learning algorithms [4,9].

Generally, ML are hard to learn because ML data process is dealing with receiving, retrieving and integrating the big data, further makes the creativity based on experimentation and tenacity. Thereafter, the implementation i.e. existing and newer creative algorithms for the development of new applications is needed [10]. The best programming languages for AI are Python, R language (analyzing and manipulating the data for statistical purposes), Lisp., Prolog., and Java [11,12]. This multiple language scheme are using by various companies like a) Yelp - Image Curation at Scale, b) Pinterest - Improved Content Discovery, c) Facebook - Chatbot Army, d) Twitter - Curated Timelines, and e) Google - Neural Networks [13-14]. Hence the function of ML provides the better application of AI for mankind.

## Applications of ML and AI in pharmaceutical sciences

Pharmacological research is a part of the pharmaceutical sciences. There are multiple updates and advancement is still required to better health care service with medicine [15]. AI application is one of the best approaches for the health care system. When we think about ML and AI, we need more data to get better yields of results. In pharmaceutical and healthcare sectors have abundant data like data-mine [16,17]. The McKinsey Global Institute (MGI) made big-data revolution in health care system and annually, it generates up to $100 billion value in US health-care system via better decision-making process, optimizing of health care innovation, enhance the betterment of efficiency and potency of drug research & testing in clinical trials, creation of newer diagnostic tools [18-20]. Furthermore, AI and ML are providing the optimized decision about best health care options for physicians, consumers, insurers, and regulators. Crucially, the source of data generates from pharmaceutical research setup like academic research, research and development organization, industrial research units, clinical pharmacy, community pharmacy and so on [21]. The greater challenges are starts from synchronizing of healthcare information. The intersectional function of ML, AI and deep leaning of healthcare data can be a better way to improve the healthcare infrastructure and treatments [22]. The usage of ML process is already initiated in various pharmaceutical and medical data analysis like drug discovery/manufacturing process for prediction of best bioactive compound with analysis of ligand-protein interactions [15], disease identification/diagnosis [23], personalized treatment [24], clinical trial research [25], radiotherapy [26], surgical robotics [27], smart electronic health records [28], and epidemic outbreak prediction [29,30].

## Applications of ML and AI in pharmacological sciences

In the pharmacological research sciences field, it is also used for the analysis of MRI, X-ray and histopathological imaging [31,32]. Analysis of real-time electrophysiological and hemodynamic data like ECG, blood pressure and EEG are providing the better results time to time and stored the 24 hour/7 day changes with the help of variable sensor and data acquisition system [33,34]. In addition, the improved ML and AI technology also revealed the all health care data via detecting the retina (eye screen) and dermal (skin) response with analyzing of input and stored data [35,36]. Further, in sports associated health care, animal research-related assessment animal behaviors, movement, physiological and pathological changes and selection of suitable medicines in personalized conditions are able to predict

with real-time monitoring with AI and ML process to improve the health care service [37,39]. The big data analysis not only functions based on data input like statistical analysis, it also generates the best algorithms and best innovative decisions with the function of deep ML and AI process [40]. The integration of AI in pharmacological research with deep and ML process has been summarized in figure 1.

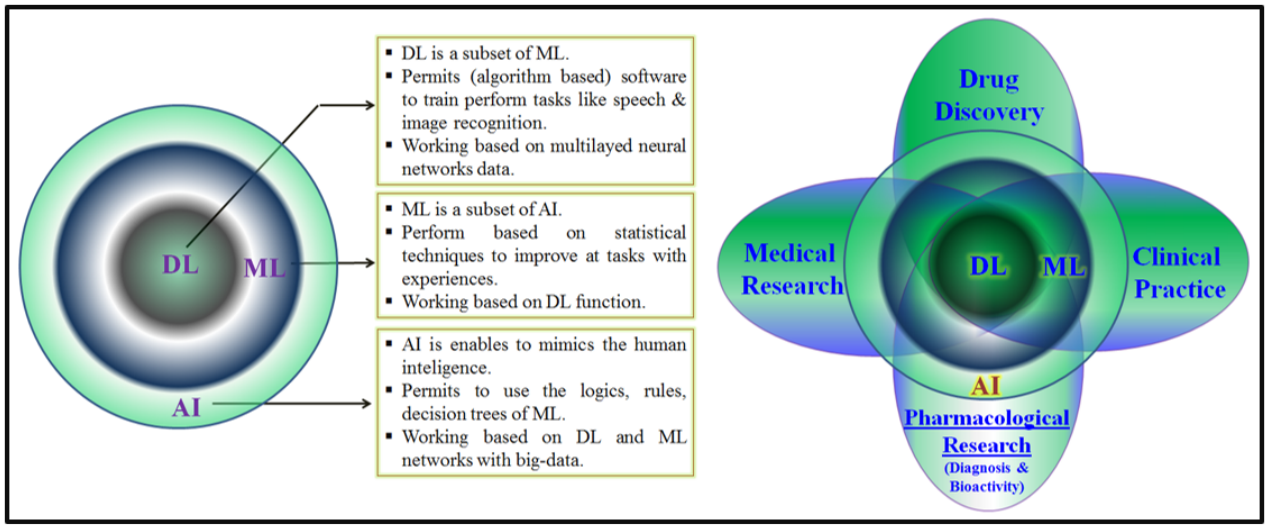


***Figure 1:*** *Summary of AI integration and application in medicine and pharmacological research. Abbreviation: DL: Deep Learning; ML: Machine Learning and AI: Artificial Learning.*

## Conclusion

This mini-review is revealed the key role of AI in pharmacological research and their functions. It will lead the pharmacological researchers to develop newer innovative products for the betterment of health care service.

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## Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

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