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"WHAT THE FUTURE OF ARTIFICIAL INTELLIGENCE (AI) HOLDS FOR US IN DENTISTRY — A REVIEW"

Dentistry

Dr. Ami Patel* PG Student, Department Of Periodontology, Government Dental College & Hospital Ahmedabad *Corresponding Author

Dr. Neeta V. Bhavsar Head & Professor, Department Of Periodontology, Government Dental College & Hospital Ahmedabad

Dr. Nilam Brahmbhatt Associate Professor, Department Of Periodontology, Government Dental College & Hospital Ahmedabad

Dr. Kirti Dulani Associate Professor, Department Of Periodontology, Government Dental College & Hospital Ahmedabad

ABSTRACT

Artificial Intelligence (AI) is a branch of computer science that aims to understand and build intelligent entities. AI provides machines with the capability to adapt, reason & provide solutions. AI is classified into 2 broad categories – Weak & Strong both having numerous applications. In healthcare field AI can save lives & improve health care for millions of patients around the world. In Dentistry AI application technology is progressing remarkably.

KEYWORDS

Artificial, Intelligence, Dental

Imagine this, a machine that can organize our cupboards as we like it or serve every member of family with customised cup of coffee, that makes our day easy going. All these and many more are miracles of Artificial Intelligence.

Why use the term Artificial Intelligence?

AI is a branch of computer science that aims to understand and build intelligent entities, often instantiated as software programs.[1]

AI has been described as the "fourth industrial revolution," which uses computer technology to simulate intelligent behaviour, critical thinking, and decision making similar to humans.[2,3]

These machines are artificially incorporated with human like intelligence to perform tasks as humans do. This intelligence is built using computer algorithms and mathematical functions but AI may not be as obvious as in the previous examples. In fact AI is used in smartphones, cars, social media, medical fields, video games, banking, surveillance and many other aspects of our daily life. So, the real question is what does an AI do at its core?

Suppose we built a robot in our lab, which is now dropped onto a field in spite of a variation in lightning, landscape & dimensions of the field, the AI robot will perform as expected. This ability to work appropriately to a new situation is called Generalised Learning. Assuming that the robot is now at a crossroads one that is paved and the other rocky, the robot must determine which path to take in light of the circumstances.This portrays the robots reasoning ability.Imagine after a short stroll the robot now encounters a stream that it cannot swim across using the plank provided as an input.The robot is still able to cross the stream, so our robot uses the given input & finds the solution for problem. This is problem solving.

These 3 capabilities make the robot Artificially Intelligent:

In Short AI provides machines with the capability to adapt, reason & provide solutions.

AI is classified into 2 broad categories:

Weak AI is also called narrow AI which focuses on one task. For example, Tim is a maestro of the carrom but you can't expect it to be even remotely good at chess. This makes Tim a weak AI. You might say Alexa is definitely not a weak AI since it can perform multiple tasks. Well that's not really true when we ask Alexa to play music, it picks up the keywords play and song name & runs a program it is trained to.Alexa can't respond to a question it isn't trained to answer.

Second category is Strong AI, this is similar to the robots that only exists in fiction. As of now ultron from avengers is an ideal example of a strong AI that is because it is self aware & eventually even develops emotions.This makes the AI response unpredictable.

Artificial Intelligence in Health Care:

AI has the ability to revolutionise & personalise targeted health care for individual patients.AI can save lives & improve health care for millions of patients around the world.AI is helping in making personalise delivery of care, make hospitals more efficient & improve access to health care by providing accurate decision making tools.The model learns from complex & large patient data in a training process to build its ability to make decisions or predict outcomes when presented with new data.It is having access to a computer model that is based on the experience of thousands of other patients, whether a treatment is likely to work & what works best for that patient based on their individual conditions.

No two humans in world are alike. But AI models are helping doctors learn from patients with similar conditions or even similar genetic conditions & make informed decisions about their diagnosis & their treatment options.

It integrates data & findings & helps in diagnosing primary lesions/infections, determine prognosis, risk factors & treatment options.

AI has been used in the medical decision-making process, and these systems can help laypeople obtain expert-level information.[4]Man-made neural networks are highly interconnected networks of computer processors inspired by biological nervous systems.[5] These systems can be helpful to connect dental professionals all over the world.[6]

Artificial Intelligence in Dentistry:

In the dental field, although it is clear that it is still a basic step, AI application technology is progressing remarkably.[7] A good example is the clinical decision support systems. These are computer programs developed to provide specialized support to healthcare professionals.[7]

AI systems are currently mainly limited to test versions of automated diagnostics, especially in dental imaging and radiology[8], and classification tools such as for periodontally compromised teeth, dental cusps, or caries. Encouragingly, the identified studies all reported high performance of the different AI systems investigated, i.e., including high diagnostic accuracy for dental caries[9], and very

good prediction accuracy for debonding of CAD/CAM crowns.[9] In tooth preservation, radiologically supported AI analysis can help detect root fractures, identify apical lesions, and classify root morphology.[11,12]

In Periodontology, disease progression can be assessed while clinical and radiographic periodontal parameters are determined automatically by AI technology.

Various surgical and nonsurgical approaches have been devised to treat damaged periodontal teeth (Periodontally Compromised Teeth-PCT) and supporting structures.[13] Despite advances in treatment modalities, no significant improvements have been made in the diagnostic and prognostic methods of PCT. Clinical diagnosis and prognosis are highly dependent on experimental evidence.[14] Lee and coworkers[15] evaluated the potential utility and accuracy of AI algorithms for diagnosing and predicting PCT. Using the AI algorithm, the accuracy of the PCT diagnosis was found to be 76.7 to 81.0%, while the accuracy of the estimated extraction requirement was 73.4 to 82.8%. The observed differences in accuracy appeared to occur between different tooth types, with premolars being more accurately diagnosed as PCT than molars (accuracies were 82.8% and 73%,respectively). This may be explained by the fact that premolars usually have only one root, whereas molars have 2 or 3 roots, thus showing a more complex anatomy.

In oral surgery, AI can be used to screen X-ray images to detect pathological changes, such as cysts and bone tumors.[16] Additionally, there are possible applications in implantology. Treatment planning based on AI in CAD/CAM implant dentistry could be of great interest in simplifying virtual, and consecutively, 3D treatment planning.[17]

AI has proven to be a promising aid during the diagnosis of cancerous head and neck lesions. With specificity and accuracy of 78-81.8% and 80-83.3%, respectively (compared to specialists at 83.2% and 82.9%), AI shows potential great in detecting tumor tissue in tissue samples or on x-rays.[18,19]

Dental Monitoring TM (DMTM) is a sophisticated app that utilizes cutting-edge technologies including control vision, metaheuristics, and artificial intelligence. It enables orthodontists to remotely monitor their patients through continuous analytics. This app utilizes a patented artificial intelligence machine learning algorithm to calculate 3-dimensional (3D) tooth movements from intraoral photos and videos that patients capture using their smartphone cameras. The accuracy error claimed by DMTM is less than 0.1 mm and less than 0.5 degrees for tip and torque.[20]

Despite technological advances AI also has certain limitations such as : it needs human surveillance, inaccuracies are still possible & is susceptible to security risks

CONCLUSION:

Since the human brain is still a mystery, it's no surprise that AI too has a lot of un ventured domains. For now, AI is built to work with humans and make our tasks easier. However, with the maturation of technology, we can only wait and watch what the future of AI holds for us.

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