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Application of Artificial Intelligence in Prosthodontics

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ABSTRACT

Artificial intelligence is gaining attention all over the globe as it has marked a high impact, breakthrough in the field of intelligence innovation. It is utilized in every field, from automation to dentistry. It is a lifesaver for dentistry especially in the field of Prosthodontics as it helps in the designing of prostheses and in the making of functional maxillofacial appliances. It is also helpful in the process of patient documentation, diagnosis, treatment planning and patient management; hence it helps the dental health care professional to work smarter not harder.

***Keywords*:** artificial intelligence, dentistry, prostheses, maxillofacial appliances, diagnosis, innovation

INTRODUCTION

To work smarter, not harder is the deepest assimilation of every human being. If a machine is given the power to think like a man and act like a man it will be a windfall to help the mankind in a lot of fields to reduce the manpower. Dentistry is such a complicated field that needs a lot of assistance.

To reduce the stressful work and man power, development of artificial intelligence can be a boon to dental health care professionals.

As the age advances, humans are expecting a more precise and comprehensive treatment, hence the dependence on artificial intelligence can only add privilege to the quality of treatment. Artificial intelligence offers advanced decision supporting tools.

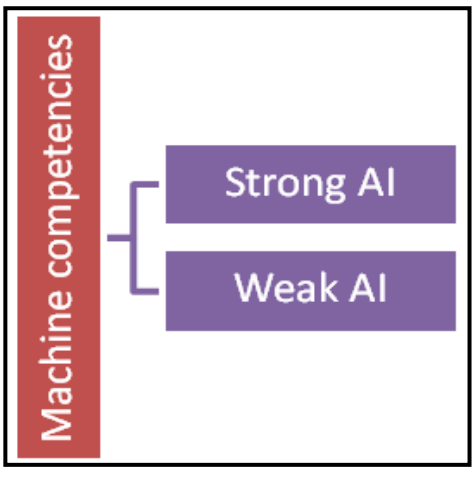
The term artificial intelligence was first used by john McCarthy in the year 1955. [1]

John McCarthy was an arithmetician and is known as the father of artificial intelligence. Artificial intelligence means the aptitude of a machine to imitate human knowledge and behaviour.

Machine learning is a field of artificial intelligence that was first mentioned in 1959 by Arthur Samuel and he defined it as the process that enables computer to learn without definite programming. [2]

Machine learning does not intend to replace the dental health care worker, but can be a method to create a second informed opinion based on mathematical decision making and prediction.

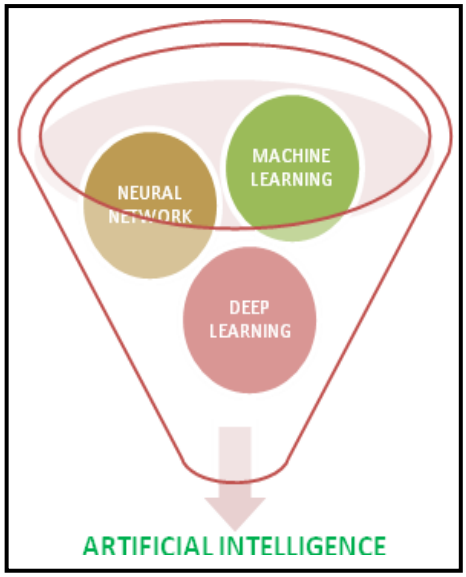
MACHINE COMPETENCIES



We experience weak AI or simulated thinking in our day today life, starting with the basic computational language which we use to command the computer programme till the robotics. Strong AI or actual thinking is only fictional at present.

Computers attaining strong AI will be the biggest innovation in this field which will have a huge impact on human civilization.

KEY ASPECTS OF AI



Machine learning

With machine learning, computers are able to infer their own rules by using advanced algorithms. [3]

Machine learning is used in e commerce, automobile, internet search, sensor, robotics, speech recognition, image recognition etc.

Machine learning is subdivided into four categories of learning

- **Supervised learning:** The computer has a tracing data set which is correctly labelled by a human expert.
- **Unsupervised learning:** The computer does not use a tracing data set, but it tries to take up the data without the human guidance separating the data into clusters or groups.
- **Semi supervised learning:** It is not easy to supervise every dataset so when a large amount of unlabelled data is combined with a small amount of labelled data the accuracy of machine learning can be improved.
- **Reinforced learning:** According to Hal Varian, it is a form of sequential experimentation of a computer in an attempt to achieve a goal while interacting with a dynamic external environment. [4]

Neural network: As the name suggests, it uses artificial neurons to set the algorithm .it works almost similar to the human brain.

Deep learning: It is a type of machine learning that utilizes the network with different computational layers to analyse the input data.

Deep learning is also known as conventional neural network.

Applications of Artificial Intelligence

Decision Support Systems

In health care systems, there is a large amount of data which gives ideal learning inputs of machine learning enabled decision support systems.

Clinical decision support can improve the diagnostic accuracy and it helps the healthcare workers to sort out the complexities in clinical variabilities.

It has potential application in the field of orthodontics, periodontics and oral surgery for analysing the condition and treatment planning.

It is also used for reducing the feudal claims in the field of dental insurance; it checks the accuracy of the details provided by the patients. [5]

In future, the dental clinics might establish an AI comprehensive care system replacing the dental assistant.

Before every appointment, the patient analyser will dictate the planning of patient's treatment with regard to his age, gender, vital signs, medical history, health conditions and drug usage.

CAD/CAM and AI

In the field of Prosthodontics, both the patient and clinician expect a gold

standard quality in the prostheses. A huge set of manpower and machinery works behind the perfect output, sometimes the man power alone can fail to meet the expectations. To save the time and energy the computer has this designing and manufacturing unit that enables us to design mill or print according to the patient's desire. AI's considerable bonus is the ability to assess and learn from the millions of doctor-approved crowns in the database, with cases added to the cloud on a regular basis. Esthetics are often evaluated by measuring the potentially enormous number of dental anatomy information available. In relation to working from a conventional template, it was.

Implant Therapy and AI

Treatment planning of dental implant can be most successful if we combine the CBCT image and intraoral scan. The introduction of AI in the field of implantology has the potential to merge both together and design the future prostheses. [6]

A new model was proposed by researchers at the Finnish Center for Artificial Intelligence (FCAI), the University Hospital of Tampere, Planmeca and the Alan Turing Institute to accurately and automatically identify the exact position of the mandibular canal for dental implant operations.

Using deep learning based object detection, implant systems can be detected from panoramic radiographic images.

Clinical Environment and AI

Augmented reality can be used for improving patient comfort and to reduce the dental anxiety.AI will improve its skill on scheduling the appointment timing, temperature setting for the patient, the music and the entertainment of their taste and even the lighting that relaxes the patient. [7]

Tongue Controlled Devices

Our goal has been developing non-invasive, self-controlling, and precise tongue-computer interfaces that can compensate the arm and hand functions, which are indicated as the upper most priorities for severely disabled individuals. The tongue drive system can analyse the motions of tongue in the oral cavity and act based on the commands specified within the guidelines.

These commands can then be used to access a computer, drive a wheelchair, or control the user's environment. [8]

Maxillofacial Prostheses and AI

The bionic eye, developed in the United States, has already been tested in a dozen patients with vision damages. Without the need for surgery, these devices can benefit the people in attaining vision with the help of artificial intelligence. In this way, a smart camera mounted on special glasses allows the user to read text or recognize faces. With the help of a small headset, the expertise processes the information seized by the camera and converts it into audio, which is conducted to the ears of the visually impaired person.

Due to amputation of limbs, patients can lose the sensory capacity in those areas. Artificial skin developed by researchers from the California institute of technology (USA) and the federal polytechnic school of Zurich (Switzerland) is changing this scenario.

The tissue composed with a thin, clear film of pectin and water, senses temperature variations in the range between 5 and 50 degrees Celsius.

Artificial olfaction plays a crucial role in robotics by mimicking the human olfactory structure that can identify different smells that compare to a range of fields, together with environmental monitoring, disease diagnosis, public security affairs, agricultural production and food industry. [13]

CONCLUSION

The field of artificial intelligence has altered medicine and dentistry in numerous ways. Though Artificial Intelligence

systems are a great strength in dentistry and dental training, the human biological system is composite and it is to be noted that these technological progressions are still the brain child of novelties and discoveries by mankind. Moreover, AI can only support the clinician in performing the tasks professionally, but in no way swaps the intellect of the human knowledge, skill and treatment planning.

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