



## A REVIEW ON ROLE OF ARTIFICIAL INTELLIGENCE: IN DIAGNOSIS OF DISEASE AND DRUG MANAGEMENT

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### ABSTRACT

*Artificial Intelligence (AI) revolutionizes healthcare through advanced algorithms, analyzing patient data for precise disease diagnosis and optimized drug management. Despite challenges in data privacy and ethical deployment, AI's transformative potential holds promise for improved patient care. Collaboration and innovation will drive the future of AI in healthcare, shaping a dynamic landscape.*

**KEYWORDS:** Disease Diagnosis, Drug Management, Machine Learning, Personalized Medicine

### INTRODUCTION <sup>(1,2)</sup>

Artificial intelligence (AI) is revolutionizing healthcare and biomedical research, exemplified by the Aravind Eye Care System's deployment of automated image classification for diabetic retinopathy screening. This is particularly significant in addressing the global impact of diabetes-related eye conditions affecting 90 million individuals and being a major cause of adult blindness. Fundus photography, employed for monitoring diabetic retinopathy, becomes more accessible with AI, given the scarcity of ophthalmologists in various regions globally. Over the years, AI research has evolved, giving rise to virtual assistants like Apple's Siri and Amazon's Alexa, capable of understanding natural language. Presently, AI's transformative influence extends beyond virtual assistants to healthcare, finance, transportation, academia, and research. In academia, AI enhances education through intelligent tutoring systems, improving student learning outcomes. In research, AI's ability to analyze large datasets unveils intricate patterns, leading to breakthroughs in genomics and drug discovery. AI also contributes to healthcare by creating diagnostic tools and personalized treatment plans. AI algorithms analyze medical images (X-rays, MRIs, ultrasounds, CT scans), enhancing diagnostic accuracy and efficiency. Its versatility extends to answering patient queries, aiding surgeries, and contributing to pharmaceutical development. This improves patient care outcomes by enabling precise treatment plans. AI's potential to revolutionize healthcare includes disease diagnosis, drug management, and personalized treatment plans.



Figure No 1: Application of AI in Healthcare

### Artificial Intelligence in Disease Diagnosis <sup>(3-8)</sup>

Real-time data analysis is crucial for detecting infectious diseases promptly, impacting society, the economy, and the world. AI's benefits extend to creating robotic surgeons, advancing healthcare beyond data processing. Kumar and Singla (2021) explore diverse AI applications in disease detection modeling. AI enables machines to learn like humans, identifying patterns and images. In healthcare, AI revolutionizes data handling for patient care by employing system planning. Real-world data, prone to errors, undergoes preprocessing to eliminate discrepancies. Information cleansing addresses anomalies, and information osmosis amalgamates data from diverse sources, correcting errors. The final step involves standardizing data for computational use, with various approaches available. In information mining computations, data evolution is crucial for maximal accuracy, focusing on reducing information to more useful levels. Information gathering involves testing and preparing data indexes. Analytical modeling assesses the probability of a given event based on input factors, particularly effective in illness prediction.

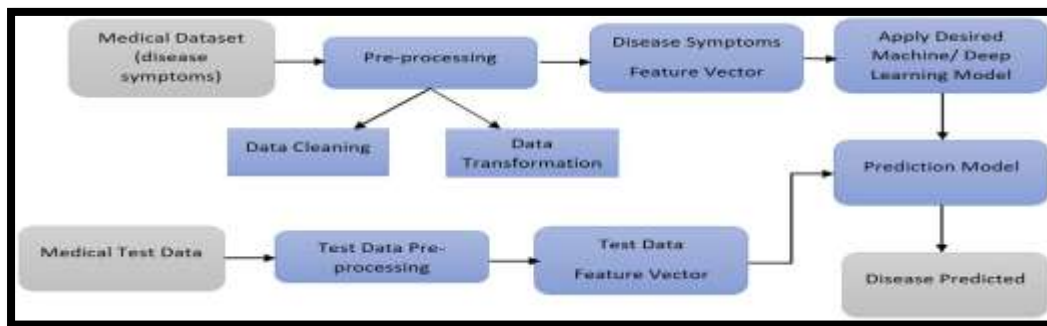


Figure No 2: Framework for Disease Detection System

### Artificial Intelligence Techniques in Disease Diagnosis and Prediction <sup>(9-17)</sup>

#### 1. Machine Learning Application In Diagnosis Image-Based Diseases

Machine Learning (ML) is a rapidly expanding field, particularly in medical imaging analysis within AI. ML, vital for computer-aided diagnosis and illness detection, leverages various imaging techniques like CT, PET, tomosynthesis, MRI, tomography, and diffuse optical tomography. ML relies on data, automatically identifying patterns to make predictions or decisions in unpredictable scenarios. Recent applications include analyzing electronic health records with natural language processing for disease diagnosis. Explainable AI techniques like SHAP are crucial for transparency in medical decision-making. Generative models like GANs create artificial medical images, enhancing data for improved model performance, chosen based on specific challenges and data types.

#### 2. Deep Learning Applications In Diagnosis Image-Based Diseases

Deep Learning (DL) stands out as a powerful technology, particularly in the realm of medicine, where it automatically learns intricate features and patterns. DL, especially through Convolutional Neural Networks (CNN) and other variants like Deep Neural Networks (DNN) and Recursive Neural Networks (RNN), has transformed medical image-based diagnosis. DL's superiority lies in automated feature extraction, extensive data analysis capabilities, and unparalleled accuracy, making it particularly effective for large datasets. Techniques such as Region Aggregation Graph Convolutional Network (RAGCN) showcase DL's application in medical imaging, dividing images into segments and employing Graph Convolutional Networks (GCNs) for precise feature extraction. Other methods, like the lesion-attention pyramid network (LAPNet), use attention mechanisms for targeted lesion identification in medical images. It's enhancing its role in disease prediction and diagnosis.

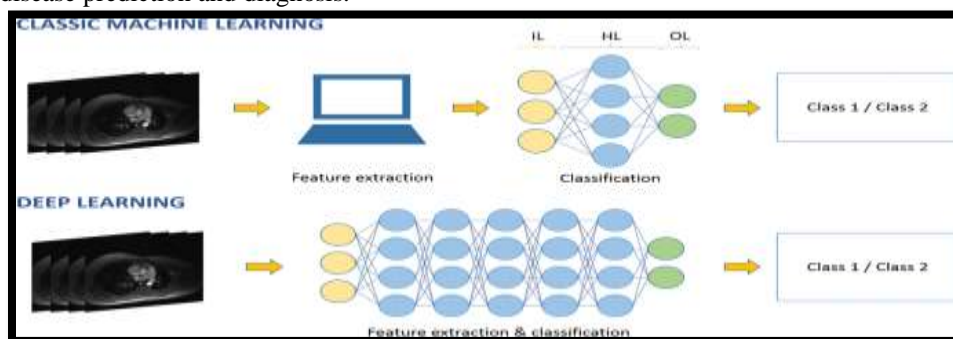


Figure No. 3: Comparison of Machine and Deep Learning



### Diagnostic use of AI

- **Medical Imaging:** AI algorithms trained on medical images like X-rays, MRIs, and CT scans can detect abnormalities with remarkable accuracy, often surpassing the abilities of even experienced human radiologists. This leads to earlier and more precise diagnoses, allowing for timely interventions and improved patient outcomes.
- **Genomics:** AI can analyze genetic data to identify mutations and risk factors associated with various diseases. This personalized approach to diagnosis paves the way for preventative measures and targeted treatment strategies.
- **Electronic Health Records (EHRs):** AI can analyze EHRs, which contain a patient data, to identify patterns and predict the onset of diseases. This can help prevent illnesses.

### Main Advantages of Applying AI to Healthcare Diagnosis <sup>(18)</sup>

1. **Increase precision:** A disease can be accurately diagnosed at an early stage thanks to AI algorithms that can analyse enormous volumes of medical data. Reducing diagnostic errors.
2. **Quicker Response Time:** Fast test result diagnosis is another important advantage of AI in healthcare. When compared to manual diagnosis, AI analyse test results quickly.
3. **Personalised Health Care:** AI in healthcare also enables patients to receive personalised medication regimens and therapies. Finding patterns and correlations requires a thorough examination of individuals' clinical data, genetic information, and treatment outcomes.
4. **Forecasting and Analysis:** AI evaluates patient data from their electronic medical records (EMRs) in real time and forecasts how their therapies will work.
5. **Clinical Advisory Services:** AI can also be used by medical professionals to recommend appropriate treatments for illnesses and assist physicians in selecting the best course of action.

### Challenges of Artificial Intelligence in Disease Diagnosis <sup>(23, 24)</sup>

1. **Generalisation and Clinical Usefulness:** The clinical usefulness of AI systems is limited because they frequently fail to achieve dependable generalizability, medical data sets.
2. **Ethical Considerations:** Using AI to diagnose diseases is fraught with ethical problems, such as data protection and privacy difficulties.
3. **Model Validation and Accuracy:** It's critical to guarantee the precision and dependability of AI models. Preventing misdiagnoses and fostering trust among the medical community.
4. **Interpretability and Explainability:** Healthcare practitioners may find it difficult to comprehend the reasoning behind diagnoses due to the interpretability of AI models.
5. **Data Quality and Bias:** The accuracy and equity of disease diagnosis may be impacted by biased predictions caused by biases in the datasets.
6. **Integration with healthcare Workflow:** For AI to be widely adopted, it must be ensured that healthcare procedures are enhanced rather than disrupted.
7. **Cost and Resource Allocation:** Overcoming financial obstacles and guaranteeing accessibility for healthcare facilities with restricted funding are problems.
8. **Regulatory Frameworks and Standards:** Lack of uniform regulatory frameworks for artificial intelligence in healthcare prevents the technology from being widely used.

### Challenges Faced By the Researcher in Diagnosis of Disease <sup>(1)</sup>

1. **Limited Size of Data:** Lack of data to train the model was the most prevalent issue across the majority of the trials. A limited sample size suggests a smaller training set.
2. **Excessive dimensions:** High dimensionality is data-related problem in cancer research.
3. **Effective method for selecting features:** To eliminate the data cleaning processes and produce high illness prediction accuracy, computational efficient selection method is needed.
4. **Generalizability of Models:** A prediction model that has been validated on a single site has been suggested by the majority of investigations.
5. **Clinical Application:** To help the medical professional confirm the diagnosis decisions, these models must be evaluated in a clinical scenario.



### Case Study: Detection of Hypertension Disease <sup>(1)</sup>

Researchers have harnessed the power of Artificial Intelligence (AI) to diagnose hypertension, utilizing input data like blood pressure and demographics. Krittanawong et al. (2018) condensed recent developments, showcasing AI's capability to predict hypertension early and study its risk factors. Arsalan et al. (2019) used public datasets like DRIVE and STARE for retinal imaging to identify hypertension, achieving impressive accuracy metrics. Kanegae et al. (2020) employed XGBoost and Ensemble models, with XGBoost excelling in predicting hypertension risk. Koshimizu et al. (2020) used AI to analyze vast data, predicting circulatory strain and exploring artificial neural networks for blood pressure control. However, Mueller et al. (2020) raised concerns about AI's application to extensive hypertension datasets, emphasizing the potential for dubious outcomes. Kwon et al. (2020) applied AI to predict pulmonary hypertension through electrocardiography. Sakr et al. (2018) evaluated various AI techniques, emphasizing AI's role in providing forward-thinking, personalized, and preventative healthcare insights for hypertension.

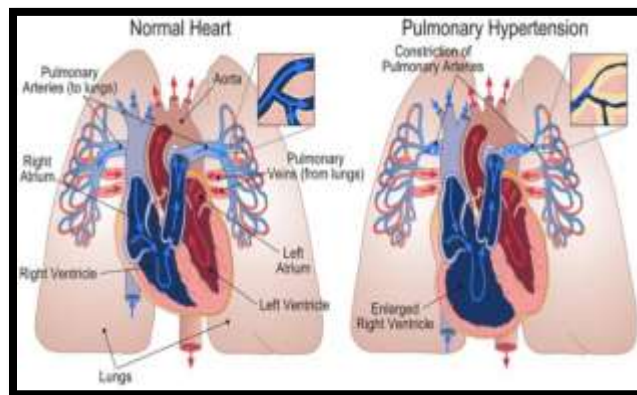


Figure No 4: Pulmonary Hypertension.

### Artificial Intelligence in Drug Management <sup>(19-21)</sup>

AI speeds up procedures, increases productivity and its enhanced human knowledge to solve problems. The main parts of artificial intelligence in drug management are:

- **Drug Discovery and Development:** AI can streamline the drug discovery process by analyzing vast chemical libraries and predicting the efficacy and potential side effects of new drugs. This significantly reduces the time and cost.
- **Personalized Medicine:** AI can analyze predict how they will respond to specific drugs. This approach optimizes treatment efficacy while minimizing side effects.
- **Dosage Optimization:** AI determines the optimal dosage for maximum effectiveness and minimal adverse effects. This personalized approach to medication management ensures the best possible therapeutic outcomes.

### AI in Drug Discovery

Drug development and research have been transformed by AI in many ways. Among AI's major contributions in this field are the following:

1. **Target Identification:** AI helps in the development of drugs that can alter biological processes by identifying targets and molecular pathways linked to disease.
2. **Virtual Screening:** AI helps researchers save time and resources by selecting compounds for experimental testing by modelling chemical interactions and estimate binding affinities.
3. **Structure-Activity Relationship (SAR) Modeling:** AI models have the ability to connect a chemical structure to its biological action and create compounds with desired properties.
4. **De Novo Drug Design:** AI broadens the chemical space and supports the creation of novel therapeutic candidates by adding knowledge from chemical libraries and experimental data.
5. **Optimization of Drug Candidates:** To maximise their efficacy and reduce any possible negative effects.
6. **Drug Repurposing:** AI expedites and lowers the cost of drug research by repurposing current medications for novel uses.
7. **Toxicity Prediction:** In clinical studies, this helps researchers minimise potential negative reactions and prioritise safer drugs.

**Resources and Applications: Advancements in AI in Drug Discovery are** <sup>(22)</sup>

- 1. AI in Drug Discovery: Revolutionizing Processes:** Drug development procedures have been dramatically transformed by AI approaches, which solve issues with speed, precision, and efficiency. Large-scale datasets are analysed.
- 2. AI's Role in Personalized Medicine:** Treatment efficacy is increased and adverse effects are decreased when treatment plans are customised based on information specific to each patient. AI-driven tactics make use of patient-specific data to provide a more accurate knowledge.
- 3. Applications in Drug Discovery Pipelines:** AI-powered computational methods greatly cut down on the time and resources needed for traditional methods.
- 4. Advancements in Drug Research & Development:** This can help with the identification of novel medication targets and the understanding of disease causes. AI-driven pharmaceutical has the potential to improve clinical trial success rates and solve unmet medical needs.
- 5. Decoding the Potential: Transforming Drug Discovery:** AI helps researchers make data-driven decisions by deciphering complex biological facts, which improves the efficiency of the drug discovery process.
- 6. Challenges and Opportunities:** To fully utilise AI in personalised medicine and drug discovery, cooperation amongst researchers, physicians, and regulatory agencies is essential.

**Clinical Significance:** AI has a clinical role in medication management, offering instruments for effective analysis and decision-making in medical environments. AI-driven medication administration and treatment processes have the potential to significantly improve patient care.

**Pre-clinical and clinical development:** AI-based methods can help choose candidates for pre-clinical trials by finding pertinent biomarkers for human diseases, predicting harmful side effects, and selecting a patient cohort by filtering a high-dimensional set of clinical factors.

**FDA approval and post-market analysis:** Utilizing Natural Language Processing (NLP), scientific literature can be mined to report side effects, such as drug toxicity or resistance, and to create automated assessments for FDA approval or patent applications. Pharmaceutical businesses may be able to maximise their commercial resources by using machine learning-based methods to predict a product's potential sales.

**Challenges and Considerations**

**Data Privacy and Security:** The vast amount of data used in AI healthcare applications raises concerns about privacy and security. Robust data governance frameworks are crucial to ensure patient data is protected.

**Algorithmic Bias:** AI algorithms trained on biased data can perpetuate existing healthcare disparities. Careful data selection and algorithm development are essential to mitigate bias and ensure equitable healthcare delivery.

**Human-AI Collaboration:** AI should not replace, but rather, augment the expertise of healthcare professionals. Effective human-AI collaboration is key to maximizing the benefits of AI in diagnosis and drug management.

**CONCLUSION**

Artificial intelligence (AI) in healthcare has enormous potential to revolutionise medication administration and disease detection. Along with improving medical diagnosis efficiency and accuracy, the integration of machine learning, natural language processing, and other AI technologies speeds up the process of finding new drugs and optimising existing ones. However, to guarantee that AI in healthcare continues to help patients and the medical community, thorough evaluation of the ethical implications and continued attempts to address difficulties are crucial.

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