

Evaluation of the Place of Artificial Intelligence Applications in Medical Sciences and Dentistry

Yapay Zekâ Uygulamalarının Tıp Bilimleri ve Diş Hekimliğinde Yerinin Değerlendirilmesi

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ABSTRACT: Intelligence, which is also considered as human mental processes such as learning, problem solving, needs to be developed. The use of devices for its development introduced the idea of machine intelligence and that has paved the way for the concept of artificial intelligence (AI). AI has the capacity not only to imitate human intelligence, but also to stimulate thoughts and reactions, and it has the ability to learn on its own. AI, which has an impact on the fields of philosophy, mathematics, gaming, music psychology, also has an impact on health sciences. Nowadays, in health sciences and dentistry, manual labor, skills and experience are sometimes cannot be sufficient in the treatments that restore the functions that patients previously lost, and patient requirements cannot be fully met. In addition, assessments such as occlusion, tubercle contacts, angulation of the prosthesis, force distributions that require millimetric calculation and their adjustments can sometimes be oversight. For this reason, computers, programs and undoubtedly AI have also taken their place in current treatment procedures.

Keywords: Artificial intelligence, dentistry, endodontics, medical informatics

ÖZET: Öğrenme, problem çözme gibi insana ait zihinsel işlemler olarak da değerlendirilen zekânın geliştirilmeye ihtiyacı vardır. Geliştirilmesi için cihazların kullanılması makine zekâsı düşüncesini getirmekle birlikte yapay zekâ (YZ) kavramının önü açılmıştır. YZ, insan zekâsını taklit etmekle kalmayıp düşünce ve tepkileri stimüle etme kapasitesine sahiptir ve kendi kendine öğrenme yeteneği vardır. Felsefe, matematik, oyun, müzik, psikoloji alanlarında etki gösteren YZ, aynı zamanda sağlık bilimlerinde de etki göstermektedir. Günümüzde tıp bilimleri ve diş hekimliğinde, hastaların daha önce kaybettikleri fonksiyonları geri kazandıran tedavilerde el işçiliği, beceri ve tecrübe bazen yeterli olmamakta, hasta gereksinimleri tamamen karşılanamamaktadır. Buna ek olarak milimetrik hesap gerektiren oklüzyon, tüberkül temasları, protezin açılması, kuvvet dağılımları gibi değerlendirmeler ve bunların ayarlamaları bazen gözden kaçabilmektedir. Bu sebeple güncel tedavi prosedürlerinde bilgisayarlar, programlar ve şüphesiz YZ da yerini almıştır.

Anahtar Kelimeler: Diş Hekimliği, endodonti, tıbbi bilişim, yapay zekâ

INTRODUCTION

Artificial Intelligence (AI) and its derivatives, which have made a great breakthrough in recent years, are appearing in the literature with different purposes and different results day by day. Artificial intelligence provides benefits in many areas such as content production, agricultural land assessment, advertising, language, literature research as well as in well-known areas such as mathematics, law, trade, communication. AI studies fed by cumulative data are focused on thinking like a human and realizing the predicted goals that a human cannot do. For AI, it can be mentioned as part of the opportunity created to achieve the goals in the world (1). AI is a general term that refers to the use of a computer to model intelligent behavior with minimal human intervention (2) and has an algorithm that can learn on its own. The tasks that he often performs have a connection with human intelligence (3). It affects the opinions that people offer in their daily lives, and even their behavior more and more every day (4). AI, traces of which are seen in every field, has also taken its place in medical sciences. AI has been a bridge between informatics and medicine in many areas such as treatment planning, X-ray deciphering, prosthetic restoration, construction. Artificial intelligence used in the healthcare sector provides improvements in specialized areas as well as operational initiatives implemented in hospitals (5). In addition, the field dentistry also can be counted as personal hospitals in other words. Every clinic has its own patients and programmes as well. Moreover, in some emergency cases the dentist should be much more intelligent,

sufficient and fast. That points the truth which dentistry is being much more attached to AI and it would have been a promising fortune (6). Because AI has recently been used in dentistry, which has led to successful results. AI provides advanced benefits such as data analysis, risk assessment, elective processing. Even in dental education, an increase in skill level has been observed. In addition, AI can be used for patient management, diagnosis, prognosis and the other branches as well (7). It has a wide range that enlightens the view of treatments. AI can detect tooth numbers, measure muscles, can detect the links between tooth and anatomical structures, can detect periodontal diseases, can detect landmarks, evaluate caries prognosis, and identify radiolucencies (8). This review has been prepared in order to show examples, to be a guide and to make evaluations about the use of programs and AI within the framework of the information provided by current literature sources.

1.1 The place of artificial intelligence in medical sciences and artificial intelligence in the health sector

AI has many benefits in many areas from music to games, from creating picture choreography to programming and directing, and even in educational sciences. AI is in a period of deceptively rapid growth, and health sciences have taken their place among the areas in which this period of growth is showing its influence (9). Medicine is very different from other fields where AI is applied. AI enables new discoveries and improved processes in the entire healthcare process (10). Medicine is an area where the potential for possible

application seems high. The idea of interpreting X-rays has been in existence for many years. However, it is technically difficult to use it as a definitive diagnostic tool in the clinic in terms of this goal (11). There are two main branches of the application of AI in medicine. These fields are called physical field and virtual field. The physical part includes medical devices and devices involved in care outcomes that are becoming increasingly complex, robots and their uses. The virtual component, on the other hand, is known as 'Machine Learning (ML)', represented by mathematical algorithms that improve learning through experience (2). Most of the concepts used in medicine can be treated as fuzzy data. Due to the inherent nature of medical concepts and the imprecise nature of the relationships between these concepts, the method suitable for medical applications is fuzzy logic, which is equivalent to fuzzy logic. Imprecise medical conditions can be identified in fuzzy sets (12). A common reason fuzzy logic framework comprises of 3 diverse stages. These stages are known as blurring, inference and rinsing. Blurring changes over numerical inputs into fuzzy values utilizing the participation capacities of the inputs. After being changed over to values, inference at that point produces fuzzy yields from fuzzy inputs utilizing rules that reflect human encounters related to the issue of intrigued. The final portion changes over fuzzy yields to numerical yield by means of the output's participation capacities (13). Fuzzy logic is useful in various fields such as cancer diagnosis in medicine, benign-malignant lesion separation, quantitative drug use, ischemic stroke, radiation therapy, appropriate lithium dosage regulation (14).

Especially what is separate from what exists in human nature, the existence of an error-free diagnosis, if possible, is questioned. Its main purpose can also be called to support the clinician in the decision-making process (15).

A subset of ML called 'Deep Learning (DL)', that has a large number of computational layers, which form a network of neurons that identify patterns and thus perception can be improved. In this way, evaluations such as alveolar bone loss, periapical radiolucency, radix entomolaris can be performed easily. Automated technology can speed up clinical processes and increase the efficiency of the dentist (7). Deep learning technologies can provide diagnostic assistance to dentists as analysing and recognizing of dental images (16). Not only diagnostic assistance but also more benefits provide by DL which are also detecting caries, tooth number and place detection, disease of periodontal tissue, lesions, determination of age and maybe more due to improving technology (17). Since AI has a wide range of applications starting from diagnosis and extending to treatment, such as pathology or radiography evaluations, drug development, dose calculations, robotic surgery applications, dentistry applications, prosthesis production, AI applications have the potential to be used in almost every field of medicine (18). Indeed, the AI item GPT-4 has the potential to assist bolster restorative development, from making a difference with quiet release notes, summarizing later clinical trials, giving data around moral rules, and much more (19). It provides significant aesthetic and functional improvements in the surgical procedure (20). Multiple clinical problems in the fields

of medicine and dentistry can cause difficulties for physicians. AI facilitates the work of clinicians by defining solutions to these problems. In this way, it will be able to have a great impact on medical medicine and dentistry (21). One of the benefits of AI is that the treatments and medical interventions applied to patients can be performed in a high-quality manner, as well as achieving predictable results, making complex protocols simple, and these applications are developing day by day (22). Today, artificial intelligence is recognized as a branch of engineering that applies new concepts and new solutions to solve complex problems (2). The application of AI in jobs where doctors are not looking hot is an advantage for the health informatics sector, where the workload is intense. For many physicians, technologies that were once very popular, such as electronic health records, have become too much responsibility over time. This situation has increased overload and burnout rather than alleviating it. Using artificial intelligence to facilitate the workload will increase the time that physicians will devote to the patient (23). When AI is used to alleviate the working conditions of medical personnel, especially physicians, it will also be a factor in increasing productivity, since the relevant personnel can use the time lost with paperwork and regulations to useful endeavors to improve both themselves and their institution. This, in turn, can shed light on the rise in the healthcare sector by contributing to both personal and social progress. When the usability, reliability and practicality of AI applications are proven as a result of sufficient research, it will also take its place in routine daily clinical treatments. Ethical, management and

regulatory considerations are of critical importance in the design, implementation and integration of every component of AI applications and systems (10).

1.2 The effects of artificial intelligence on dentistry

AI applications operating in many fields are gaining a place in the field of dentistry as well as in many fields of medicine. Dentists are using AI more and more in their branches as time goes on (24). Computer-based diagnostics is gaining momentum thanks to its ability to detect and diagnose lesions that the human eye cannot notice, thus paving the way for a holistic application (25). Micro-endodontic robots can also be used in endodontic treatments associated with painful patients, narrow field of vision, blocked root canals. The devices can evaluate the history information and intraoral images entered with their own coding (26). However, there is also the use of AI in areas such as tumor-related lesions, alveolar bone loss, evaluation of maxillofacial cysts, diagnosis of salivary gland diseases, maxillary sinusitis (27). In addition, it has been found that it has enough sensitivity, specificity and accuracy to become a model for detecting vertical root fracture in digital radiography (28). The configuration of the root canal can be created in three dimensions, and the findings found in the root canal, such as the depth of caries or calcifications, can be detected. Treatment applications minimize the possibility of experiencing undesirable conditions such as ledge, perforation, tool separation, healthy tissue destruction, which are unsuccessful due to the fact that they are performed according to measurements in a planned manner (29).

Prosthetically, it also contributes to the production of aesthetic prostheses by making many calculations, including face measurement (30). Physicians should not forget that computers can also give erroneous results when using the possibilities of technology. Regardless of the extent to which digitization advances, physicians must incorporate their own knowledge and experience into their practice (31) Artifacts, intraoral image of the patient and clinical symptoms should of course be compared with the data output presented in radiography and AI application, and the supported data should be focused on.

1.3 Limitations and issues that need to be improved

AI should be improved in some aspects or steps should be taken for ease of use by physicians. The way humans interpret data and the way machines express data are not the same. For this reason, there is doubt in medical diagnoses, compliance is sought. The correlation in the anamnesis findings is an accepted basis as an intermediate Deceleration. However, medical interventions, when examined technically, are based on the basis of causality for a definitive diagnosis in order to solve the mechanisms underlying the patient's medical history (32). Due to the complexity of medical clinical practice by patient statements, traditional quantitative analysis approaches are not suitable (12). The lack of information and uncertainty caused by the limitlessness of medical science may cause machine fatigue to be contradictory. However, the confusion of the system, the expensive device installation, the need for technicians to receive adequate training, the bias due to the use of data for both testing

and learning, the fact that the results cannot be easily applied, the presence of erroneous or incomplete diagnoses should also be considered (5). The necessity of artificial intelligence to support medical decisions and the extent to which it can support them if necessary is a necessary consideration (32). There is no hesitation in accepting the biochemical results and evaluations obtained from an automatic analyzer or images produced by magnetic resonance imaging. However, researchers operating in this field have an obligation to produce evidence that these techniques work at a practical level. Therefore, the need to conduct more randomized controlled trials to prove the effectiveness of artificial intelligence systems in medicine is of vital importance (18). In most cases, it is necessary to understand how a machine decision is made and evaluate the quality of its explanation. The accuracy of disease diagnosis will be higher in the future thanks to programs that can integrate AI diagnosis and human diagnosis to increase appropriate diagnostic possibilities (33). As an example of other limitations in diagnostics, the fact that the performance of each radiography device is different will also affect AI performance. For the information required for diagnosis, AI is processed within data pools, and if the pool does not have a wide knowledge base, the success of the results obtained on rare diseases, drugs and uses will not be high (34). Although artificial intelligence can help in many ways, the final decision should be made by the dentist, since dental treatments require a multidisciplinary approach (25). The most basic reason for this is that the one who will be left alone with any legal responsibility is not the

device, but the physician himself. The patient may put forward the grounds that he/she has been harmed while complaining from the physician and may file a lawsuit. What is at the root of the disadvantages that occur in the distinction between malpractice and complications is sloppy work and careless work. The physician should improve himself according to current medical sciences (35). Besides all these data, it should be remembered that AI is a science that can learn and act on what it learns. The fact that different answers can be obtained when the same question is asked in different ways in chat programs, which are AI products, is one of the issues that best exemplifies this situation. This leads us to the conclusion that the fact that the data 'taught' to the relevant program is not correct leads to the fact that the result obtained is also not correct.

CONCLUSION

AI operates in many areas of human life on a wide range from the past to the future. In the health sector, it is also used in a wide range from document arrangements to patient records, from operational data to prosthesis construction, from diagnosis to treatment. The presence of manual dexterity in treatments causes differences in the medical interventions applied by some physicians and there are difficulties in providing medical standards. Providing a certain standard in transactions can be achieved with AI applications. The cumulative increase in technology and knowledge, combined with each literature publication and practical applications, enables artificial intelligence to move towards taking its place in daily clinical treatments in a routine way. Although

artificial intelligence is a science based on data, it should be remembered that it may have errors, it should be evaluated that an incomplete response may be obtained in cases with rare or limited information, and the doctor should definitely create a synthesis appropriate to his own knowledge, experience and the patient's symptoms on the couch and make an ethical decision on his own with the outputs from artificial intelligence.

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