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Can Artificial Intelligence be Easily Accessible in General Dentistry in the Near Future…? Review of Literature

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Abstract:- Any computer or technology that can simulate human cognitive abilities like problem-solving is said to have artificial intelligence. It is used to develop a computer programme that can easily mimic human intellect and perform specific tasks. Convolutional neural networks and/or artificial neural networks are the sorts of AI that have demonstrated several programme and forecast the success of therapeutic methods.

This overview demonstrates how quickly artificial intelligence and the use of neural networks have developed in recent years. Higher efficiency, accuracy, and time savings are advantages of this method at various stages of the diagnosis, prognosis, and treatment plans. In order to integrate neural networks into routine practice and to make it easier, more research and improvements are required for their application in dentistry.

Keywords:- *Artificial Intelligence (AI), Neural Networks (NNs), Convolutional Neural Networks (CNN), Multilayer Perception (MLP), Deep Learning.*

I. INTRODUCTION

Artificial intelligence (AI) is becoming increasingly important in dentistry nowadays. It could be helpful in many areas where new technologies can help and support people. The first AI tendencies emerged in 1943, but John McCarthy coined the phrase "artificial intelligence" in 1956 at a meeting in Dartmouth. Artificial intelligence is divided into three subsets: deep learning, neural networks, and machine learning. Through knowledge gathering and the creation of algorithms, machines are able to solve problems without human assistance. In a mathematical nonlinear model, neural networks (NNs) imitate the human mind by using artificial neurons that resemble human neural networks. NNs are able to mimic human cognitive functions such as problem-solving and human reasoning, which include learning and decision-making. Three layers make up a neural network: the input layer (where information enters the system), the hidden layer (where information is processed), and the output layer (wherein the machine comes to a decision on what to do). Given the proper mathematical structures, NNs can define any input to an output. Such NNs may be trained to represent the underlying statistical figures of the supplied information if an accurately large number of data is available. Multilayer perception (MLP) neural networks are more complex artificial neural networks that have additional hidden layers. Artificial neural networks (ANN), convolutional neural networks (CNN), and recurrent neural networks are the three most often utilized types of neural networks. Deep learning, a component of neural networks, allows the computer to learn how to interpret information on its own. Within the buried layer of deep learning neural networks, there are between a few thousand and a few million neurons [1–5]. Due to advancements in technology and digitization, artificial intelligence is becoming more prevalent in dentistry. In many dental specialties, second evaluations can now be performed using computers. In dentistry, NNs can be utilized to increase diagnostic' precision, speed, and effectiveness. Fast advancement and fresh research on neural networks in dentistry were the driving forces for the creation of this review.

II. REVIEW

Since dental caries is the most prevalent dental condition, disclosing it as soon as possible is important. Neural networks may help diagnose dental caries on radiological images, allowing for a faster and more accurate examination. Although the use of neural networks in conservative dentistry has grown significantly, it isn't necessarily widespread yet.

Artificial intelligence can now be used to help with routine diagnosis and treatment method selection. While more research is needed to integrate new technologies into daily activities, neural networks in decision-making could be useful in a variety of restorative dental sectors.

In endodontics, artificial intelligence is expanding quickly. It may help in periapical lesions and root fracture detection, evaluation of the root canal morphology, prediction of the viability of dental pulp stem cells, and prediction of the success of retreatment treatments [6]. For making decisions, artificial neural networks can be utilized to locate the minor apical foramen on radiographs. Because of the bacterial infection of the root canal, apical periodontitis is a particularly inflammatory condition.

Through radiographic diagnostics, it can be identified as periapical translucencies, also known as periapical lesions. Deep learning was utilized by Setzer et al. in their experiments to find periapical lesions on cone-beam

computed tomography (CBCT) images. Finding the lesions correctly increased to 93% [7]. Maximum is determined from periapical or panoramic radiographs and cone-beam computed tomographic images to demonstrate periapical translucencies [8,9]. In Orhan et al investigations CNN was heavily used to find periapical lesions on CBCT images. Out of 153 periapical lesions, 142 were found by the convolutional neural community (92.8 accuracies). The results obtained through CNN were identical to those obtained from a qualified dental professional [10]. A specialized form of the artificial neural community called a convolutional neural community (CNN) is highly helpful when extracting capabilities from a picture using alluring convolutional techniques. In the investigation by Pauwels et al., these convolutional neural networks had been used. To find periapical lesions formed in bovine ribs, the periapical radiographs have been examined. The results were compared to the findings of three oral radiologists, and CNN verified an extremely high accuracy of 87% [11].

Artificial neural networks may also be employed in non-radiological fields such as genetics or others to facilitate analysis, in addition to dental radiology [12]. Orthodontics is a profession where artificial intelligence is becoming increasingly prevalent. Artificial neural networks (ANN), convolutional neural networks (CNN), assist vector machines (AVM), and regression algorithms are the algorithms that are most frequently utilized in orthodontics [13]. According to studies, deep-learning neural networks are utilized to identify TMJ osteoarthritis. It appears that orthodontics can make extensive use of artificial intelligence, and its beneficial applications may last even longer. Neural network simulations can help surgeons and orthodontists improve their treatment plans [14]. The detection of odontogenic lesions might benefit from deep learning. Convolutional neural networks can also be used to determine the extent of treatment on panoramic radiographs and to assist dental implant manufacturers [15]. Convolutional neural networks can be used to evaluate the optimal osseointegration. Finally, a study has graded peri-implant bone loss using artificial intelligence [16]. Due to the need for extreme precision and precise planning, implantology in particular is a branch that is growing very quickly and using neural networks is possibly very useful in daily exercise. A few writers have employed neural networks to reduce analysis errors. Dental periapical radiographs can reveal peri-implant bone loss, however, the problem is that the boundaries of bone around the implants are frequently ambiguous or the margins can overlap. Convolutional neural networks can therefore examine dental periapical radiographs to determine the marginal bone level, top, and apex of implants. In addition to scientists, physicians may find the usage of neural networks in periodontology valuable in their daily job. When doing a periodontal analysis and developing a treatment plan, the precise evaluation of bone loss may be essential.

III. CONCLUSION

One area of medicine where new technology is developing swiftly is dentistry. In dental radiology today, artificial intelligence and neural networks are mostly used to facilitate analysis, treatment planning, and the consequences of the therapy. Neural networks are also employed in many other areas of dentistry, including genetics, psychology, microbiology, and a great deal more. Artificial neural networks and convolutional neural networks are the two neural network types that are most frequently employed. This analysis reveals that artificial intelligence has developed quite quickly in recent years and could become a common tool in modern dentistry in the near future. Higher efficiency, accuracy, precision, increased monitoring, and time savings are all advantages of this approach. In order to integrate neural networks into a routine dental practice, more research is required.

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