Is there A Scope of Artificial Intelligence in Dentistry

Neelam Noel Andrade
Email Id : chiefeditor.nhdcjcd@gmail.com

Machine learning and deep learning are the two branches of artificial intelligence commonly used in medicine. Systems perform tasks without prior knowledge in machine learning. Whereas in deep learning, machines not only learn a pattern but also the hierarchy of patterns that build on each other. Convoluted neural network (CNN) is, a sub class of deep learning which uses mathematical operation and special neuron connection to analyse digital signals.[2]

Artificial intelligence can have a huge potential in a field like dentistry that requires a lot of supportive assistance. AI applications range widely from diagnosis to predicting the treatment outcome. It is now evident that AI can be useful in all the specialities of dentistry.

Clinical applications in dentistry:

In Maxillofacial Radiology: CNN based AI systems are able to detect tooth number in a periapical radiograph; dental carious lesions with an accuracy of 74.5-97.1%.[2] Similarly AI systems can identify proximal carious lesions in bite wing radiographs and root caries, periodical radiolucencies, maxillary sinusitis, osteoporosis in panoramic radiographs[1,3,4]. CNN based system also has the ability to diagnose sjogren's syndrome on CT images, higher diagnostic accuracy has been reported in diagnosing lymph node metastasis in CT images[1,3]. Whereas deep learning can create super resolution magnetic resonance imaging which can detect the disc perforation in TMJ disorders.[5]

In Orthodontics: AI based systems are instrumental in orthodontic treatment planning and predicting the treatment outcomes. They can be used to determine the need for orthodontic teeth extraction. AI can also identify cephalometric landmarks using cephalometric radiographs [1,3,4]

In Endodontics: AI can be used to determine the working length; extra canals, vertical fractures on CBCT. [3,4,6]

In Periodontics: Apart from identifying bone loss in panoramic radiographs, CNN based systems correlate systemic health to periodontal health. Studies reveal that it can differentiate between aggressive periodontitis and generalised periodontitis by using immunologic parameters like leukocytes, interleukins and IgG titres[1]. Periodontally compromised teeth can be identified using CNN based systems, premolars more accurately than molars thereby predicting the need for extraction of teeth.[3]

In Maxillofacial Prosthodontics: AI has found its use in shade matching. CAD CAM unit enables computer to design and manufacture or mill according to patients individual needs.

Implant systems can be integrated into panoramic imaging by using deep learning object detection. Bionic eye, was developed in the United states which uses a smart camera mounted on glasses and enables user to read and recognise faces.[6]

In Maxillofacial Surgery: post operative facial swelling following third molar extraction can be predicted using AI based system. Confocal laser endomicroscopy images allow early detection of oral squamous cell carcinoma[7]. AI is a useful tool in predicting the facial alterations after orthographic surgery[1,3,5]. CAD CAM technology has been tried in manufacturing orthodontic and surgical splints required during orthognatic procedure. Machine learning allows to measure the dimensions of airway space thereby influencing the treatment for obstructive sleep apnoea syndromes.[2]

Oral Pathology: CNN has an ability to detect tumoral tissues in tissue samples or radiographs. It can distinguish between ameloblastoma and odontogenic keratocyst in 38secs compared to specialists who took an average time of 23.1 min.[1,3]

Forensic Odontology: CNN based systems can be used in staging lower third molar which helps in estimating the age of a person. Gender and age can be determined more accurately using AI.[2,3]

Apart from these, AI based augmented reality in clinical setting can be conveniently used to reduce patient anxiety. AI based patient analyser is a useful tool in planning the treatment based on a patient's age and expectations. AI can also help address the limited resources available.[6]

Though artificial intelligence has many applications in dentistry it is still not routinely used because the human to human interaction, empathy which are key to deliver health care cannot be replaced by machines. Data sharing required as a part of AI does not meet health care privacy needs. Besides complete reliance on AI based systems can have questionable consequences in case of unintentional errors caused by technology.[8,9,10]

However, given the number of benefits of artificial intelligence in dentistry, it has a potential of eliminating dental assistants from the clinics in the near future. AI can play a tremendous role in enhancing the accuracy in diagnosis, predicting treatment outcomes and catering individual needs. Artificial intelligence has made inroads in field of medicine especially research and would be beneficial in the field of dentistry as well.

Editorial

The editorial aims at bringing out the promising future of artificial intelligence to the dental fraternity If Siri and Alexa can play you a favourite song then why not be your aide in dental clinical practice? Today this is a possibility through artificial intelligence (AI), an applied branch of computer science that equips machines with an ability to mimic intelligent human behaviour. [1-3]

The term "artificial intelligence" was coined by John McCarthy, an arithmetician in 1955. Though introduced in 1950s, it did not gain popularity until 1997 when IBM launched 'DeepBlue' project which beat the world chess champion Gary Kasparov. Later in the early 21st century the applications of artificial intelligence expanded into various fields including medicine. [2]

Conflict of interest : Nil

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