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A comprehensive review of Artificial Intelligence

Gayatri J. khanderao *, Ravindra L. Bakal, Jitendra A. Kubde, Pooja R. Hatwar and Vaishnavi G. Karule

Department of Pharmaceutics, Shri Swami Samarth Institute of Pharmacy, At Parsodi, Dhamangaon Rly, Dist -Amravati (444709) Maharashtra, India.

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Abstract

In the past decade, Artificial Intelligence (AI) has revolutionized healthcare, particularly in response to the COVID-19 pandemic, which accelerated the demand for non-invasive and precise medical solutions. This review explores the evolution and multifaceted applications of AI, especially in dentistry, nano dentistry, radio oncology and pharmaceutical sciences. AI technologies such as machine learning, deep learning and computational chemistry have significantly improved diagnosis, drug discovery, patient management and clinical trial design. In dentistry, AI enhances precision in implants, diagnostics and treatment planning, while nano dentistry offers futuristic solutions like nanobots and lab on a chip system. The integration of AI in healthcare promises a future of increased efficiency, personalized care and improved patient outcome

Keywords: Artificial Intelligence (AI); Machine Learning; Dentistry Innovation; Drug Discovery; Nano dentistry; Clinical Trials Optimization

1. Introduction

In the past ten years, technology has experienced significant change. The COVID-19 pandemic has compelled humanity to create a lifestyle that is faster, non-explosive and controlled at the touch of a finger. Due to precautionary measures and the risk of infection in medical practice, there has been a demand for procedures that are non-invasive and minimally exposive for patients. In such situations, AI has proven to be a life-saving, wizardly tool. In 1956, at a workshop where he was recognized as the father of artificial intelligence, mathematician John McCarthy from Dartmouth university introduced the concept of AI [1]. In 1978, richard bellman characterized artificial intelligence as "the automation of activities linked to human cognitive abilities, which encompasses learning, decision making and problem solving [2]. Over the last few decades, this tool has made significant advances in dentistry and has seen increased demand during the COVID-19 phase, a trend that is expected to continue. This has altered the practice of dentistry in the 21st century by minimizing inaccuracies and enhancing precision. AI has proven advantageous in producing rapid clinical solutions, digitizing patient records and processing them through data-driven analysis, algorithms and machine learning [3]. AI and device-present day applications have integrated into medication in various ways, including, but not limited to, assisting in the identification of outbreaks of contemporary infectious diseases that can impact public health; integrating medical, genetic and many different laboratory outputs to identify rare business operation [4]. The emergence of fashionable artificial intelligence (AI), advanced deep learning (DL), contemporary machine learning (ML) and computational chemistry techniques in drug discovery has significantly influenced its success rate. The techniques formed by integrating these strategies, either individually or collectively, consist of a broad array of cutting-edge effective algorithms that improve the predictions [5]. Electricity algorithms and computation for generating new leads with therapeutic significance in the advanced drug design system are essential. [6].

* Corresponding author: Gayatri J. khanderao

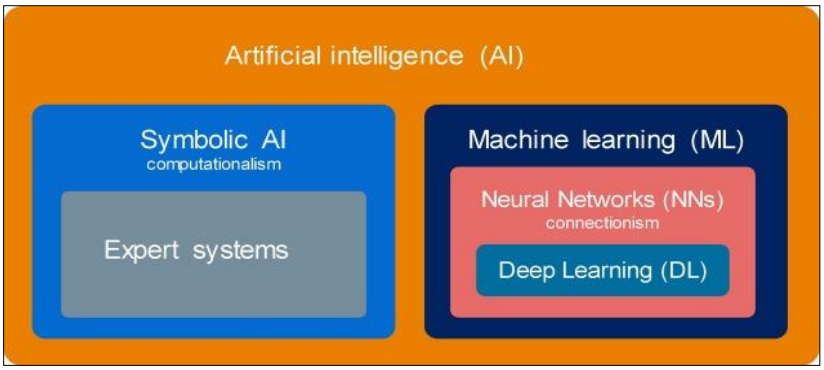

Figure 1 Artificial Intelligence

2. Types of Artificial intelligence: [7]

2.1. Depending on the quality and their existence

- Weak AI or artificial narrow intelligence; Strong AI or artificial general intelligence
- AI of the highest caliber
- According to presence (Four Primary Artificial Intelligence Types)

2.2. Relative Maschine

- Memory system with restrictions
- Understanding of mental states
- Selbstbewusstsein

3. Function of artificial Intelligence (AI) in these fields: [8]

- Diagnosis of illness
- Digital therapy/customized treatment
- Radio(chemo) therapy
- Retina
- Tumor
- Additional chronic conditions
- Pharmaceutical research
- Forecast of bioactivity and toxicity
- Trials of a clinical nature
- Planning clinical studies, pinpointing patients and enlisting and registering them;
- Monitoring of trial, adherence of patients and detection of end point.
- Predicting the course of an epidemic/pandemic.

4. Advantages of Artificial Intelligence Technology:

The potential benefits of Artificial Intelligence technology include the following

4.1. Accuracy Enhancement

AI helps to decrease errors and improve precision, leading to greater accuracy. Space exploration utilizes resilient metallic robotic entities that can endure harsh space conditions and withstand challenging atmospheric environments [9].

4.2. Challenging Expedition

Uses of AI in the field of pharmacy drug discovery and development AI has the capability to analyze extensive datasets to identify potential drug candidates, predict their pharmacological properties and optimize the drug discovery process.

The system's enhancement of knowledge about models can also enhance the optimization of molecular systems for drug design [10].

4.3. Routine Implementations

AI is useful in our daily tasks and behaviors. As an example, GPS systems are commonly used for long journeys and the incorporation of artificial android devices helps anticipate user input and correct spelling mistakes [11].

4.4. Infinite Possibilities

Machines function without restrictions and are free of feelings. These soulless machines can surpass humans in a variety of tasks, carrying them out with greater efficiency and accuracy [12].

4.5. Pharmacovigilance

AI can uncover and scrutinize adverse drug reactions, aiding pharmaceutical companies and regulatory bodies in identifying potential safety issues with medications more swiftly.

4.6. Drug Formulation

AI can enhance drug formulation, contributing to the development of more robust and effective medications with advanced drug transport structures.

4.7. Identifying Drug Interactions

AI can identify potential drug interactions and alert healthcare professionals to prevent harmful combinations of medications.

4.8. Patient Counselling

AI-driven chatbots or virtual assistants can provide patients with statistics and advice regarding their medicinal drugs and fitness conditions [13].

5. Application of Machine Learning:

5.1. Unsupervised Learning

Unsupervised learning within machine mastering, unsupervised mastering involves the challenge of seeking hidden patterns in unlabeled data. Because the examples provided to the learner are unlabeled, there are no errors or praise indicators to evaluate a correct answer.

5.2. DNA classification

According to genomics expert parent three, DNA microarray data indicates that the colors pink, green, gray and others reflect the extent to which different individuals possess or lack a specific gene. The aim is to create a group of diverse individuals, each possessing a specific gene. Thus, a clustering set of rules can categorize individuals into unique classes or distinct types of people [14].

5.3. Organizing larger computer clusters

Organizing larger computer clusters at large statistics centers, which consist of massive laptop clusters, unsupervised learning allows for the identification of machines that typically work together. This means that when these machines are prepared or in the event of a crisis, the data centers can operate more effectively [15].

5.4. Health documentation

As automation has come in, digital medical records have gained popularity. Thus, if scientific facts are converted into clinical knowledge, diseases may be better understood [16].

5.5. Supervised learning

5.5.1. Email data email batch detection

The issue of identifying sets of emails that have been generated according to the same template must be dealt with. This inconvenience is motivated by the decision to eliminate spam more effectively by leveraging collective data about entire batches of simultaneously generated messages [17].

6. Dental implant

The success of navigational implant placements is evident in their ability to reduce the occurrence of maxillary sinus perforations; other chronic complications related to the sinus cavity and infections. A dynamic navigation device was utilized along with planning data and cone beam computed tomographic (CBCT) images for surgical implant insertions [18].

7. Nano dentistry

Nano dentistry includes nanomaterials, biotechnology and dental nanorobotics aimed at preserving comprehensive oral health [19]. Because of their size, nanobots operate at the atomic, cellular and molecular levels. In endodontics and conservative dentistry, it can be utilized for cavity preparation, restoration and other purposes. In orthodontics, it can assist with single sitting alignments, while in periodontics, it provides alternative methods for inducing controlled oral analgesia and manipulating tissues to support restorative and periodontal treatments [20]. Denti robots can help maintain oral hygiene by eliminating pathogenic bacteria and removing plaque. This can alter methods of drug delivery through nanoencapsulation and offer innovative approaches to bone grafting. Moreover, it can provide us with enhanced dental materials through nano solutions in the near future. This includes recent innovations in dentistry, such as the lab on a chip, which may become sought after in the future. Lab on a chip utilizes saliva to identify morphological, biophysical and biochemical nanoscale characteristics of the tooth surface or oral fluid, aiding in the diagnosis of disease susceptibility, including dental caries and oral cancer [21].

8. Future of artificial intelligence in dentistry

In the future, all dental practitioners will adorn AI. Patient records and diagnostic data can be saved virtually through the prudent application of machine learning. This will aid patients in preserving health track records and enable practitioners to share data with colleagues for consultation and case discussion without difficulty. In the future, advanced technologies will greatly assist dentists by saving their valuable time, providing a streamlined workflow and enhancing their precision. AI exhibits reduced bias and enhanced judging probability, making it an excellent assistant for dentists in analyzing diseases, diagnosing them and formulating optimal treatment plans based on gathered evidence. A clinician, however, retains the responsibility for making the final decision. In the future, utilizing dental insurance for AI could prove advantageous. By uploading radiographs and CT scans, insurance companies will gain more transparency and patients will experience a faster claims process, leading to increased benefits for patients and reduced losses for practitioners. More recent innovations would assist clinicians in mastering treatment plans. It is anticipated that nanotechnology will produce additional marvels in dentistry, utilizing robots and nanobots to assist dentists rather than supplant them. The catalytic antimicrobial robots (CARS) are set to improve the upkeep of oral hygiene. The development of 3D printers is transforming prosthetics and surgery by delivering desired biocompatible components in a remarkably short timeframe and making the procedures more affordable [22].

9. Artificial intelligence in radio oncology

Recent technological advancements in automated treatment planning provide substantial benefits for radiotherapy treatment planning. It increases the quality and consistency of the plan and reduces the frequency of errors. The treatment process can be divided into three parts: application of automated rules, modeling of past clinical knowledge and multi-criteria optimization. Clinical guidelines can be implemented by a basic computer program with predefined structures. The treatment planning system can examine a patient's anatomy and physiology and imitate the reasoning process usually employed in manual treatment planning. Radiomics can be applied to predict outcomes and assess toxicity in individual patients receiving radiation therapy [23].

10. AI utilized in the design of clinical trials

Clinical trials are conducted to assess the effectiveness and safety of pharmaceutical products in humans for a specific disease condition. This laborious process may require 6 to 7 years or even more for completion and it will also necessitate a considerable financial investment. In addition, the success rates are unacceptably low, placing a considerable burden on the industry. Failures can stem from a flawed patient selection strategy, inadequate infrastructure or missing technical requirements. AI integration can lessen these errors AI is capable of performing all phases of clinical trial design, which encompasses study preparation and execution. This could raise the success rates of trials and lessen the burden of pharmaceutical research and development. In order to achieve ethical and benchmarked results, the incorporation of AI into clinical trials must be reviewed first. With the appropriate strategy, it is possible to lower trial costs and failure rates, as well as accelerate the process. AI can assist in choosing individuals with particular health conditions for phase II and III studies through the analysis of patient-specific genome exposome profiles [24].

11. Pharmaceutical marketing

Pharmaceutical marketing AI is already being used in e-commerce and other marketing strategies for successful campaigns. Pharmaceutical companies can use similar tools and techniques to grow and efficiently serve their market. AI strategies in pharmaceutical marketing can significantly boost total profits [25]

12. Conclusion

Artificial intelligence (AI) is rapidly transforming the fields of dentistry and pharmaceuticals by providing innovative, precise and efficient solutions. From enhancing diagnostic accuracy and facilitating personalized treatments to streamlining clinical workflows and accelerating drug discovery, AI has proven to be an invaluable asset. The integration of machine learning techniques enables predictive analytics, improved health documentation and optimized patient management. In dentistry, AI-driven systems support implant placements, nano dentistry and digital diagnostics, promising a future of minimally invasive and highly effective oral care. Meanwhile, in pharmaceuticals, AI contributes significantly to drug formulation, pharmacovigilance and clinical trial design, improving outcomes while reducing time and cost. The use of AI in radiotherapy and patient-specific treatment planning is revolutionizing cancer care.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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