



Review Article

Role Of Artificial Intelligence (AI) in the Field of Pharmacy: An Insightful Analysis

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ABSTRACT

Artificial intelligence popularly known as AI is a new technology that allows machines and computers to mimic human abilities. AI can be used in many applications including digital assistants, search engines, social media, online shopping, robots, fraud prevention, navigation etc. Familiar examples of AI-controlled systems include Apple's SIRI (in iPhone) Amazon's Alexa and the self-driving cars of Google, Mercedes, BMW, and Tesla etc. AI plays a transformative role in pharmacy, accelerating drug discovery, improving medication management, and enhancing patient outcomes. It streamlines processes, reduces costs, and enables personalized medicine, impacting various aspects of pharmaceutical research, manufacturing, and patient care. AI plays vital role in Pharmaceutical Industry in fields like QA & QC, Clinical Trial Design & Monitoring, Pharmaceutical Manufacturing, Pharmaceutical Product Management, Pharmaceutical Product Development and Drug Discovery. AI has also role in pharmacy education and pharmacy practice but challenges like lack of transparency, lack of data availability, data privacy, data biases, interpretation of results, regulatory issues, and ethical concerns about decision-making need to be addressed.

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Introduction

Artificial intelligence popularly known as AI is a new technology that allows machines and computers to mimic human abilities like: learning, comprehension, problem solving, decision making, creativity and autonomy. AI can be used in many applications including digital assistants, search engines, social media, online shopping, robots, fraud prevention, navigation etc. This breakthrough has led to several technological advancements in virtually all fields from engineering to architecture, education, accounting, business, health, and so on. Familiar examples of AI-controlled systems include Apple's SIRI (in iPhone) Amazon's Alexa and the self-driving cars of Google, Mercedes, BMW, and Tesla etc.

Based on their caliber, AI system is classified as follows:

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 virtual personal assistance, tagging in social media.
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 an unfamiliar task, it can find the solution. AGI can perform all the things as humans.

3. **Artificial Super Intelligence (ASI):** It is brainpower, which is more active than smart humans in drawing, mathematics, space, etc; in every field from science to art. It ranges from the computer just little than the human to a trillion times smarter than humans.

AI in Pharmaceutical Industry:-

Top pharmaceutical companies are collaborating with AI vendors and leveraging AI technology in their manufacturing processes for research and development and overall drug discovery. Reports show nearly 62 percent of healthcare organizations are thinking of investing in AI shortly, and 72 percent of companies believe AI will be crucial to how they do business in the future. Top pharmaceutical companies, including Roche, Pfizer, Merck, AstraZeneca, GSK, Sanofi, AbbVie, Bristol-Myers Squibb, and Johnson & Johnson have already collaborated with or acquired AI technologies. In drug design, a company known as Atomwise developed the first deep learning neural network for structure-based drug design and discovery that they called AtomNet. AtomNet technology

enables the pharmaceutical chemists to perform core processes of drug discovery and design like hit discovery, lead optimization, and prediction of toxicity with high precision and accuracy in weeks as against years.

Insilico Medicine announced an AI project by the company called Pharm AI. Insilico

The application of artificial intelligence in pharma covers a wide range of processes, such as drug discovery, clinical trials, and supply chain optimization, where AI plays a pivotal role.

Medicine claims they applied Generative Adversarial Networks (GAN) and reinforcement learning algorithms. With Pharm AI, through GAN and reinforcement learning, Insilico Medicine claims that it can generate new molecular structures and ideate the biological origin of a disease.

QA & QC ✓ Understanding critical process parameters. ✓ Guide future production cycle. ✓ Regulation of inline quality. ✓ Ensure QA with the help of ELN and other techniques.	Clinical Trial Design and Monitoring ✓ Subject enrolment section ✓ Market prediction and analysis ✓ Product costing	Pharmaceutical Manufacturing ✓ Automation of manufacturing process ✓ Correlating manufacturing errors to set parameters
Drug Discovery ✓ Target protein structure prediction ✓ Drug protein interaction ✓ De novo drug design ✓ Bioactivity, toxicity and physicochemical property prediction ✓ Can predict pharmacokinetics, ✓ Optimize drug dosage and administration.	Pharmaceutical Product Development ✓ Aid in deciding suitable excipients ✓ Monitoring and modifying development process ✓ Ensuring in-process specification compliance	Pharmaceutical Product Management ✓ Market positioning. ✓ Market prediction and analysis. ✓ Product costing.

Popular AI model tools

The field of drug discovery has seen significant advancements with the use of AI model tools. Here are some of the popular AI model tools used for drug discovery:

- DeepChem, RDKit, ChemBERTa, GraphConv, AutoDock Vina, SMILES Transformer
- Schrödinger Suite, IBM RXN for Chemistry, scap-DB
- GENTRL (Generative Tensorial Reinforcement Learning)

AI in pharmacy practice in hospital and community pharmacies:-

AI can help pharmacists analyze patient data to identify drug interactions, assess safety and efficacy and make personalized recommendations, it can also help in anticipating adverse drug interactions.

Chatbots can be used to increase the efficiency of service delivery. Chatbots are capable of mimicking interactions between customers and customer care of sale staffs. Chatbots are capable of automatically resolving customer complaints and queries and the difficult questions are transferred to human staff. In retail pharmacy, this principle can be applied. The chatbots can be programmed to mimic pharmacist-patient interaction.

Walgreen made a partnership with Medline, a telehealth firm to create an avenue to help patients interact with

healthcare professionals through video chat. AI can also be useful in inventory management. With the use of AI-powered data analytics, a patient's future drug purchase can be predicted. Predicting the patient's drug purchase through AI will help the pharmacist to make proper stock procurement decisions.

AI in Pharmacy education:-

AI can be used in pharmacy education in a variety of ways, including:

- Simulation-based learning: AI-driven virtual patients can help students practice clinical skills in realistic scenarios.
- Personalized learning: AI can adapt content based on a student's performance and provide instant feedback.
- Simplifying complex concepts: AI can help students understand complex concepts more easily.
- Generating practice problems: AI can generate practice problems to help students prepare for exams.
- Refining communication skills: AI can help students improve their communication skills.

Conclusion:-

AI technology is transforming the pharmaceutical industry's drug discovery, development, and personalized medicine through enhanced efficiency and data

analysis. The application of AI in Pharmaceuticals has the potential to speed up treatment identification and optimize clinical trials, benefiting patient outcomes. Apart from this AI has revolutionized the field of pharmacy education, pharmacy practice, medical management etc.

Despite this, challenges like lack of transparency, lack of data availability, data privacy, data biases, interpretation of results, regulatory issues, and ethical concerns about decision-making need to be addressed.

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