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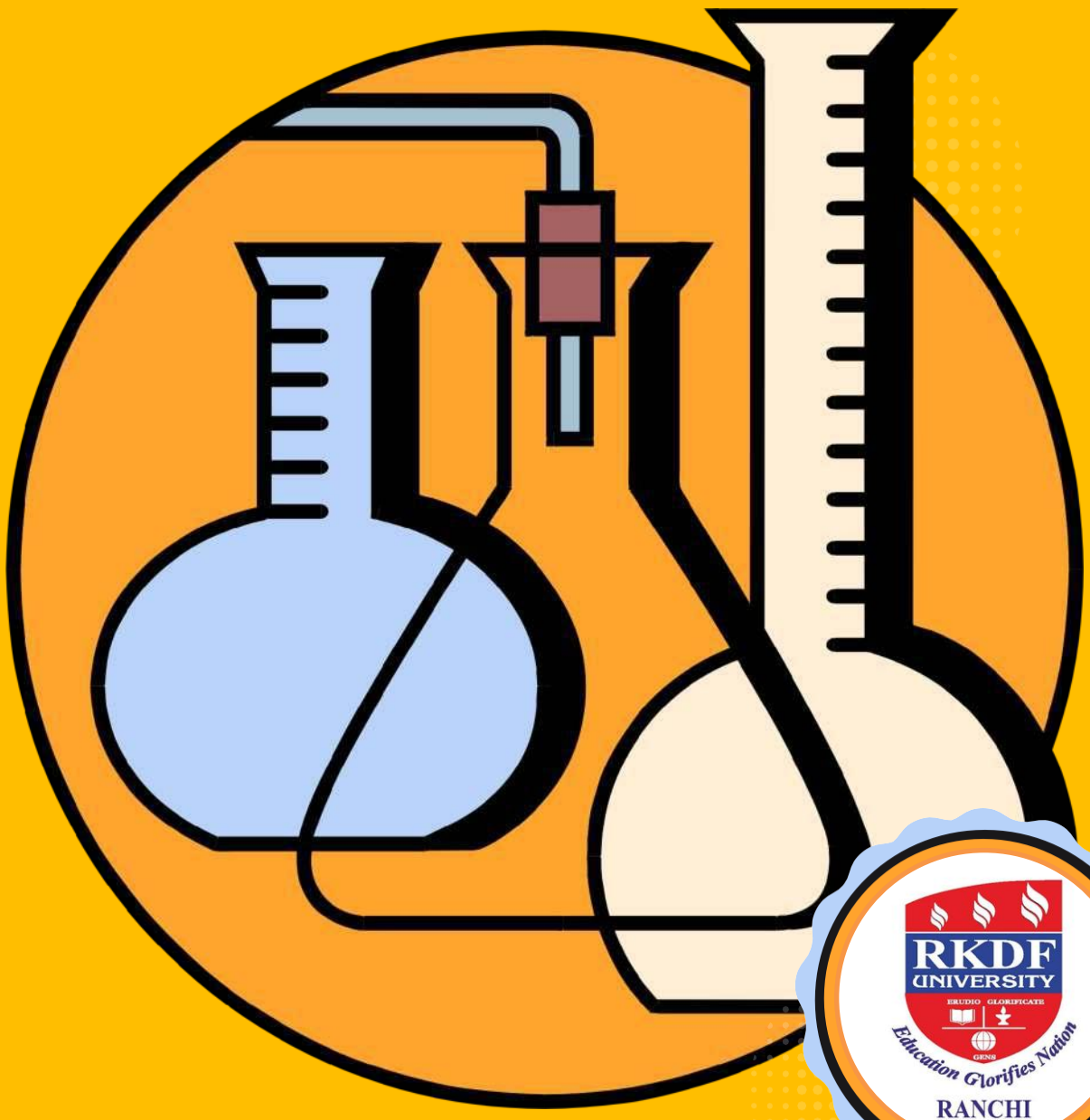

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Index

Article: 1

Artificial Intelligence in Rehabilitation Process: An Innovative Approach in Modern World

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Abstract:

Artificial Intelligence (AI) is revolutionizing the rehabilitation process after several trails (Preclinical and clinical trials) by providing innovative solutions that enhance animal or patient recovery and refine treatments that results AI-driven technologies, such as robotic exoskeletons, virtual reality systems, and wearable gadgets, help patients restore their movement and cognitive capacity with enhanced accuracy and flexibility. AI also facilitates remote evaluation of patients and rehabilitation, enhancing medical services for those in remote or underprivileged areas (Used in modern pharmacovigilance data collection processes). AI can predict health hazards, often offers proactive measures, and improve accessibility, personalization, and efficiency in healthcare processes. It can expedite drug development, automate administrative tasks, and improve surgery by reducing invasiveness and precision (automated techniques using AI). However, ethical concerns and data privacy concerns remain. Collaboration across disciplines is crucial for successful AI implementation.

Keywords: Clinical trials, Sensors, Pharmacovigilance, Rehabilitation, Automated techniques using AI.

Introduction

Integration of Artificial Intelligence (AI) into rehabilitation procedures is being achieved through several approaches, such as data gathering and analysis, AI-driven robotic devices, and virtual reality. These approaches optimize the effectiveness, customization, and availability of treatment. Medical data is gathered by sensors, wearable devices, and rehabilitation equipment, and then analyzed using machine learning algorithms to detect patterns, forecast patient results, and there body systematic plans through rehabilitation activities. Artificial intelligence (AI)-driven robotic devices imitate human movements, offering directed, repeated rehabilitation for those suffering from neurological illnesses, spinal cord injuries, or musculoskeletal problems. Virtual reality (VR) rehabilitation uses artificial intelligence (AI) to generate immersive settings where patients may engage in physical and cognitive activities[1, 2].

Wearable technology constantly tracks patients' vital signs and physical activities, offering feedback and identifying any deviations from the recommended regimen. Tele-rehabilitation technologies featuring artificial intelligence (AI) capabilities enable patients to remotely communicate with therapists, offering immediate instruction and feedback during sessions. Artificial intelligence (AI)-powered cognitive rehabilitation systems evaluate cognitive capacities and provide workouts specifically designed to improve memory, attention, and executive function. Predictive analytics and outcome modelling employ artificial intelligence to forecast how patients will recover, identify possible obstacles, and choose the most effective treatment strategies. Furthermore, AI systems assist therapists by offering data-driven insights and suggestions, hence improving therapeutic decision-making and decreasing cognitive burden.

Methods

The integration of Artificial Intelligence (AI) into rehabilitation is grounded on several theoretical frameworks that clarify how AI improves patient recovery, facilitates therapeutic interventions, and enhances clinical decision-making processes. By drawing upon fields such as machine learning, robotics, cognitive science, and motor learning, these concepts provide a foundational framework for understanding the operation of AI technologies in the field of rehabilitation. The following are the core theoretical assumptions that support the use of artificial intelligence in the field of rehabilitation:

Algorithms for machine learning and adaptive systems hypothesis: (As we all know hypothesis and its testing techniques are the crucial points for any idea creation and research to implement) Machine learning, a subfield of artificial intelligence, functions based on the assumption that computers have the ability to gain information from data, identify patterns, and improve their performance progressively without requiring explicit programming. Within the realm of rehabilitation, this concept suggests that artificial intelligence (AI) systems may be trained using large datasets to recognize trends in patient recovery and adapt treatment approaches appropriately.

Applications: Machine learning algorithms undertake continuous analysis of patient performance data and make real-time adjustments to rehabilitation regimens. For example, artificial intelligence has the ability to differentiate to what extent a patient is ready for more challenging tasks or require adjustments to prevent undue stress, therefore augmenting the dynamism and customization of treatment.

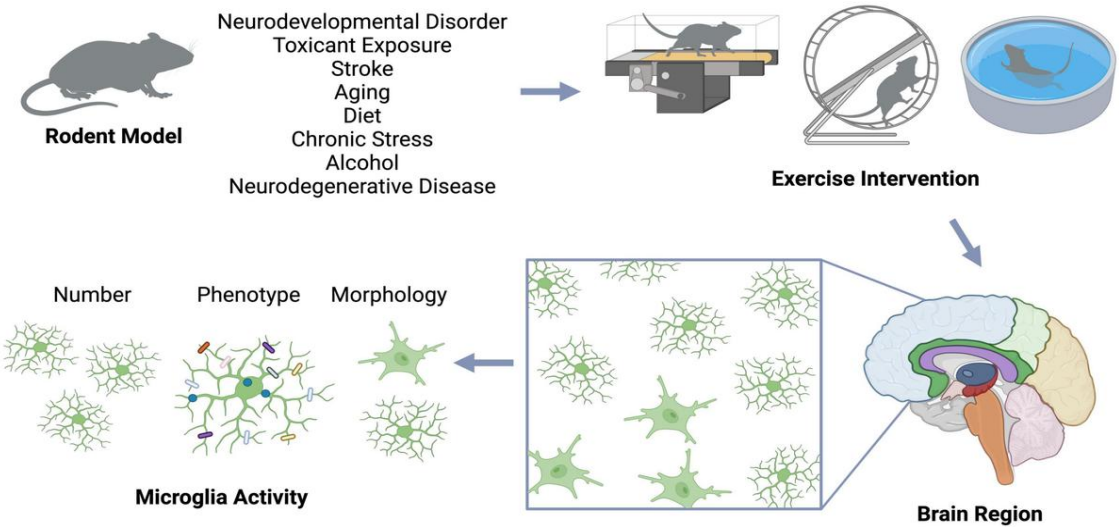


Figure 1: Patent claim 1: On the above title the cognitive motor functioning with exercise helps the recovery by using the sensors using AI for rehabilitation purposes.

Conceptual framework: A substantial component of rehabilitation research is based on the concept of neuroplasticity, which pertains to the brain's ability to reorganize itself by forming new neural connections. Specifically designed to leverage this notion, artificial intelligence (AI)-powered rehabilitation solutions provide repetitive, task-specific training that promotes neural adaptation and recovery.

Applications: Artificial intelligence (AI) equipment, such as robotic exoskeletons and virtual reality (VR) environments, provide patients repeated and intentional tasks that stimulate neuroplastic remodelling in the brain. By customizing exercises based on real-time feedback, artificial intelligence ensures that patients engage in the most effective techniques of practice to enhance their recuperation.

Motor learning: Motor learning theory is the theoretical framework that includes the processes engaged in the acquisition and enhancement of motor skills via repeated practice and constructive analysis. The practical application of artificial intelligence (AI) in rehabilitation involves providing prompt feedback and adjustments, therefore enabling patients to improve their movements and achieve optimal motor skills.

Applications: Wearable sensors and robotic devices, which are equipped with artificial intelligence (AI), are used to monitor patient movements and offer feedback to help patients improve their motor skills. Over time, this negative feedback loop enables the acquisition of accurate movement patterns and the recovery of motor function in patients who have experienced traumas or neurological events like strokes.

Cognitive load: Cognitive load theory is a theoretical framework that analytically investigates the brain's ability to efficiently absorb and retain information during learning tasks. Within the realm of rehabilitation, this concept suggests that treatment should be precisely customized to optimize cognitive resources, therefore ensuring that exercises are both challenging and within controllable boundaries.

Applications: Artificial intelligence is applied to create rehabilitation programs that are both engaging and easily manageable. For instance, virtual reality rehabilitation systems integrated with artificial intelligence may adjust the level of difficulty of activities to suit the requirements of patients, thus assuring that they are sufficiently stimulated without encountering mental fatigue, so maximizing cognitive and physical recuperation.

Self-efficacy and motivation theories: Self-efficacy theory posits that an individual's belief in their ability to attain success influences their motivation and persistence in a certain undertaking. Rehabilitation interventions driven by artificial intelligence (AI) often incorporate elements of gamification and progress tracking, utilizing this principle to sustain patient motivation.

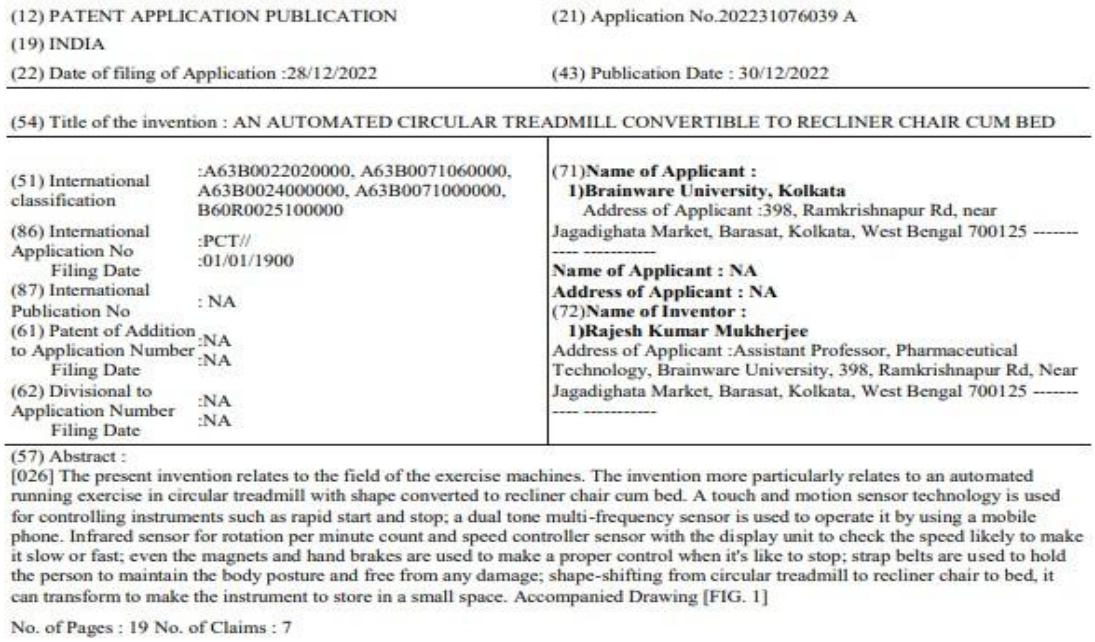
Applications: Self-efficacy principles are applied by artificial intelligence (AI) systems, such as gamified rehabilitation apps, by presenting patients' progress over time, setting achievable goals, and providing rewards for goal achievement. Patient motivational variables have a significant role in their long-term engagement and commitment to their rehabilitation programs, leading to enhanced outcomes.

Human-Robot interaction: The theory of Human-Robot Interaction (HRI) examines the dynamics of interaction between humans and robots and explores methods to improve these interactions for specific tasks. Within the realm of rehabilitation, this theory explores the capacity of robots powered by artificial intelligence to augment the efforts of human therapists and aid patients in regaining their mobility and autonomy.

Applications: Robots driven by artificial intelligence (AI), such as exoskeletons and robotic arms, provide physical support and help patients perform repetitive tasks, such as walking or grasping objects. The design of these robots is guided by Human-Robot Interaction (HRI) theory to ensure their intuitiveness, safety, and capacity to adapt to the unique healthcare needs of individual patients. Consequently, this enhances patient engagement and trust in the technology.

Predictive analytics and decision support theory: Predictive analytics theory refers to the use of retrospective and real-time analytical data to predict future outcomes. Within the realm of rehabilitation, artificial intelligence systems rely on this theory to forecast the trajectories of patient recuperation and propose therapeutic adjustments.

Applications: Artificial intelligence systems evaluate large datasets from previous patients and use prediction models to anticipate the length of a patient's recovery or identify the most effective therapies. These predictions let therapists make educated assessments on the course of treatment, therefore enabling them to optimize patient outcomes.



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(57) Abstract :
[026] The present invention relates to the field of the exercise machines. The invention more particularly relates to an automated running exercise in circular treadmill with shape converted to recliner chair cum bed. A touch and motion sensor technology is used for controlling instruments such as rapid start and stop; a dual tone multi-frequency sensor is used to operate it by using a mobile phone. Infrared sensor for rotation per minute count and speed controller sensor with the display unit to check the speed likely to make it slow or fast; even the magnets and hand brakes are used to make a proper control when it's like to stop; strap belts are used to hold the person to maintain the body posture and free from any damage; shape-shifting from circular treadmill to recliner chair to bed, it can transform to make the instrument to store in a small space. Accompanied Drawing [FIG. 1]

No. of Pages : 19 No. of Claims : 7

Figure 2: Patent claim 2: On the above title the shape changing gadgets for clinical approach using AI helps in both rehabilitation and rest.

Tele-rehabilitation: Tele-rehabilitation is rooted on the principles of distant learning and telehealth, which emphasize the use of digital platforms to provide healthcare treatments remotely. Artificial intelligence enhances this process by providing real-time analysis and feedback, mimicking the experiences observed in a controlled clinical environment.

Applications: Tele-rehabilitation platforms integrate artificial intelligence to allow patients to participate in therapeutic activities from the comfort of their own homes, while also receiving prompt feedback and support from artificial intelligence systems. This remote learning environment enables continuous rehabilitation and broadens the accessibility of therapy for those who may have restricted capacity to regularly attend in-person sessions[1,2].

Results

In the patent claim 1 and 2 those are prepared and used for rehabilitation purposes, both are under hit and trail, the stage of project is Technology readiness level (TRL) 4.

Conclusion

The utilization of artificial intelligence (AI) in the realm of rehabilitation is based on recognized theoretical frameworks that augment the efficiency, availability, and customization of therapy. Concepts such as machine learning, neuroplasticity, motor learning, and human-robot interaction theories give a strong basis for comprehending how artificial intelligence might enhance patient rehabilitation. Through the utilization of these ideas, rehabilitation programs powered by artificial intelligence provide progressive solutions that not only enhance patient results but also reshape the trajectory of therapeutic treatment helps the society.

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Article: 2

Unlocking the Impact of Artificial Intelligence in Pharmaceutical Research

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Abstract
The use of medicines in veterinary and medical therapy has increased food production and economic welfare in addition to improving the health of humans and animals. Nonetheless, the introduction of pharmaceuticals into the environment via multiple channels, including production processes, human waste, and inadequate disposal methods, can adversely impact ecosystems and the diverse biological entities linked to these systems. Significant concentrations of pharmaceutical residues have been identified downstream from manufacturing sites, and unprocessed remnants of veterinary medications may find their way into aquatic environments. Techniques involving artificial intelligence (AI) and machine learning (ML) have been applied to create links between chemical structure and biological activity, known as quantitative structure–activity relationships (QSARs) for the compounds. QSAR models utilize chemical structures to forecast hazardous activity in the absence of experimental data, thus assisting in the prioritization of chemicals for testing and documentation. This multidisciplinary approach is essential for developing solutions that minimize toxicity in pharmaceutical techniques, thus resulting in improved public safety and fostering the long-term preservation of environmental resources. Through the integration of these sophisticated methodologies, the pharmaceutical sector can enhance detection accuracy and improve its ability of producing eco-friendly products, which will eventually result in safer pharmaceuticals and a more sustainable world.
Keywords: QSAR, Veterinary, Machine Learning, Artificial Intelligence

Introduction

Medications have many positive effects in medicine and veterinary care, including healthier outcomes for people and animals, more food manufacturing, and higher economic well-being. But pharmaceuticals may cause damage to ecosystems and creatures when released into the natural world across many channels like production, human waste, and improper disposal[1,2]. The pharmaceutical industry is rapidly becoming one of the most dangerous new environmental and public health hazards. Although the amounts of medicines present in surroundings typically remain beyond therapeutic thresholds, several categories, including beta-blockers, antibiotics, anticancer agents, and endocrine disruptors, have demonstrated the potential to inflict severe damage on ecosystems[3]. Currently, there are around 28 million documented chemical structures, although only a small subset has associated experimental toxicity data. Advancements in artificial intelligence and deep learning offer a remarkable chance to improve the logical drug screening process, which will ultimately be advantageous to humankind. The amalgamation of advanced predictive toxicology technologies with mitigation strategies presents considerable potential for mitigating the environmental repercussions of pharmaceutical consumption. Combinatorial chemistry, in conjunction with AI-driven QSAR modeling, facilitates the systematic investigation of chemical space to uncover molecules with diminished environmental risk profiles. The concepts of green chemistry optimize this process by advocating for the development of medications that exert minimal environmental impact throughout their entire lifecycle, from synthesis to disposal. The amalgamation of QSAR modeling, augmented by artificial intelligence, comprehensive machine learning, and a varied information repository, alongside combinatorial and green chemistry methodologies, may significantly enhance the development of pharmaceutical products and sensor technologies characterized by low toxicity and environmental sustainability.

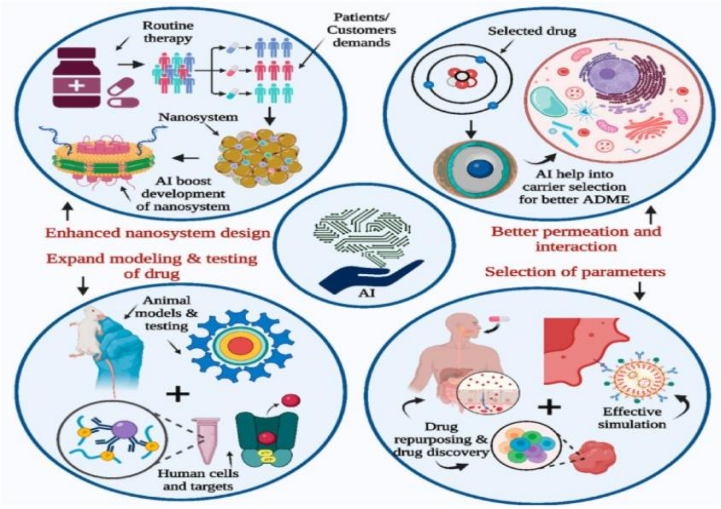

Figure 1: Animated depiction of AI utilizing different approaches to human evolution

The impact of AI on the pharmaceutical industry

AI has a revolutionary and wide-ranging impact on QSAR analysis and pharmaceutical developing technologies. Artificial intelligence has transformed the domain by improving the efficiency and precision of drug discovery methodologies. In pharmaceutical sensing technology, AI-driven systems utilize advanced algorithms and machine learning techniques to analyze extensive chemical data repositories, facilitating the swift and accurate identification of compounds with specific therapeutic properties. These systems utilize multimodal libraries that integrate various datasets, including molecular structures, biological activities, pharmacological profiles, and clinical outcomes[4]. Accessing comprehensive references enables AI algorithms to analyze and correlate complex relationships between chemical structures and their therapeutic effects effectively. AI-driven approaches provide scalability and efficiency in screening chemical compounds, thereby accelerating the drug discovery process and minimizing the time and resources needed for experimentation. These systems refine their predictive capabilities through iterative learning and optimization, thereby enhancing the accuracy as well as reliability of compound identification. Researchers can priorities candidate molecules that exhibit a greater likelihood of success, thereby facilitating the discovery of new medicines with enhanced efficacy and safety profiles[5].

Additionally, AI-driven QSAR methodologies facilitate a more thorough exploration of chemical space. Conventional drug discovery approaches typically emphasize established chemical entities, thereby constraining the breadth of investigation. AI-powered QSAR models are capable of analyzing extensive datasets of substances, involving compounds that weren't previously synthesized or experimentally tested[6].

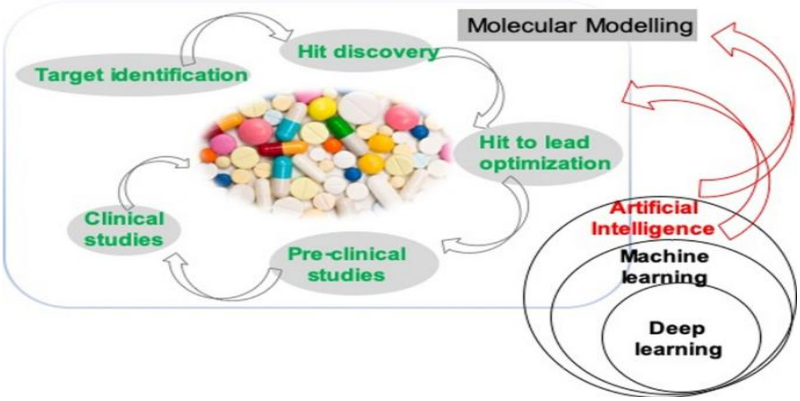

Figure 2: Artificial intelligence in pharmaceutical evolution: an integrated approach

Role of AI in green chemistry

Chemical sustainability, also called "circular chemistry" or "sustainable chemistry," is an approach to chemical product and process design that seeks to reduce or eliminate the

production and use of potentially harmful chemicals[7]. It aims to mitigate the adverse effects of chemistry on the environment by minimizing the consumption of non-renewable resources and developing technological solutions for waste management. This domain has resulted in the advancement of alternative sustainable technologies and the formulation of 12 principles of green chemistry, which offer a framework for enhancing the environmental sustainability of chemical processes and products[8]. Green chemistry possesses the capacity to transform the pharmaceutical sector, yielding advantages both environmentally and economically. The pharmaceutical industry is a significant global polluter, releasing 1.9 million tons of CO_2 each year. Pharmaceutical firms necessitate access to the most recent research in the field to attain a sustainable and ecologically friendly approach to drug development. They must develop beyond conventional synthetic methodologies[9].

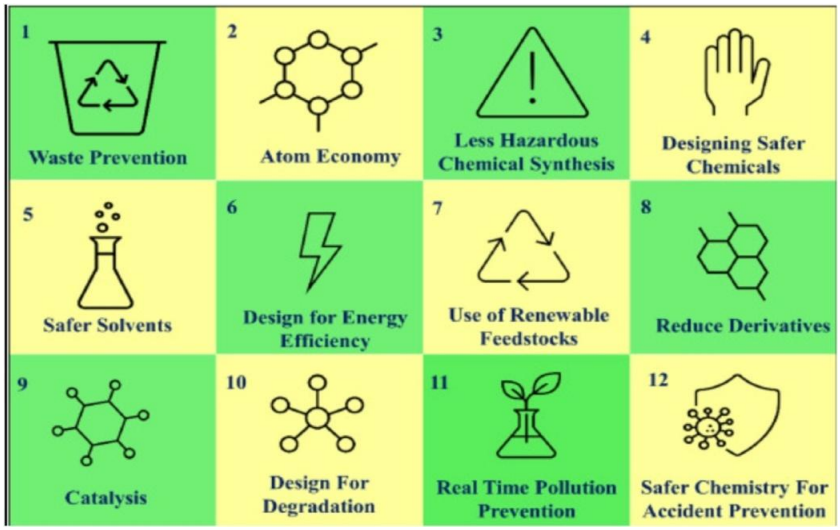

Figure 3: The fundamental concepts of sustainable chemistry that can be relevant for the enhancement of quantitative structure-activity relationship techniques

Combining QSAR and ML for the execution of strategies

In QSAR modelling, predictors consist of physio-chemical properties or theoretical molecular descriptors of chemicals, while the QSAR response parameter may represent the biological action of these chemicals. QSAR models originally summarize a proposed connection among chemical structures and biological activity within a chemical data set. Secondly, QSAR models predict the activities of new substances. A mathematical relationship, commonly referred to as a QSAR, exists between physicochemical attributes or structures that can be quantified numerically. Upon careful review of the mathematical expression, it might be employed to predict the behavior of various chemical frameworks[10].

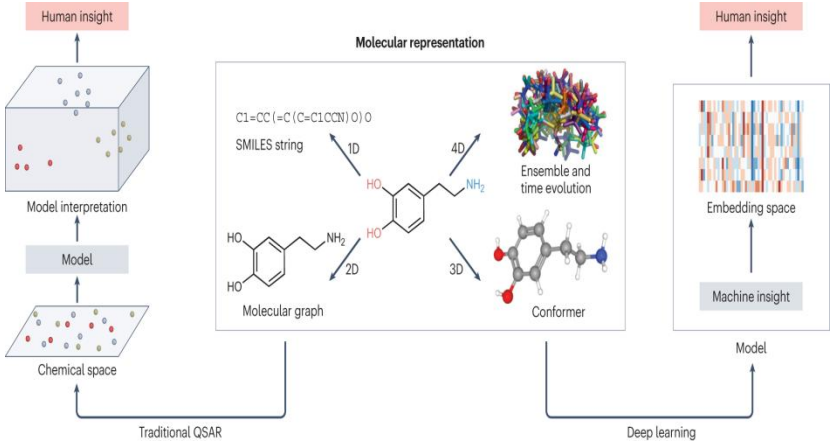

Figure 4: Role of AI in QSAR and machine learning

Machine learning (ML) approaches have emerged as promising techniques for enhancing QSAR modelling, attracting major interest from the academic community. This study

conducted a systematic review of the use of machine learning algorithms in QSAR, presenting a framework called 'ML-QSAR'. This framework aims to support future investigations by enabling algorithm selection tailored to specific application needs, enhancing current methods, and providing a comparative platform for analyzing various methodologies. The process of ML-QSAR starts with a systematic classification of QSAR modelling studies that utilize machine learning models, and is subsequently complemented by the establishment of criteria for assessment to measure the performance of these models[11, 12].

Conclusion

The combination of AI, ML, QSAR, and green chemistry promotes significant advancements in the PST and pharmaceutical sectors, enhancing both effectiveness and efficiency in development processes. This integration of diverse fields not only improves the accuracy and effectiveness of sensor design but also encourages sustainable methods in the discovery and development of pharmaceutical drugs. The collaborative synergy among these innovative methodologies presents significant potential for developing environmentally friendly products that are safer and inherently more sustainable. Through the reduction of toxic pharmaceuticals, these innovative methods seek to lessen their negative environmental effects, establishing a groundwork for future sustainable progress focused on protecting public health and conserving our precious planet's resources. By utilizing the best qualities of each discipline, the pharmaceutical sector can develop greater sensitivity, accurate, and eco-friendly sensor technologies that have the potential to greatly enhance production results and minimize the ecological impact of manufacturing pharmaceuticals.

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Article: 3

AI in Dental Health and Dental Surgery

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Abstract
The integration of artificial intelligence (AI) into dental health and surgery is rapidly gaining traction due to its ability to enhance diagnostic accuracy, treatment planning, surgical precision, and patient management. This research article reviews current AI applications in dental health, evaluates the effectiveness of AI-assisted procedures in surgery, and explores the challenges and future directions of AI integration in the dental field. The research focuses on diagnostic AI systems, machine learning algorithms in imaging, robotic-assisted surgeries, and preventive care technologies.
Keywords: Artificial Intelligence, Dental Surgery, Machine Learning, Robotic-Assisted Surgery, Preventive Care.

Introduction

Artificial intelligence (AI) has emerged as a transformative tool in healthcare, particularly in fields like radiology, cardiology, and now dentistry. AI has been adopted in all dental disciplines, i.e., operative dentistry, periodontics, orthodontics, oral and maxillofacial surgery, and prosthodontics. The majority of the AI applications in dentistry are for diagnosis based on radiographic or optical images, while other tasks are not as applicable as image-based tasks mainly due to the constraints of data availability, data uniformity, and computational power for handling 3D data. Evidence-based dentistry (EBD) is regarded as the gold standard for decision making by dental professionals, while AI machine learning (ML) models learn from human expertise. ML can be seen as another valuable tool to assist dental professionals in multiple stages of clinical cases. This review summarizes key research findings on AI's role in improving diagnostic accuracy, facilitating surgical interventions, and enhancing preventive care. We will also address the ethical challenges and limitations of AI integration into dental practice.

AI in dental diagnostics

Machine learning in imaging analysis

One of the most promising applications of AI in dental health is its use in the analysis of dental radiographs and 3D imaging. Machine learning algorithms, particularly convolutional neural networks (CNNs), have demonstrated accuracy rates surpassing those of traditional methods in detecting dental pathologies.

Dental caries detection: Research by Lee *et al.* (2021)[1] trained a CNN-based AI model to detect dental caries from radiographs. The AI model showed a sensitivity of 0.92 and specificity of 0.85, outperforming dental experts in early-stage caries detection.

Periodontal disease: Wu *et al.* (2020)[2] developed an AI system capable of identifying periodontal bone loss with an accuracy of 94%. The AI's capacity to recognize minute changes in bone density made it an essential tool for early intervention in periodontal disease.

Oral cancer screening: A study by Yadav *et al*. (2022)[3] used a deep learning algorithm to screen for early signs of oral cancer. Their AI model achieved a classification accuracy of 91%, which is significant given the typically late diagnosis of oral cancers in clinical settings.

AI in 3D orthodontics: Recent studies have also focused on AI's role in orthodontics. AI-based models are capable of predicting tooth movement and optimizing treatment plans. Kim *et al.* (2022)[4] explored AI-driven simulations that reduced orthodontic treatment time by 15% while achieving the same clinical outcomes.

AI-assisted dental surgery

Robotic-assisted dental procedures

AI-driven robotic systems in dental surgery are relatively new but show significant promise. By assisting in precision-based tasks like dental implants and endodontic surgeries, robotic systems powered by AI reduce human error and enhance patient outcomes.

Robotic dental implantology: Chen *et al.* (2021)[5] compared the success rate of AI-guided robotic dental implants versus traditional methods. Their study showed that AI-assisted systems resulted in a 98% success rate, reducing complications such as implant misalignment and nerve damage.

Minimally invasive extractions: AI-guided robotic systems have also been applied to complicated procedures such as wisdom tooth extractions. Research conducted by Zhang *et al.* (2020)[6] demonstrated that the use of AI-assisted robotic systems reduced surgery times by 20%, with fewer post-operative complications.

AI in laser dentistry

AI-based algorithms integrated with laser dentistry devices have improved the precision of soft tissue surgeries. Research from Al-Khateeb *et al.* (2021)[7] demonstrated that AI-powered lasers can dynamically adjust their intensity during procedures like gingivectomies, ensuring more precise cuts and faster healing times.

AI in preventive dental health

AI has a growing role in predictive and preventive dental care. By analyzing large datasets from patient histories, AI systems can predict future dental problems and suggest preventive measures.

Caries risk prediction: In a study by Muller *et al.* (2022)[8], an AI system was able to predict the likelihood of dental caries development based on a combination of patient data (such as diet, oral hygiene, and past dental history). The algorithm's predictive power surpassed conventional risk assessment tools.

Wearable devices: Wearable devices, equipped with AI algorithms, are becoming part of preventive dental care. For instance, real-time analysis of grinding patterns using AI wearables has helped patients with bruxism. Early alerts reduce long-term damage to teeth and jaw alignment.

Challenges and limitations

Data privacy and security

AI systems rely on vast amounts of patient data, raising concerns about privacy. Ensuring that AI systems comply with data protection regulations like the General Data Protection Regulation (GDPR) remains a critical challenge.

Ethical concerns: The possibility of AI replacing human dentists raises ethical concerns. While AI can assist in many areas, the human aspect of patient care cannot be entirely replaced. The ethical implications of fully autonomous dental systems require thorough consideration.

Bias in AI models

The accuracy of AI models depends on the diversity and size of the datasets used in training. Several studies have raised concerns about biases in AI systems, particularly when datasets lack demographic diversity. Biases can lead to inaccuracies in diagnosing conditions in underrepresented populations.

Future directions

AI in biomaterials: Research is exploring the combination of AI with biomaterials for regenerative dentistry. AI models could help optimize tissue-engineered constructs for dental restorations and implants.

Integration of AI with genomics: Future research may focus on combining AI with genetic data to develop personalized dental treatments, especially in fields like periodontics and orthodontics.

Autonomous dental systems: While AI-assisted systems dominate the current landscape, fully autonomous AI-driven dental surgeries may become a reality. Ongoing research is investigating AI's role in fully automating simpler procedures like scaling and polishing.

Although the future of AI in dentistry is promising, it is not without its challenges and ethical considerations. AI systems should be transparent, but not so much that sensitive information is exposed. It's important to establish who's responsible if AI-based recommendations lead to adverse outcomes. AI-based software must be approved by regulatory boards before it can be used in dentistry. The key takeaway is that by embracing AI as a tool to augment their skills, dental technicians will thrive in the future rather than being replaced.

Conclusion

AI in dental health and surgery is transforming the landscape of patient care by improving diagnostic accuracy, optimizing treatment plans, and enhancing surgical precision. Research supports the use of AI in both preventive care and complex dental surgeries. Despite challenges related to data privacy, ethical concerns, and the potential for bias, the continued development of AI technologies holds promise for more personalized, efficient, and accessible dental care.

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Article: 4

Leveraging AI for Global Health: A Path to Universal Well-being

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Abstract

Artificial intelligence (AI) is revolutionizing healthcare worldwide, promising to improve access, accuracy, and affordability of healthcare services. This article explores the potential of AI to enhance global health, focusing on early diagnosis, personalized medicine, and health equity. By examining key case studies and technological advancements, the article highlights the transformative impact AI can have on health outcomes. The study also addresses the challenges, such as ethical concerns, algorithmic bias, and data privacy, proposing future directions for research and development to ensure AI benefits everyone, everywhere.

Keywords: Artificial Intelligence, Global Health, Healthcare Access, Early Diagnosis, Precision Medicine, Health Equity, AI in Medicine, Ethical AI, Public Health

Introduction

The global healthcare system faces numerous challenges, from resource shortages in low-

income regions to the rising cost of care in more developed areas. In this context, AI has emerged as a powerful tool capable of addressing many of these challenges. Its application in healthcare ranges from improving early diagnostics to enabling personalized medicine and expanding healthcare access to underserved populations. Moreover, AI's potential to optimize healthcare systems and assist medical professionals offers a unique opportunity to address global health disparities.

This article investigates the role of AI in transforming healthcare on a global scale and explores the ethical, technological, and societal issues that come with it[1].

Methods

This article synthesizes a range of sources, including peer-reviewed studies, industry reports, and real-world case studies, to evaluate AI's potential impact on global health. The research focuses on three primary areas: (1) AI-driven diagnostics and personalized medicine, (2) AI's role in expanding healthcare access, especially in resource-poor settings, and (3) the ethical implications of widespread AI adoption in healthcare. Case studies of successful AI implementations in countries like India, Kenya, and the United States are analyzed to illustrate AI's diverse applications and outcomes[1, 2].

Results

The research findings indicate that AI can significantly improve health outcomes across various domains:

AI-driven diagnostics: AI algorithms, particularly in radiology and pathology, have shown exceptional accuracy in detecting diseases like cancer, cardiovascular issues, and infectious diseases. For instance, AI-based image recognition systems have been deployed in low-resource settings to assist non-specialist healthcare workers in diagnosing conditions such as tuberculosis and diabetic retinopathy with high accuracy.

Personalized medicine: AI is enhancing precision medicine by analyzing large datasets to predict patient responses to treatments, enabling personalized healthcare. This approach has led to breakthroughs in chronic disease management, such as diabetes and hypertension, particularly in developed countries, but the potential for global application remains.

Healthcare access and telemedicine: AI-powered telemedicine services have improved healthcare access in remote and underserved regions. For example, mobile health platforms in Africa use AI to diagnose conditions remotely, providing patients with care that would otherwise be unavailable. Additionally, AI chatbots offer 24/7 health advice, helping reduce the burden on healthcare systems.

Healthcare systems efficiency: AI has also proven effective in improving hospital workflows, automating administrative tasks, and optimizing the allocation of medical resources, thereby reducing the strain on healthcare providers[3].

Future Scope

While AI is making substantial strides in global health, further research and development are necessary to maximize its impact. Key areas for future focus include:

Addressing algorithmic bias: There is a need for more inclusive datasets to ensure that AI tools do not perpetuate health disparities across different demographics, particularly in terms of race, gender, and socioeconomic status.

Enhancing data privacy and security: As AI systems rely heavily on patient data, ensuring robust data protection frameworks is crucial. Future research should focus on developing AI models that are both effective and privacy-preserving, possibly through technologies like federated learning.

Integrating AI with global health policies: AI implementation should be aligned with global health policies, ensuring equitable access to AI-driven healthcare solutions, especially in low-income countries. Public-private partnerships will play a key role in scaling AI solutions in these regions.

Regulatory frameworks and ethical AI: To build trust and ensure the safe use of AI, governments and international bodies must develop comprehensive regulatory frameworks. This includes guidelines for ethical AI usage, transparency, and patient consent[4, 5].

Conclusion

AI allows us to reimagine how we deliver health and care to patients, improve outcomes, and accelerate universal health coverage. AI tools can help optimize vaccine delivery and community healthcare worker routes, thus enabling limited resources to have a maximal impact. Other promising AI tools have demonstrated ability to: predict burn healing time from smartphone photos; track regions of socioeconomic disparity combined with environmental trends to predict communicable disease outbreaks; and accurately predict pregnancy complications such as birth asphyxia in low resource settings with limited patient clinical data.

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Article: 5

Application of artificial intelligence in drug design

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Abstract

Artificial intelligence (AI) is a field of computer science that involves acquiring information, developing rule bases, and mimicking human behavior. The fundamental concept behind AI is to create intelligent computer systems that can operate with minimal human intervention or without any intervention at all. AI is integrated with these models to learn, understand, and analyze provided data. The rapid advancement of AI is reshaping numerous industries, with the pharmaceutical sector experiencing a notable transformation. AI is increasingly being employed to automate, optimize, and personalize various facets of the pharmaceutical industry, particularly in pharmacological research. Traditional drug development methods are known for being time-consuming, expensive, and less efficient, often taking around a decade and costing billions of dollars. The integration of AI techniques addresses these challenges by enabling the examination of compounds with desired properties from a vast pool of input drugs. Furthermore, it plays a crucial role in drug screening by predicting toxicity, bioactivity, ADME properties (absorption, distribution, metabolism, and excretion), physicochemical properties, and more. AI enhances the drug design process by improving the efficiency and accuracy of predicting drug behavior, interactions, and properties. These approaches further significantly improve the precision of drug discovery processes and decrease clinical trial costs leading to the development of more effective drugs.

Keywords: Artificial Intelligence, Pharmaceutical Sector, Drug Development

Introduction

The basic mechanism behind intelligent computers is artificial intelligence (AI), which utilizes machine learning (ML) to achieve its objectives. Machine Learning (ML) facilitates the development of intelligent systems through sophisticated mathematical processes applied to data via algorithms, enabling them to perform tasks without the need for explicit

programming. Thus, ML serves as a subset within the broader spectrum of AI and plays a pivotal role in its functionality. In contrast, deep learning (DL) employs a more complicated structure, incorporating complex algorithms and models inspired by the human brain. This advanced approach demands extensive computational resources and data for training, resulting in higher costs. It is widely understood that AI is the overarching goal, machine learning serves as the brain, and deep learning constitutes the soul of an artificial intelligence system. This sophisticated architecture is adept at processing unstructured data, encompassing documents, images, and text.

The traditional pharmacy system and its related processes were mostly dependent on manual processes and human expertise. This leads to many errors, time delays, inefficiencies, and manual operations. The integration of artificial intelligence (AI) in pharmacies has developed a transformative solution that automates various workflow aspects. It helps to automate assure quality, improve drug efficacy polypharmacology and personalized manufacturing with the least detected error. AI finds many applications in pharmaceutical science such as adverse drug reaction detection, clinical decision support systems, community pharmacy, market analysis, product positioning etc[1, 2].

The role of AI in drug design

AI is being integrated into almost every stage of drug discovery, from early target identification to the clinical trial phase. Below, we review the key areas where AI is making a profound impact.

AI in target identification and validation

Identifying the right biological target is crucial for drug development. AI facilitates this process by analyzing massive datasets from genomics, proteomics, and other "omics" fields to identify potential targets that may be involved in disease processes.

Data-driven target discovery: AI algorithms, particularly machine learning (ML) models, help identify patterns and relationships in complex biological data, uncovering novel drug targets.

Network biology: AI can analyze biological networks and molecular interactions to predict which genes, proteins, or pathways are relevant to a disease.

Lead compound identification and virtual screening

AI significantly enhances lead discovery by predicting the interactions between chemical compounds and biological targets.

Virtual screening: AI-driven virtual screening is used to rapidly evaluate millions of chemical compounds, identifying potential lead compounds with a high likelihood of success. Deep learning models can predict the binding affinity of small molecules to a target protein, speeding up the process significantly.

De Novo drug design: AI models, including generative algorithms such as variational autoencoders (VAEs) and generative adversarial networks (GANs), are used to design new molecules from scratch. These models generate novel compounds optimized for desired properties like efficacy, safety, and bioavailability.

Lead optimization

Once potential lead compounds are identified, they must be optimized for improved performance. AI assists in refining these molecules by predicting their behavior and interaction with the target.

Molecular docking: AI-powered molecular docking algorithms predict how a molecule binds to its biological target. This information is used to optimize the structure of the compound to improve binding affinity.

Pharmacokinetics and pharmacodynamics (PK/PD) modeling: AI models predict how a drug will be absorbed, distributed, metabolized, and excreted (ADME) in the body, as well as its potential toxicity, optimizing the drug for human use.

AI in clinical trials and precision medicine

AI is transforming clinical trials by enabling more efficient and precise study designs.

Patient stratification: AI algorithms can analyze large clinical datasets to identify patient subgroups that are most likely to respond to a specific drug. This stratification allows for more targeted clinical trials and improves success rates.

Trial optimization: Adaptive trial designs, driven by AI, allow real-time monitoring of trial data and the adjustment of variables such as dosage and patient selection to improve efficacy and reduce trial duration.

Drug repurposing

One of the most practical uses of AI in drug design is in drug repurposing-identifying new therapeutic uses for existing drugs. AI algorithms analyze large-scale biomedical data to uncover drugs that can treat conditions other than their original indication.

Pattern recognition for repurposing: AI identifies patterns in how different drugs interact with biological pathways, revealing potential new applications. For example, during the COVID-19 pandemic, AI was used to identify existing antiviral drugs that could be repurposed for treating the virus[3].

AI techniques in drug design

Several AI methods are employed in drug design, each with unique capabilities:

Machine learning (ML): ML models are widely used to predict drug-target interactions, optimize drug properties, and analyze complex biological data. Algorithms like random forests, support vector machines (SVM), and gradient boosting are commonly used.

Deep learning (DL): DL techniques, such as convolutional neural networks (CNNs) and recurrent neural networks (RNNs), are particularly effective in identifying molecular patterns and predicting drug efficacy and toxicity.

Natural language processing (NLP): NLP is applied to mining scientific literature and clinical data for insights into drug efficacy, potential side effects, and off-label drug uses.

Future perspective

The future of AI in drug design looks promising, with several advancements on the horizon:

Protein structure prediction: The recent success of DeepMind's AlphaFold in predicting protein folding with near-experimental accuracy is a major breakthrough. This advancement will enhance the design of drugs targeting previously uncharacterized proteins[4].

Integration of real-world data: AI will increasingly use real-world data from sources like electronic health records, wearable devices, and patient-reported outcomes to personalize treatments and improve drug efficacy.

AI-driven clinical trials: The design of fully adaptive clinical trials, where AI dynamically adjusts the trial parameters based on ongoing results, will become more prevalent. This could drastically reduce trial durations and costs while improving patient outcomes.

Collaborative AI models: Open-source AI platforms and collaborative models where pharmaceutical companies, academic institutions, and tech companies work together will accelerate drug discovery and improve the AI models being used[5].

Conclusion

Artificial intelligence is revolutionizing drug design by improving the speed, efficiency, and accuracy of the drug discovery process. From target identification and lead optimization to clinical trials and drug repurposing. AI is poised to become a central tool in the pharmaceutical industry. However, challenges such as data quality, model explain ability, and regulatory approval must be addressed to fully unlock AI's potential. As AI technology continues to evolve, it promises to transform drug discovery, offering new hope for the treatment of diseases that are currently difficult or costly to address.

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Article: 6

In What Ways May AI Enhance Global Health for All Individuals

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Abstract
Artificial Intelligence (AI) has emerged as a transformative force in healthcare, offering innovative solutions to improve health outcomes for populations worldwide. This article explores how AI can enhance health equity, focusing on personalized medicine, predictive analytics, telemedicine, and public health initiatives. Deploying AI in low and middle-income countries leapfrogs existing medical and public health infrastructure, adds essential capacity to countries with a dearth of doctors, public health workers, and aid specialists, and accelerates vaccine development that will dramatically improve health outcomes.
Keywords: Artificial Intelligence, Healthcare system, Medicine

Introduction

The potential of AI to revolutionize healthcare is immense. From diagnosing diseases to personalizing treatment plans, AI can enhance the quality of care and accessibility. This article examines how AI can improve health for everyone, everywhere, while considering the challenges that must be addressed to achieve equitable health outcomes. The benefits of using AI tool in solving day to day challenges in healthcare system are as follows:

Personalized medicine

AI algorithms can analyze vast datasets, including genetic information and electronic health records, to tailor treatments to individual patients. This personalization can lead to more effective interventions and improved patient satisfaction.

Predictive analytics

AI can identify patterns in health data, enabling the prediction of disease outbreaks and risk factors. By leveraging predictive analytics, healthcare providers can implement preventive measures and allocate resources more effectively, particularly in underserved communities.

Telemedicine and remote monitoring

AI enhances telemedicine platforms by providing virtual health consultations and monitoring systems. These tools improve access to healthcare, especially in rural or low-resource areas, allowing patients to receive timely care without geographical barriers.

Public health surveillance

AI-driven tools can analyze data from various sources, such as social media and health records, to monitor public health trends and detect outbreaks early. This capability is crucial for timely interventions and resource allocation during public health emergencies.

Health education and promotion

AI can deliver personalized health information and educational resources, empowering individuals to make informed health decisions. These interventions can target specific demographics, addressing health literacy gaps and promoting healthier behaviors.

Mental health support

AI applications, such as chatbots and mobile apps, can provide immediate mental health support and resources. These tools can help address the mental health crisis, particularly in areas with limited access to professionals[1, 2].

Future Prospective

The future scope of AI in enhancing global health for all individuals is vast and transformative.

Precision medicine

AI can analyze large-scale patient data to tailor treatments to individuals based on their genetic makeup, environment, and lifestyle. This personalized approach could improve treatment outcomes and reduce adverse reactions.

Early disease detection and prevention

By analyzing medical records, images, and genetic data, AI can detect diseases like cancer, diabetes, or heart conditions at their earliest stages, even before symptoms appear. AI-driven predictive analytics could also help in identifying populations at risk, enabling targeted prevention programs.

Remote diagnosis and telemedicine

AI-powered diagnostic tools and wearable devices can provide real-time health monitoring and remote consultations. This is particularly useful for underserved or rural populations with limited access to healthcare. AI could assist in delivering high-quality healthcare remotely.

Efficient drug discovery

AI can significantly speed up the process of drug discovery by predicting how different molecules will behave, reducing the time and cost of bringing new treatments to market. This is crucial for addressing global health crises and rare diseases.

Global health surveillance and epidemic management

AI can monitor global health data to detect and respond to disease outbreaks in real-time, improving the speed and effectiveness of interventions. AI models can also help predict the spread of infectious diseases and optimize resource allocation during pandemics.

Mental health support

AI-powered mental health apps and virtual assistants can provide continuous, personalized support for individuals struggling with anxiety, depression, or other mental health challenges. These tools could improve accessibility to mental healthcare worldwide.

Addressing health disparities

AI has the potential to reduce health disparities by providing affordable, scalable solutions that can be deployed in low-resource settings. For example, AI-driven mobile health platforms can offer diagnostics and healthcare guidance to populations without regular access to healthcare professionals.

Optimizing healthcare operations

AI can improve hospital efficiency by automating administrative tasks, managing patient records, and optimizing the allocation of healthcare resources. This could lead to reduced wait times and better patient care experiences globally.

Health education and awareness

AI can tailor health education content to individuals' specific needs, promoting healthier behaviors through personalized guidance. This can be especially impactful in areas with low literacy rates, where AI can adapt content to be culturally relevant and accessible.

Collaborative global research

AI can facilitate global collaboration by helping researchers analyze vast amounts of data, share findings, and develop solutions faster than traditional methods. This could lead to breakthroughs in understanding diseases that disproportionately affect certain regions or populations[2, 3].

Conclusion

AI has the potential to significantly improve health outcomes for populations worldwide, but careful consideration must be given to implementation challenges. By addressing these issues, we can harness the power of AI to create a more equitable healthcare system that serves everyone, everywhere.

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About RKDF University Ranchi

It was in the year 2018, **Dr. Sunil Kapoor**, the founder decided to fulfil his dream of establishing an institute for quality education to the people and the region & beyond initiated **"Ayushmati Education and Social Society"** trust in an attempt to make the holy city of Ranchi, a recognized destination for knowledge seekers from different spheres of life and strive to become one of the best Universities in Jharkhand. This is what led to the foundation of a milestone at the karmabhoomi of the versatile and sagacious **Bhagwan Birsa Munda**.

RKDF group has been actively involved with social causes since its very inception and has drawn appreciation from one and all for its works in various facets of societal paradigms. The Group started its journey in 1994 by establishing 1st private engineering college at Bhopal, Madhya Pradesh. Now the group has 162 institutions & 6 universities (Five in Madhya Pradesh and one in Jharkhand). The six universities and social society established by Ayushmati Education are **RKDF University, Bhopal** (2011), **Sri Satya Sai University of Technology & Medical Science, Sehore** (2014), **Sarvepalli Radhakrishna University, Bhopal** (2015), **Dr. A.P.J. Abdul Kalam University, Indore** (2016), **Bhabha University, Bhopal** (2018), **RKDF University, Ranchi** (2018). RKDF Ranchi is a highly prestigious government recoginized university established under the Jharkhand Govt. Act & registered under UGC 2f 1956. RKDF University, Ranchi is a recoginized member of AIU (Association of Indian Universities) and has publication house, named IJHESM (International Journal of Humanities, Engineering, and Science & Management) with an impact factor of SJIF-5.81.

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