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### Artificial Intelligence and Its Areas of Use in Healthcare

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#### Abstract

Artificial intelligence (AI) is computer systems that can perform tasks that require human intelligence. It consists of data based on machine learning, deep learning and artificial neural networks. AI; with the increase in data collection and the ability to store large numbers of data, its use in the field of health has increased. It has been increasing rapidly recently. AI is being used more and more frequently with its features that help physicians in diagnosis, treatment planning, prognosis prediction and application of treatments. In this review, it is aimed to specify AI and its areas of use in the healthcare system.

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## 1. Introduction

Technology has recently become a big part of our lives. In the 21st century, Industry 4.0, also called the 4th Industrial Revolution, has come to the fore with computer and information technologies. Developments such as robots, 3D software and AI are examined under the title of Industry 4.0. As the number of electronic devices in our lives increases, it has become necessary to store the data recorded by these devices. This stored data can be used and analyzed by AI (Ding et al., 2023; Taş, 2018).

AI is used when the definition of the problem at hand is known, but the method (algorithm) of the solution is unknown; it is the name given to all human-made systems that infer, learn or discover a correct and efficient solution method. In short, AI is automatic systems that can produce algorithms (Köröglü, 2017).

Terms such as AI, machine learning, deep learning, artificial neural networks are basically related to data. Although data has many meanings in the literature, in its simplest sense it is the source of information. Information is obtained by processing data.

Algorithms are structures that allow us to systematically examine our ability to solve complex problems. Algorithms break down these complex problems into small units that can be easily realized through analysis. When these successive units are performed sequentially, the problem is solved. The use of machines for algorithms, that is, the use of AI, was first made by Alan Turing in 1950 (Köröglü, 2017).

The concept of AI was first put forward by John McCarthy at a conference held at Dartmouth in 1956. An AI program that plays a chess game created with LISP, a programming language used in AI, has been produced (Doğan & Türkoğlu, 2019).

Artificial intelligence; must be able to communicate successfully with language skills, preserve what they perceive, use the information they have stored, adapt to new conditions, have computer vision to perceive objects, and be able to move robotic objects with or without commands (Ding et al., 2023).

## 2. Classification of Artificial Intelligence

AI can be classified as weak, strong and super. Weak AI has also been called “narrow AI”. It uses a trained program to solve single or specific tasks. Nowadays, weak AI is mostly used (Ding et al., 2023). Since powerful and super AI may create ethical problems, it should be studied carefully (Karabağ, 2021). AI today is categorized with machine learning and deep learning as a subclass. Machine learning forms the basis of AI studies.

### 2.1. Machine Learning

Machine learning is the general name of computer algorithms created for a problem using data obtained within that problem. Since the aim is to develop the algorithm with the best performance, many machine learning algorithms have been developed. Some of these are k-nearest neighbor algorithm, simple Bayes classifier, decision trees, logistic regression analysis, k-means algorithm, support vector machines and artificial neural networks (Atalay & Çelik, 2017).

In machine learning, there is a data-based system and algorithms that can learn with data are created.

The 'machine' in the term machine learning basically refers to a computer. These machines learn from the data we collect. There are three different methods in machine learning.

### **2.1.1. Supervised Learning**

In supervised learning, training data consists of data collected for the answer we are looking for and known answers (outputs). The machine evaluates these mathematically and creates a model. This learning is stored in models and used to evaluate data whose answer is unknown.

### **2.1.2. Unsupervised Learning**

We may not always have training data as in supervised learning. Obtaining logical results in problem analysis from the machine without training data is unsupervised learning. In this type of learning, data is classified and sets are created from the ones closest to each other.

### **2.1.3. Reinforcement Learning**

In the reinforcement learning method, there is no training data, as in unsupervised learning. However, there is a consultant who evaluates the answers obtained. This consultant compares the resulting response with the initial data and characterizes it as good or bad. Thus, a feedback, or reinforcement, is provided for the model formed (Atalay & Çelik, 2017).

## **2.2. Deep Learning**

Deep learning; it is an AI method, a subbranch of machine learning, that uses multi-layered neural networks in areas such as object and speech recognition and natural language processing. While machine learning has data based on certain rules, deep learning can use data such as video, audio recording, and images. For this reason, while machine learning data is subjected to preprocessing, this is not necessary in deep learning (Yılmaz, 2021). In addition, today's developing data storage systems have enabled the number of data to increase. Deep learning has been developed to solve more complex problems (Türk, 2021). In recent years, this increasing data structure has created the field of "Big Data" and machine learning is becoming much easier. Another reason deep learning is used today is because of the computational resources to run larger models. By introducing hidden layers in artificial neural networks, the memory used and the processor capacity for calculation increases. The greater the number of hidden layers, the deeper the network. With more hidden layers, there is also a need for faster computers with larger memories.

In the literature, deep learning neural networks consist of input, hidden and output layers. The reason why they are called hidden layers is that they contain concepts that help understand the relationships in the data that are necessary to determine the model, rather than the values in the data. Most deep learning networks use a technique called convolution, which constrains the neural connections in the network to capture them naturally.

Thus, deep learning consists of convolutional neural networks (ESA). There are multiple trainable sections placed sequentially in ESA. After the input data is received, the training process is carried out by layer by layer operations and at the end, the output data is obtained for comparison with the correct result. An error occurs equal to the difference between the produced result and the desired result. When the network makes a lots of errors, the loss is high, and when it makes fewer errors, the loss is low.

### 3. Use in Healthcare

The use of computer-based diagnosis in practice is increasing day by day, thanks to its ability to detect and diagnose lesions that may not be noticeable to the human eye. Over the past two decades, advances in medical imaging technology and related research have revolutionized the storage of medical imaging data in digital format. These data should be processed in a way that can be used with AI to optimize compliance and patient outcomes and increase the accessibility and efficiency of the current healthcare system (Özkesici & Yılmaz, 2021). AI helps the healthcare sector with robotic developments for a more efficient process by improving patient care and treatment costs (Hoşgör & Güngördü, 2022). They can undertake tasks such as arranging patient appointments, reminding patients about their appointments and medications, reminding the physician about the patient's history and warning them about systemic diseases. AI can learn about diseases using a single source of information or multiple sources to diagnose a particular disease.

AI applications in medicine and dentistry are used in subjects such as early diagnosis, treatment planning,

prediction of treatment outcome and disease prognosis (Ding et al., 2023). In the field of dentistry, studies such as caries detection, dental plaque, detection of periapical lesions, detection of root fractures, root canal system anatomy, tooth numbering, dental age determination, detection of dental anomalies, detection of anatomical structures and implant planning have been carried out (Hwang et al., 2019, Amasya et al., 2020, Türk, 2021; Agrawal & Nikhade, 2022; Kaya et al., 2022; Schönewolf et al., 2022; Duman et al., 2023; Akdoğan & Özdemir, 2024).

Amasya et al (2020), have created a basis for developing an algorithm that helps detect bone age by using AI to detect the maturation of cervical vertebrae. Duman et al (2023), conducted a study on using an AI algorithm to diagnose teeth with taurodontism in panoramic radiography. You et al (2020), developed an AI algorithm to detect plaques in primary teeth and tested its accuracy. Zheng et al (2021), aimed to evaluate and compare deep learning to aid the clinical diagnosis of deep caries and pulpitis on periapical radiographs.

Using AI for diagnosis after long working hours helps dentists save time and make accurate determinations. Determining the number and length of implants in implant planning, detecting proximal caries and determining the number of roots and canals in posterior teeth by examining superposed teeth and tooth roots in detail, accelerating endodontics by determining the canal length by detecting the anatomical apex, determining the treatment plan by detecting caries and lesions and determining the dental caries in bone. Helping the

treatment plan in orthodontics by determining age and contributing to early diagnosis of oral cancer while examining intra-oral lesions are just some of what AI brings to dentistry (Saghiri et al., 2012(a), Saghiri et al., 2012(b), Uthoff et al., 2018, Hiraiwa et al., 2019, Amasya et al., 2023, Akdoğan & Özdemir, 2024). It is thought that AI will have a stronger place in the field of health in the future, thanks to the studies that have been done and the basis that these studies provide for future studies.

#### 4. Conclusion

AI is a computer system on which a lot of research has been done recently. The use of AI in the field of healthcare is gaining momentum. It has a wide range of services, from planning patient appointments to robotic surgeries. With this review, AI is introduced and its fields of study in health are specified. Especially in dentistry, every study has the capacity to form the basis of another study. More work needs to be done in this field, which is expected to be present in many areas of dentistry in the future.

#### Ethical Statement

There is no need to obtain ethics committee permission for this study due to in review format reason. However, the study was conducted in accordance with ethical principles.

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#### Presentation Information

The findings of this study have not been presented at any conference or journal.

#### Conflicts of Interest:

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#### Author Contributions:

The contributions of the authors are as follows: Suna Deniz BOSTANCI participated in data collection and prepared the draft of the paper; Mehmet BANİ conducted the final revision of the manuscript.

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