A Review on – Artificial Intelligence in Pharmacy

Mudit Srivastava*, Ms. Richa Singh, Dr. Tarkeshwar P. Shukla
S.C.P.M College of Pharmacy, Lucknow Road Haripur, Gonda

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ABSTRACT
In many capacities, intelligent machines will eventually replace or improve human talents. The intelligence displayed by software or robots is known as artificial intelligence. Recently, AI plays an important role in various fields of pharmacy like drug discovery, drug delivery, formulation development, polymer pharmacology, hospital pharmacy. In drug discovery and development, various artificial neural networks (ANNs) like deep neural networks or recurrent neural networks are being employed. The utility and efficiency have increased in these sectors using artificial intelligence technologies.

Key Word:- Artificial intelligence, Pharmacy, Research, Technology, Drug Discovery, Machine, Networks.

I. INTRODUCTION
A. I is the capacity of a computer or robotic system that is computer-enabled to process information and create results that are comparable to how a human might think while learning, making decisions, and solving problems. [1] There are opportunities for AI to explore further in the field of pharmaceutical and healthcare research because of its ability to investigate teenormousdata from various modalities.[2] AI technology is exercised to perform more accurate analyses as well as attain useful interpretation.[3] Recently, AI technology becomes a very fundamental part of the industry for useful applications in many technical and research fields. Reflecting on thousands of pharmaceuticals, it has done a great job of addressing the growing demand for prescriptions, even when faced with pharmacists shortage, growing operating costs, and lower reimbursements. Pharmacy has also done a great job of leveraging enabling technology automation to improve workflow efficiency and lower operating costs while promoting safety, accuracy, and efficiency in every pharmacy setting. Automated dispensing gives pharmacists more time to engage with a greater volume of patients while also enhancing their health outcomes. [4]

Objective of A.I
The overall research goal of artificial intelligence is to create technology that allows computers and machines to work intelligently.

Advantages of A.I:[5]
• A.I can significantly reduce errors and increase precision.
• A.I is able to help pharmacists provide personalized medicine to their patients.
• A.I can enhance communication between patients and health care providers.

Disadvantages of A.I:[5]
• A.I has been tasked with creating everything from computer code to visual art, yet it lacks original thoughts.
• AI technology needs to be extensively trained with curated data sets in order to perform as expected. However, due to privacy concerns, it cannot access the necessary data.
• The disadvantages are things like costly implementation, potential human job loss, and lack of emotion and creativity.

AI classification
AI can be classified in two different ways:-

a) According to caliber
b) According to the presence

a) According to caliber
1. Weak intelligence or Artificial Narrow Intelligence (ANI): This system is designed and trained to perform a narrow task, such as facial recognition, driving a car, playing chess, and traffic signaling. E.g.: Apple Siri, a virtual personal assistant.

2. Artificial General Intelligence (AGI) or Strong AI: It is also called Human-Level AI. It can simplify human intellectual abilities. Due to this, when it is exposed to a complex task, it can find the solution. AGI can perform all the things a human can.

3. Artificial Super Intelligence (ASI): It is brainpower, which is...
Arend Hintze, an AI scientist, classified the AI technology based on its presence and not yet present. They are as follows:

b) According to the presence
- **Type 1:** This type of AI system is called a Reactive machine. E.g. DeepBlue, the IBM chess program which hit the chess champion, Garry Kasparov, in the 90s. It can identify checkers on the chessboard and make predictions; it does not have the memory to use past experiences. It was designed for narrow purposes and is not useful in other situations. Another example is Google's AlphaGo.

- **Type 2:** This type of AI system is called a Limited memory system. This system can use past experiences for present and future problems. In autonomous vehicles, some of the decision-making functions are designed by this method only. The recorded observations are used to record the actions happening in the future, such as changing the lanes by car. The observations are not in the memory permanently.

- **Type 3:** This type of AI system is called a "theory of mind." It means that all humans have their thinking, intentions, and desires, which is not the same in AI systems. The observations are not in the memory permanently.

- **Type 4:** These are called self-awareness. The AI systems have a sense of self and consciousness. The machine has self-awareness. It understands the condition and uses this knowledge in other situations. The observations are not in the memory permanently.

Role of A.I. in Different Areas
- Disease diagnosis;
- Digital therapy/personalized treatment:

Radiotherapy
- Retina
- Cancer
- Other chronic disorders
  - A. Indrug discovery

Alin disease diagnosis:-
  Disease analysis becomes pivotal in designing a consistent treatment and safeguarding the wellness of patients. The inaccuracies generated by humans create a hindrance for accurate diagnosis, as well as the misinterpretation of the generated information creating a dense and demanding task. AI can have varied applications by bringing about proper solutions for diseases and improving efficiency. After a vast literature survey, the applications of various technologies and methodologies for the purpose of disease diagnosis have been reported. With the evolution of the human population, there is always an ever-increasing demand for the healthcare system, according to varied environmental manifestations. It is important to categorize the patients based on whether he/she is severely affected by the diseases, and the AI can gain importance in diagnosis. It is always advised to maintain every patient’s health report forms, so as to collect the majority of review that are obtained via performing examinations and testing. Upon gathering information, the appropriate outcomes are mainly concerning the healthcare needs for a timely diagnosis. The analysis is the sole discretion of the state of the clinician and may fluctuate.

Alin digital therapy/personalized treatment:
Radiotherapy
Automated treatment planning is a recent technology, which is highly beneficial in radiotherapy treatment planning. Automated treatment planning efficiently improves the plan quality, consistency, and error rate. The treatment workflow can be organized into three categories, i.e., automated rule implementation, reasoning modeling of prior knowledge in clinical practice, and multi-criteria optimization. A simple automated computer program with a structure can implement the clinical guidelines for implementing clinical guidelines. The treatment planning system can analyze the anatomy and physiology of the patient and can analyze the condition and use this knowledge in other situations. Three-dimensional dose distribution and dose models for spatial dose have shown promising accuracy. Radiomics can give a unique advantage in understanding the tumor and its environment. The high-resolution imaging of the retina has given the scope to assess the human health remarkably. From single photon imaging to the help of several maging biomarkers, Radiomics can be implemented for the prediction of outcomes and toxicity for individual patients' radiation therapy.
theophthalmologist/retinologist can define a personal therapy and establish a continuously improving learning healthcare system.[15]

Cancer

With the huge applicability of AI, it has gained importance in the fields of diagnosing and treating various cancers. The lymphoma subtypes of non-Hodgkin lymphoma were predicted by using gene expression data in a multilayer perceptron neural network. The neural network has 20,863 genes as the input layer and lymphoma subtypes as the output layer.

Lymphoma subtypes include mantle cell lymphoma (MCL), follicular lymphoma, diffuse large B-cell lymphoma (DLBCL), marginal zone lymphoma and Burkitt. An AI neural network has predicted the lymphoma subtypes with high accuracy.[16]

In Drug Discovery

The drug discovery process is limited or resisted due to the lack of advanced technologies. Drug discovery process is the costly and time-consuming process.[17] With the implementation of AI in this field, it will eliminate some additional steps like it can easily and quickly shows the drug target as well as predict the drug structure.[18] It also faces some problems in the growth, variety, and doubtful or incomplete data, it is unable to deal with such data whereas such data can be handled in the industry.

QSAR-based computer model (Quantitative structure-activity relationship) can be helpful in the quick prediction of physicochemical properties of unknown compounds as well as their stability, efficacy and ADR of compound in the biological environment but this model has some problems such as experimental errors in the handling of small training sets, lack of validations etc. To solve this problem, there are DL (deep learning) and relevant modeling studies, new Alinnovations, which is devised for the predictions of safety and efficacy evaluation parameters of drug compounds in the researches.

There are many tools which act as virtual chemical space and predict the environmental distribution of the molecules by illuminating the properties of drug molecules. Examples of such virtual chemical space are: PubChem, ChemDB, ChemBank, etc. The reason behind the virtual chemical space is the illumination of the distribution of compound and the collection of data to explore the bioactive compounds.[19]

Application of A.I. in healthcare

There are several applications of AI in hospital-based healthcare,[20,21] in organizing dosage forms for individualized patients and selecting suitable or available administration routes or treatment policies.

- **Maintaining of medical records:** Maintenance of the medical records of patients is a complicated task. The collection, storage, normalizing, and tracing of data are made easy by implementing the Al system. Google DeepMind health project[22](developed by Google) assists to excavate the medical records in a short period. Hence, this project is a useful one for better and faster healthcare. The Moorfields Eye hospital NHS is assisted by this project for the improvement of eye treatment.

- **Treatment plan designing:** The designing of effective treatment plans is possible with the help of AI technology. When any critical condition of a patient arises and the selection of a suitable treatment plan becomes difficult, the Al system is necessary to control the situation. All the previous data and reports, clinical expertise, etc., are considered in the design of the treatment plan as suggested by this technology. IBM Watson for Oncology[23] as a software as a service, is a cognitive computing decision support system that analyzes patient data against thousands of historical cases and insights gleaned from working with thousands of hours with Memorial Sloan Kettering Cancer Center physicians and provides treatment options to help oncology clinicians make informed decisions. These treatment options are supported by literature curated by Memorial Sloan Kettering, and over 300 medical journals and 200 textbooks, resulting in almost 15 million pages of text.[23]

- **Health support and medication assistance:** In recent years, the usefulness of AI technology is recognized as efficient in health support services and also, for medication assistance. Molly[24] (a start-up designed virtual nurse) receives a pleasant voice in
ong with a cordial face. Its aim of it is for helping patients to guide the treatment of patients as well as support them when doctor's visits. Ai Cure[25] is an app existing in a Smartphone webcam, which monitors patients and assists them to control their conditions. This app is useful to patients with severe medication situations and for patients who want to participate in clinical trials.

- **Accuracy of medicine:** AI shows a good impact on genomics and genetic development. Deep Genomics[26] analyzes cell lines for mutations and linkage of diseases. This system informs doctors about the events happening within a cell when DNA is altered by genetic variation. An algorithm designed by the father of the human genome project, Craig Venter[27], that gives information on patients' physical characteristics based on their DNA. "Human Longevity" AI technology is useful to identify the exact location of cancer and vascular diseases in their early stage.

- **AI helps people in the healthcare system:** The "open AI ecosystem"[28] was one of the top 10 promising technologies in 2016. It is useful to collect and compare the data from social awareness algorithms. In the healthcare system, vast information recorded includes patient medical history and treatment data from childhood to that age. This enormous data can be analyzed by the ecosystems and gives suggestions about the lifestyle and habits of the patient.

- **Healthcare system analysis:** In the healthcare system, all the data is computerized then retrieval of data is easy. Netherlands maintains 97% of invoices in digital format[29] which contain treatment data, physician names and hospital names. Hence, these can be retrieved easily. ZorgprismaPubliek, a local company, analyzes the invoices with the help of IBM Watson cloud technology. If any mishap occurs, it recognizes it immediately and takes the correct action. Because of this, it improves and avoids patient hospitalization.

## II. CONCLUSIONS

The scope of Artificial Intelligence and machine learning in the Pharma industry looks very promising in the future. Pharmaceutical industries are in constant advancement with their technologies and AI will be an opportunity for minimizing the cost and time of drug development. AI can play a key role in clinical trials in reducing the total duration and cost of launching a drug to market. The use of AI applications in pharmacology will ensure operational excellence across drug development processes, selecting patients for clinical trials, monitoring drug performance, identifying proper dosage, etc.

### REFERENCE:-


[9]. Menschner, P., Prinz, A., Koene, P., Köbler, F., Altmann, M., Krčmar, H., Leimeister, J. M. Reaching into patients' homes: Participatory designed AAL services: The case of a...


[20]. Manikiran, S. and Prasanthi N., Artificial Intelligence: Milestones and Roles in Pharma and Health Care.}


