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Artificial Intelligence: A Boon to Conservative Dentistry

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ABSTRACT

The goal of these researches was to examine and review artificial intelligence in the field of conservative and endodontics. Since the last two decades it has been observed that, the area of artificial aptitude has seen tremendous advancement and growth. Artificial intelligence is becoming more prevalent in fields formerly regarded to be the domain of human specialists. When used for medicine and dentistry, artificial intelligence has immense latent to improvise patient maintenance and change profession. Artificial intelligence advancements enable the processing of massive amounts of data, leading in more accurate data and better decision-making. Every day, technology advances and the newest advancements in Artificial Intelligence have made dental operations faster and less intrusive. With the emergence of the ANN, the area of machine learning has taken a dramatic turn in recent years. Artificial Intelligence (AI) has potential to transmute health-care business and improve patient care. AI is being studied for a number of applications, including the detection of normal and divergent structures, illness diagnosis, and therapy prediction.

Key words: Artificial intelligence, Machine learning, Artificial neural network

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INTRODUCTION

Artificial neural networks area type of computer processing system that is highly influenced by the way biological systems operate. It is made up of artificial neurons which arise from biological neurons. Artificial neural networks are composed of a large number of interconnected computer nodes whose work is merged in a certain pattern in response to learn from the input and optimize final yield [1-4]. The human brain's operation is represented by an artificial neural network. Artificial neural networks are known for being adaptive in the sense that they alter as to gain experience from their original instruction and in future runs to supply new information about the environment [5]. The covered layer makes judgments based on the decisions of the preceding layer and assesses how a proposed modification within itself improves the final output, a process known as learning. In image processing jobs, there are two basic learning patterns: supervised and unsupervised learning. Learning with pre-labelled inputs that operate as targets is referred to as supervised learning. The absence of labels in the training sets distinguishes unsupervised learning from supervised learning. The primary advantage of these systems is their capacity to tackle issues that are too complicated for traditional approaches to address [6].

In medicine and dentistry, the convolutional neural network has been assumed to be most frequently used subclasses of ANN [7]. In the extent that they have been made up of neurons that learn how to enhance themselves, deep neural networks are similar to standard artificial neural networks. The main difference between convolutional neural networks also traditional artificial neural networks is that convolutional neural network remains commonly employed to identify patterns in images [4]. In spite of the fact that it has been concluded 30 years since the initial convolutional neural network was developed, current convolutional neural network designs maintain many of the same characteristics as the original, such as convolutional and pooling layers. Convolutional neural network may adjust to a variety of input sizes [8].The three types of layers that make up a convolution neural network are convolution, pooling, and fully connected (CNN) [9].

Artificial Intelligence (AI) is also a part of science and engineering concerned with the study of intelligent behaviour using computers, as well as the design of products that exhibit this behaviour [10]. Artificial intelligence as well as neural networks is rapidly being

employed in dentistry [11]. In dentistry, it is utilized to identify and detect various characteristics from photographs, such as tooth decay and implant placement [12]. Artificial Intelligence (AI) is rapidly-emerging skill that allows robots to carry out the activities that have been previously performed by humans [13]. Developed a particular interest as well as reduces the number of procedures which are no longer mandatory are just two techniques for raising one's quality of life [14]. It also has the potential to dramatically increase diagnosis accuracy when utilized in the fields of medicine and dentistry. During the last two decades, the machine learning has progressed and grown tremendously. It seems to have enormous help to improve patient treatment as well as modify the health care field even before applied to medicine and dentistry. It's being considered in dentistry to identify normal and pathological features, diagnose infections, and predict treatment response, among several things. It is widely employed in dental laboratories, and it is also becoming more prevalent in dental education [15].

The most widely used machine learning branches in clinical medicine include deep learning and, most subsequently, profound learning [16]. It's a type of AI that enables computers to learn and grow without being explicitly programmed [17]. It is a field of artificial intelligence in which a system learns to do intelligent tasks without the use of past knowledge or pre-programmed rules. It relates to the capacity of deep Neural Networks (ANNs) to adapt from events to make predictions based on the information gathered [5].

Neural network is a type of machine learning for which the software attempts to gain a network of reusable components structures that depend on each other instead of a particular structure [15]. It is the process of arranging numerous hidden layers on top of each other [4]. It has a more complicated technique of linking layers than conventional networks, as well as a higher number of neurons to express complex models, greater computer power to train, and automated feature extraction [18].

Because the ANN is a new technology, it may be utilized for data analysis in areas like pattern recognition, prediction, and system identification and control [19]. Because of its numerous potentials, Artificial Intelligence can produce tremendous discoveries and breakthroughs for mankind in this way. The research implies that Artificial Intelligence (AI) can provide genuine value to our lives [20]. In recent years, development in the field of image processing utilizing neural networks has obstructed [4]. When it came to diagnosing dental cavities in periapical radiographs, a deep CNN algorithm performed well [21]. AI is already one of our economy's most important technologies. It will bring about changes similar to when the steam engine or electricity were first introduced [22]. Diagnostic and treatment expenses might be reduced, alleviating the strain on health care system caused by an ageing society and an increase in the number of complicated chronically sick patients.

LITERATURE REVIEW

Caries detection

A number of studies have discovered that those from low-income and socially marginalized groups are more prone to develop dental caries. Dental caries has been commonly accepted as one of the most frequent infection, affecting over 90 percent of total global population therefore, and many people's lives all over the world [21]. Oral disorders are the fourth most costly disease to treat in developed nations; according to the WHO [23]. The traditional approach for caries detection involves utilizing a dental probe and depends mainly on naked eye examination. Cavitation, periodontal bone loss, and periapical disease have been diagnosed through radiographs, although enamel caries can only be diagnosed if more than half of the enamel width is destroyed. Multiple techniques for recognizing and treating dental caries are now being developed to overcome problems with clinical and radiological identification, such as fibre optic trans-illumination and ultrasonic caries detectors. Visual inspection is the most common method for detecting caries in day-to-day clinical practice since it is a straightforward technique with no added costs. Because graphic investigation provides good overall accuracy and a high value used for specificity, we advocate using it alone in clinical practice without the use of an auxiliary approach Caries in the mouth is a self-motivated procedure that involves rotations of demineralization and remineralization. Detecting early carious lesions or providing therapy to avoid more invasive therapies is the primary goal in dental practice [12]. Several investigations have been using machine learning as well as variety of dental photographs to explore the field of dental caries detection [24]. Such techniques have lot of potential for detecting and diagnosing oral cavity lesions that go unobserved by the human eyes. As a result, they're gaining some resistance in the dental field [25]. Dental caries can also be detected by convolutional neural network. The addition of bitewing radiography to the diagnosis provides further information [26]. The property of light scattering is used in Fibre-Optic Trans Illumination (FOTI) to improve the difference among normal and infected enamel [27]. The International Caries Detection and Assessment System (ICDAS) is a unique method for evaluating dental caries that has been developed economy recent studies into clinical caries detection methods as well as other sources. Acceptance of integrated and usefulness considerations within a caries detection & evaluation system is important to the future development of ICDAS. It's tough to put a complicated because the procedure is constant and can also be observed, it is really easy to place a condition like tooth caries on something like a spectrum.

DISCUSSION

In the healthcare sector, artificial intelligence has several applications. In healthcare, artificial intelligence is being utilized to build highly experienced computers capable of

spotting cancer cells. Radiographic pictures are commonly used by endodontists to inspect, measure, and assess the status of the tooth below the gingival margin. Because of its exclusive capability to acquire it gives significant advantage in head and neck modalities [28]. It is also helpful in providing consultations to general practitioners in order to align crowded lower teeth [29]. In dentistry, AI is utilized to recognize and detect many characteristics from photographs, such as tooth decay and implant [12]. In terms of patient care, it can help to manage and retain patient records through a virtual database that also includes appointment frequency. Traditional neural networks have demonstrated a potential capacity to recognize and identify anatomical features in radiography [30]. Dental caries can also be detected by convolutional neural network [21]. In orthodontics the patients with malocclusion, an artificial neural network was utilized to evaluate necessity for tooth extraction before orthodontic therapy. Chemical stability, resistance to abrasion, and flexure strength in restorative dentistry also can be examined using artificial neural network [31]. In prosthetic and restorative dentistry, it allows you to create inlays, on lays, crowns, and bridges in less time and with fewer errors [32]. Digital smile design aids in the pre-visualization of new smile designs before the treatment, as well as assisting the dentist in developing a more effective treatment plan for the patient [3]. Bio printing, technology allows viable tissue and sometimes even organs to be produced in successive slim cell films, is another application [28]. In periodontitis patient with acute and chronic periodontitis can be classified using ANN based on their immune response profile [33].

Advantages: In dental practices procedures can be made more uniform [32]. Diseases can be diagnosed very accurately. Artificial intelligence can save time [25]. Improve the flow of work of radiology department by recognizing patients who are probably going to miss meetings précised schedule and providing personalized support. It's a useful tool for recognizing patterns, anticipating occurrences, and organizing items [34]. Using machine learning to analyses medical data directly can help to reduce mistakes caused by human error [35]. It can also help by recurring reminders for patients on tobacco or smoking cessation programs. Taking care of the paper work and insurance [28]. It presents a novel approach for solving difficulties. It is more capable of handling information than humans.

Limitations: It is not possible to adapt to new machine or imaging software right away [35]. Not all algorithms used are suitable for experimental usage. More trials are needed to identify appropriate systematic algorithms for various scenarious. When shown pictures outside of their set of knowledge, it is necessary to have a very large and good record of information; if not, it may result in extraneous replies [34]. It is not able to rapidly adjust to new imaging software or a new computer. More trials are needed to identify appropriate analytic algorithms for various circumstances [35]. Personal data from patients is required for both the primary training of AI algorithms with the ongoing validation and enhancement of those algorithms. In order to participate AI into medical procedures, the system must be modified to safeguard individual privacy and confidentiality [36]. Data that has been incorrectly tagged can lead to poor outcome [37]. The practice of AI in health care may still be in its early days and still require significant requirements [38]. Despite the capacity to take these steps, the health-care sector remains doubtful about secure data exchange [39-43].

CONCLUSION

Despite the fact that several researches have proven Artificial Intelligence might be used in dentistry. For various specialists and dentists, AI has been regarded as useful tool [1]. Clinical use of AI approaches may be possible in the future, but more basic research is required to overcome current restrictions. Artificial intelligence employs a wide range of methodologies, and it is still in its early stages. As a result, AI benefits "Will AI replace practitioners in the future?" is a prevalent question that arises in the minds of practitioners. Today, the response would be "No." Rather, it will undoubtedly improve a practitioner's ability to handle difficult circumstances. According to academics, AI represents the future of assisting physicians in integrating several disciplines of expertise in order to provide better patient care. Dentistry and especially dental research have a significant character to play in certifying that AI progresses dental treatment by decreasing costs, profiting patients, workers and society as whole. The foundation for successful treatment of any disease is accurate diagnosis. Artificial disease's etiology is complicated. Its requests in each field are intensifying on a daily basis. Even though AI systems are thought to help in the field of dentistry and dental education, biological process are distantly more complicated, and AI systems will never replace human acquaintance, proficiency or decision-making capacity. Clinical use of AI approaches may become possible in the future, but more basic research is needed to overcome current restrictions. Thus, artificial intelligence is fast growing field in dentistry.

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