RESEARCH ARTICLE

ARTIFICIAL INTELLIGENCE: A MISSION TO SUPPORT HEALTHCARE SPECIALISTS

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ARTICLE INFO

ABSTRACT

Artificial intelligence (AI) is a breakthrough in the field of technology which is rapidly progressing and has captivated the minds of researchers across the globe (1). Eversince, its inception dentistry has witnessed some of the exceptional achievement (2). Hence, this situation demands every dentist to get acquainted with this technology as the future of dentistry is abutting the implementation of its applications. While, in no ways, AI can replace the role of a dentist, it is of prime importance to be aware of the possibilities to integrate this technology in the future for a gratifying and successful practice (2).

INTRODUCTION

The human brain is unreproducible miracle structure composed of networks of interlinked neurons that transmit signals throughout the body. This nature of human brain has created researchers and scientists inquisitive from past. The deed of the constant search has given rise to what's called artificial intelligence (AI), that may be extremely evolved system capable of mimicking functioning of the human brain (3). The last couple of years have seen many ideas for applied AI in medical services emerge and deployed as well. The initiative has migrated from paper to the patient. There are 2 main areas that have seen a sporadic growth in application - genetic science and digital medicine. Whereas the former is directed towards gaining knowledge concerning what happens at the cellular level, the latter deals with a way to create technology a lot of accessible with easy interfaces each for doctors and patients (4). Computer-based diagnosis is gaining momentum because of its ability to detect and diagnose lesions which can go ignored to the human eye, thereby paving method for a holistic practice (5).

HISTORY OF ARTIFICIAL INTELLIGENCE: History dates back to as early as four hundred B.C, Plato envisaged a basic model of brain performance. Since then, this sector of science has witnessed varied inventions with the arrival of technology for making a model that may simulate the functioning of the human brain (6).

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In1950, a British mathematician, Alan turing devised a machine that would decode encrypted messages; this might be referred to as the first breakthrough within the history of super computers. He devised the "TURING TEST" that is intended to work out exhibit intelligence. The term artificial intelligence was coined by John Mccarthy in 1956(7).

Artificial intelligence: Artificial intelligence (AI) is outlined as a field of science and engineering involved with the computational understanding of what's usually referred to as intelligent behavior, and with the creation of artifacts that exhibit such behavior(8). Artificial neural networks simulating the neural signal transmission and also the human brain are an essential a part of AI(9). Programming languages of artificial intelligence are the principal tools in understanding these symbolic data. The various techniques of AI that are being applied in dentistry embrace artificial neural networks (ANN), genetic algorithms (GA), and fuzzy logic (10).

Artificial neural network: Artificial neural networks are developed based on brain structure and just like the brain they can acknowledge pattern, manage data and learning (11). The ANN may be a computational or mathematical model based on the biological signal processing of the neural structure (12). Construction of the ANN model is based on analysis and learning of the structure, mechanism, and performance of biological neural networks. An understanding of biological neural networks permits for development of an ANN thatmay facilitate complicated relationships or establish patterns within a group of data points (13).

The ANN can process nonlinear relationships and might exhibit learning ability. ANN provides researchers with benefits like large-scale parallelism, distribution representation of knowledge, robustness, and self-organization, all of which offer a replacement approach to complicated problems (14). The foremost vital advantage of artificial neural networks is that this sort of system solves issues that are too complicated for conventional techniques and those that don't have algorithmic solution or the solution is just too complicated to be used. These systems facilitate connect dental health care professionals everywhere the globe. With this, the patients will enter the symptoms that they're experiencing and might be created alert to the foremost probable identification of the health problem. Today there are mobile applications available that facilitate the patients to spot malignant melanomas by examinationthe photographs from the patient with a huge interphase of images of lesions from round the world. (e.g. Mole check app, on-line corium clinic etc.) (15).

Similar system will be applied and enforced for reflection of suspected oral cancerous lesions. This technology helps patients to get an expert opinion at the earliest whereas additionally serving to the dental health care professionals to prioritize the appointments when necessary (16). One of the most important breakthrough in this technology was brought about when in 1958, a psychologist, named Dr Frank Rosenblatt developed perceptron which worked on a multilayer feed forward mechanism. Multiple layers of computer processors capable of performing parallel computations for data processing make up these networks (17). Each of these units is known as "neurons" and they are interconnected by links, each of which has a numerical weight associated with it. The network has the ability to "learn" though repeated adjustments of these weights. Another breakthrough in this technology came when Paul werbos in 1974 introduced "back propagation" learning (18). Today we use this ability of the computers programs to "learn" from newer data to assist health care professionals everywhere the world to higher understand diseases, to diagnose them early, and to treat them effectively while also sharing this important information

Augmented reality: Augmented reality is an interactive experience of a real world environment where the objects that reside within the universe are augmented by computer generated perceptual information sometimes across multiple sensory modalities including visual, haptic, olfactory and somatosensory (19). The overlaid sensory information is also constructive or destructive and is seamlessly interwoven as an immersive aspect of real environment. Augmented reality contains lots of applications in laparoscopy similarly as plastic and neurosurgery (20). In oral and maxillofacial surgery, augmented reality has applications in implantology and orthognathic surgery. It's applications in endodontic, orthodontics and restorative dentistry (21). Augmented reality is defined as "a technology that superimposes a computer-generated image on a user's view of the important world, thus providing a composite view."(22). The invention of augmented reality has simplified the strategy of delivering aesthetic prosthesis and meeting the patient's expectations. With the help of AI systems and augmented reality, the patient can try a virtual prosthesis, which will be altered till the patient is satisfied and, the final prosthesis is made exactly in keeping with these specifications (23).

Virtual reality: Virtual reality can be a computer generated simulation of a three dimensional image or environment which will be interacted during a seemingly real or physical way by someone using special equipment. In dentistry, virtual reality can function an efficient non pharmacologic analgesic for dental pain(24) .Virtual reality has been shown promise in training dental students. Le blanc et.al in their preliminary study in using virtual reality to educate dental students between 6 to 10 hours on a daily showed significant improvement in their performance(25). The AI systems along with virtual reality has been used not only to chop back dental anxiety but is additionally considered a robust tool for non-pharmacological control of pain.

Clinical disease support system: The decision support system (DSS) which supported only the financial or administrative domain has been replaced by clinical disease support system (CDSS). CDSS aims to form computer programs to simulate the human thinking by using machine techniques(26). The machine learning algorithms heavily rely upon available data from previous observations which include information provided by physician, pharmacists and other health care individuals (27). The main objectives include documentation and clinical coding, organizing clinical complexity, storing and maintaining patient databases, tracking patient orders, monitoring health condition further as a preventive measure (28). CDSS thus provides information to medical personal, patients or individuals or populations to supply faster, more efficient and better health outcomes for both individual health services and health of population (28).

Some practical usage of AI in healthcare fields are those:

Cancer is one in all the foremost widely researched areas ever since the machine learning algorithms for computer vision became specialized at identifying anomalies. An early-stage cancer diagnosis is currently the closest to cure. So, researchers at MIT'S computing and AI laboratory (CSAIL) and Massachusetts general hospital (MGH) have created a new deep-learning model which will predict from a mammogram if a patient is probably going to develop carcinoma the maximum amount as 5 years within future. A 5-year window has the potential to avoid wasting many lives (29). So far, voice assistants are entertaining the users from playing music to answering trivia. Now Amazon's alexa is teaming up with NHS to deliver the users with medical advice. For example, if the user contains a rough night with a cough then these voice assistants can identify the audio and prescribe cough drops from trusted medical databases(30). The new arrangement essentially integrates the NHS database into alexa. When British users ask alexa about disease symptoms or treatments, the response will correspond to information on the NHS website. The large scale usage still might take time, given the likelihood of the data being stolen or users not being comfortable with discussing their ailments with a non-human entity (31). According to the reports, chronic kidney diseases (ones lasting over three months) affect 10% of men and nearly 12% of women around the world. Up to 10.5 million people need dialysis or a kidney transplant, but many don't receive these lifesaving treatments due to cost or lack of resources. Additionally, over 13 million people suffer from acute kidney injury (32). Some will last to develop chronic nephropathy. Deepmind together with experts from the US department of Veterans Affairs (VA), has developed a technology that may give doctors a 48-hour advantage in treating acute kidney

injury (AKI), a condition that's associated with over 100,000 people within the UK every year (33). The research shows that AI could accurately predict AKI in patients up to 48 hours prior it's currently diagnosed. A deep-learning-based reverse image search tool for histopathology images: Similar Medical Images Like Yours (SMILY). Histopathology images is viewed at different magnifications (zoom levels), SMILY automatically searches images at the identical magnification (34).

Artificial intelligence various application: The applications of these AI technologies like expert systems, game- playing, and theorem-proving, language processing, image recognition and robotics in various fields like telecommunication and aerospace have grown manifold(17). Technology has also revolutionized the sphere of medication and dentistry within the last decade. Artificial intelligence based virtual dental assistants can perform several tasks within the dental clinic with greater precision, fewer errors and fewer manpower compared to humans(35). Can be used to coordinate appointments, managing insurance and paper works further assisting clinical diagnosis or treatment planning, it is very useful in alerting the dentist about patient's medical history further as habits like alcoholism and smoking. In dental emergencies, the patient has an option of emergency tele-assistance especially when the practitioner is unavailable. Thus an in depth virtual database of the patient are often created which is ready to travel an extended way in providing ideal treatment for the patient. Fixing regular reminders for patients who are on tobacco or smoking cessation programs (36).

 The AI software can document all necessary data and present it to the dentist much faster and more efficiently than a human counterpart. (e.g: collecting all necessary dental records, extra oral photographs and radiographs necessary for diagnosing any dental condition). Due to its unique ability to search out out, it may be trained to perform many other functions (17). it may be integrated with imaging systems like MRI and CBCT to spot minute deviations from normalcy which may have gone unnoticed to the human eye, can even be used to accurately locate landmarks on radiographs, which might be used for cephalometric diagnosis. Within the sector of pathology it is often accustomed scan large number of sections to locate minor details which aids in diagnosis and clinical deciding. Within the sector of orthodontics the software can perform variety of study on radiographs of research that aid in diagnosis and treatment planning (37).

Artificial intelligence, guide the dentist during the full procedure administrated a digital impression and aid in making a perfect impression. Supported the information that's fed into the system, the set algorithms and statistical analysis, the AI software helps to predict tooth movement and final outcome of treatment too(17). AI along with some designing software also aid the dentist to style the most effective possible and aesthetic prosthesis for patients while considering sort of variables like anthropological calculations, facial measurements, ethnicity and even patient's desire. The fabrication of the prosthesis is currently dispensed with CAD-CAM technologies like subtractive milling and additive manufacturing technologies like 3d printing. The entire replaced the time consuming and laborious process of conventional casting and simultaneously drastically reduced the human errors within the final prosthesis (38). These technologies can even be used to fabricate accurate orthodontic plates and appliances too. AI software has helped

plan surgeries to the tiniest detail before the actual surgery. One of the most effective applications of AI is within the field of oral and maxillofacial surgery with the arrival of robotic surgery(9). ANN is found to act as a second opinion to locate the minor apical foramen, thereby enhancing the accuracy of working length determination by radiographs and in diagnosing proximal cavity. It is also found to possess sufficient sensitivity, specificity, and accuracy to be a model for vertical root fracture detection in digital radiography(39). Optimally trained with relevance lower third molars are found to possess high specificity and sensitivity the same as specialist consultation in categorizing tooth to "gold standard" supported NIH consensus criteria. Added to the present, the ANN to determine employed to figure out if extractions are necessary before treatment (40). ANN can even effectively be utilized in classifying patients into aggressive periodontitis and chronic periodontitis group supported their immune reaction profile. Finally one of the foremost innovative applications of AI is seen within the field of "bio printing", where living tissue and even organs is made in consecutive thin layers of cells which in the future is additionally used for reconstruction of oral hard and soft tissues lost due to pathological or accidental reasons (41).

Advantages of AI:

- Accuracy in diagnosis
- Standardization of procedures
- Saves time.

Disadvantages of AI:

- The complexity of the mechanism
- The cost involved in the setup.

While, in no ways, there exists a doubt in the supremacy of integrating AI into practice, it can never replace the role of a dentist since clinical practice isn't only about diagnosing but also correlating with clinical findings and providing personalized patient care. Although AI can assist in numerous ways, final call must be made by a dentist as dentistry could be a multidisciplinary approach.

HEALTHCARE: Healthcare is one of the foremost dynamic, yet challenging, sectors in India, and is predicted to grow enormously, yet it faces major challenges of quality, accessibility and affordability for an outsized section of the population: Shortage of qualified healthcare professionals and services like qualified doctors, nurses, technicians and infrastructure: as evidenced in 0.76 doctors and a pair of 0.09 nurses per 1,000 population (as compared to WHO recommendations of 1 doctor and a pair of 0.5 nurses per 1,000 population respectively) and 1.3 hospital beds per 1,000 population as compared to WHO recommended 3.5 hospital beds per 1,000 population (42).

Non-uniform accessibility to healthcare across the country with physical access continuing to be the main barrier to both preventive and curative health services, and glaring disparity between rural and concrete India. With most of the private facilities concentrated in and around tier 1 and tier 2 cities, patients and urban travel substantial distances for basic and advanced healthcare services. The problem is further accentuated by lack of consistent quality in healthcare across India, most of the services provided is individual driven

instead of institution driven, and fewer than 2% of hospitals in India are accredited (43). Affordability remains a problem with private expenditure accounting for ~70% of healthcare expenses, of which ~62% is out-of-pocket expenditure, probably one of the most effective within the world. Significant slice of hospital costs in both rural (~47%) and concrete India (~31%) are financed by loans and sale of assets. Poor and marginalised are hit the most, and as per the government estimates, a sizeable a part of the population (~63 million) are faced with poverty every year because of their healthcare expenditure (44).

Reactive approach to essential healthcare largely due to lack of awareness, access to services and behavioral factors implies that majority of patients approach a hospital/ physician only if a disease has reached a complicated stage, thus increasing the worth of care and reducing the probabilities of recovery. The government of India has been making a series of enormous scale interventions to deal with India's healthcare challenges, viz. Transformation of 1.5 lakh health and wellness centers, developing district hospitals to cater to long-term care for non-communicable diseases, ayushman bharat mission, promoting e-health etc. Niti aayog is functioning with microsoft and forus health to roll out a technology for early detection of diabetic retinopathy as a test. AI based healthcare solutions may additionally help in making healthcare services more proactive – moving from "sick" care to true "health" care, with emphasis on preventive techniques.

CENTRAL GOVERNMENT'S ROLE IN AI: In order to bring the advantages of artificial intelligence and related technologies to the folk, a National centre for computer science (AI) will soon be established, announced by Piyush goyal, Union minister of finance, while presenting interim budget 2019."India has become the second largest startup hub of the world. We are proud of the hard work and innovative ideas of our youth in this sector. A national programme on AI has been envisaged by the government. To actualise the ambitious initiative, the central government has identified nine priority areas, and so the National portal on AI are going to be developed soon. "The new scheme on AI may be a futuristic scheme, which might promote use of technology and digitisation," says Gulzar Didwania, director , Deloitte India (47). Will another committee bring clarity on India's AI campaign?

India is travelling toward a path where both the private and public divisions are unified in their duty to advance and upscale AI. Within the past, we have seen that the ministry of electronics and data technology (MEITY), and so the NITI Aayog have separately framed National strategy reports on AI. As indicated by a media report, the four-member panel, framed in october 2019, are going to be led by the principal scientific advisor to the union government- k Vijay Raghavan, alongside secretary within the department of science and technology, CEO of NITI Aayog and secretary of MEITY. The committee will work on removing any duplication of tasks between MEITY and NITI Aayog within the sector of to judge policy. Specific roles are going to be specified to expedite the execution of the AI policy.

Conclusion

Applications of AI in standard of living are growing leaps and bounds. Dentists have always been at the forefront of implementing a technology. Hence, understanding the assorted concepts and therefore the techniques involved will have a clear advantage in the future when it's time to adapt to the change with redefined roles for a rewarding practice.

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