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The function of artificial intelligence and its sub-branches in the field of health

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Abstract

Nowadays, computers and smartphones, tablets and other electronic gadgets have become indispensable for human life. Human health is paramount. It is very important to know the use of robotic applications in the health sector and to closely follow the general developments related to this issue. The human brain is in a constant state of interaction with this technology. The specialties formed by the adaptation of nanotechnology to human health; tissue engineering is very important for people. Artificial intelligence is one of the greatest engineering works in the history of mankind and the world. Artificial Intelligence technology has become a field that humanity has often heard about with the increase of epidemic diseases. Artificial intelligence is the ability to exhibit human-like behavior. Artificial intelligence has the potential to make scientific research, an area where people focus, much more efficient and increase the speed of scientific research by a factor. In this study, the importance and usability of machine learning in human health were investigated by literature review. The results obtained from different studies are shown in the figures.

1. Introduction

Before defining artificial intelligence, we need to know the definition of intelligence. Intelligence can be briefly called the abilities of a person to think, reason, perceive, understand, judge and draw conclusions from real events. In addition, Intelligence can also be seen as the ability of the mind to learn, take advantage of what has been learned, adapt to new situations and find new solutions. Intelligence, in other words, can be called the ability to adapt to technological events that can be developed through education, training, knowledge, accumulation and experience [1]. Artificial intelligence is the process by which the human brain, non-organic systems (computer, program, robot, etc.) based on its functions. Who thinks like a human, perceives like a human, interprets like a human, analyzes like a human and makes decisions like a human after all these stages). Scientists have defined artificial intelligence differently. For example, artificial intelligence is the science of computer programs that imitate intelligent behavior, and artificial intelligence is the science of converting things into machines that require intelligence when done by humans [2-4]. Artificial intelligence is also used in other fields besides the health field. For example, when current studies are examined; the interaction of artificial intelligence and space design has been evaluated in today's design education. In the research, the interaction of artificial intelligence and space design was compared in today's design education [5]. The artificial intelligence index was investigated with the use of doubt in favor approach. In order to investigate the impact of artificial intelligence talent, capacity and potential levels of countries on their economic development, the relationship between Artificial Intelligence Index scores and category shares and economic development indicators has been deciphered with graphs [6]. The ability to control the military with artificial intelligence The global management of artificial intelligence from the

perspective of international security has been studied. At the end of the study; the idea that the global management of artificial intelligence can be realized with an effective international border organization emerges [7].

2. Material and Method

In this study, artificial intelligence and its sub-branch, machine learning, were investigated. Previous studies have been examined by conducting a literature review. The usability of the lower branches of artificial intelligence in the field of health has been investigated. The studies obtained at the end of the research are shared with reference to the photos.

2.1. Artificial Intelligence (AI)

A number of processes have been left behind by artificial intelligence scientists. Some scientists define artificial intelligence as "the study of mental abilities using computational models." Other scientists, artificial intelligence a modern approach', 4 AI can be classified under the title of description in the book of like-minded people, systems, system of systems that behave like rational human beings maintain a rational system [8-9]. Artificial Intelligence and its subsets are given in Figure 1 in the form of a photo.

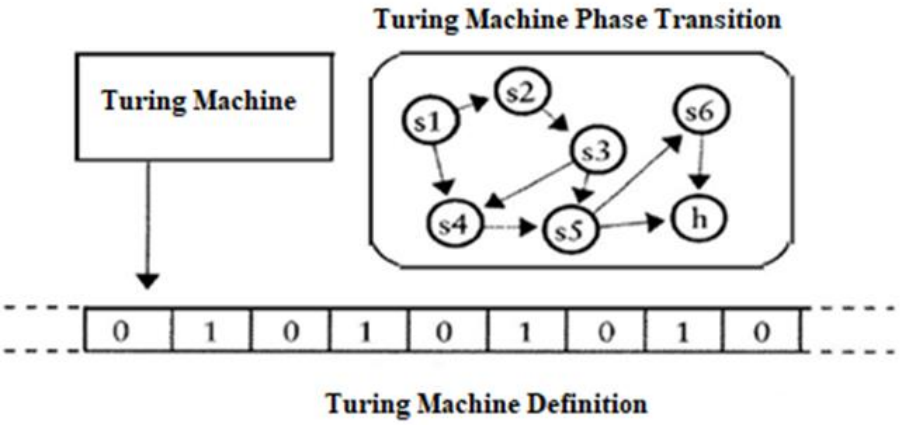


Figure 1. Artificial Intelligence and its subsets [10]

2.2. Literature Studies on Artificial Intelligence in the Health Sector

The use of artificial intelligence in the health sector continues rapidly. Artificial intelligence can also be used for dentists and oral health. At a time when human health is the most important; health services are one of the fastest growing sectors in the health sector, covering the diagnosis, treatment and prevention of oral diseases in general. For example, diagnosis is of great importance because tooth deficiencies cause malocclusion, loss of function and aesthetic problems in individuals. In dentistry, intraoral or extra-oral radiographs are used to detect tooth deficiencies. For example: in a study; the artificial atom algorithm of the individual-specific optimal nutrition program was used [11]. In a study, the lateral buckling behavior of hybrid composite materials was estimated using the Artificial Neural Networks (ANN) tool using test data on the effects of different environmental conditions and different fiber combinations [12]. In a different study, a pilot study on artificial intelligence was conducted to detect tooth deficiencies from panoramic radiography using the deep learning method [13]. In a different study, the diagnosis and predictions of periodontically weakened teeth were investigated using an artificial neural network algorithm [14]. They shared the software studies they developed on the detection of dental caries and dental problems in X-ray images using artificial neural networks and the diagnosis and classification of caries in digital radiographs with the literature [15-16]. In different studies, MRI images were associated with a deep learning model. In this way, it is believed that the specialist radiologist can reach the result more efficiently and in a short time [17].

2.3. Machine Learning

Machine Learning (Machine Learning) is a branch of artificial intelligence that uses statistics and computer science and has recently become very popular. Machine learning is all algorithms that mimic human intelligence. However, it does not need rules that we interpret and enter manually. In the machine learning model, learning occurs in the form of teaching-teaching (education) and testing (testing). At the learning stage, a learning model is created by learning algorithms and features to the system using examples from the dataset. At the experimental stage, estimation is made for the trial data with the learning model application Engine [11-18].

2.4. Deep Learning, Robotics, the Method of Artificial Neural Networks and Genetic Algorithms

Deep learning is a machine learning method consisting of multiple layers that predicts outcomes with a specific set of data. Deep learning, machine learning and artificial intelligence are terms that have different meanings from each other. Deep learning has been described as a class of machine learning techniques that use many nonlinear hidden layers for supervised or unsupervised feature extraction, transformation, pattern analysis, and classification [19]. Artificial intelligence is used in tumor diagnosis in the health sector. Early detection of tumors is very important for human life. To facilitate this situation, the Machine learning method and deep Learning Algorithms (DLAs) are based on a kind of artificial intelligence and machine learning, which occurs by imitating the way people acquire information [20-21]. The mathematical modeling given below can be used to detect tumor cells by deep learning [22]. The mathematical modeling equations used in this regard are given below [22].

$$Accuracy = \frac{TP+TN}{TP+FP+FN+TN} \quad (1)$$

$$Sensitivitiy = \frac{TP}{TP+FN} \quad (2)$$

$$Precision = \frac{TP}{TP+FP} \quad (3)$$

$$Specificitiy = \frac{TN}{TN+FP} \quad (4)$$

$$F1\ Score = \frac{2*(Precision*Sensitivitiy)}{(Precision+Sensitivitiy)} \quad (5)$$

In different studies, more than one model has been identified to diagnose dental caries using deep learning or to detect lesions on dental x-ray images. The results obtained are close to the truth [23-26]. An example of a sample tooth structure analysis and caries labeling is given in Figure 2.

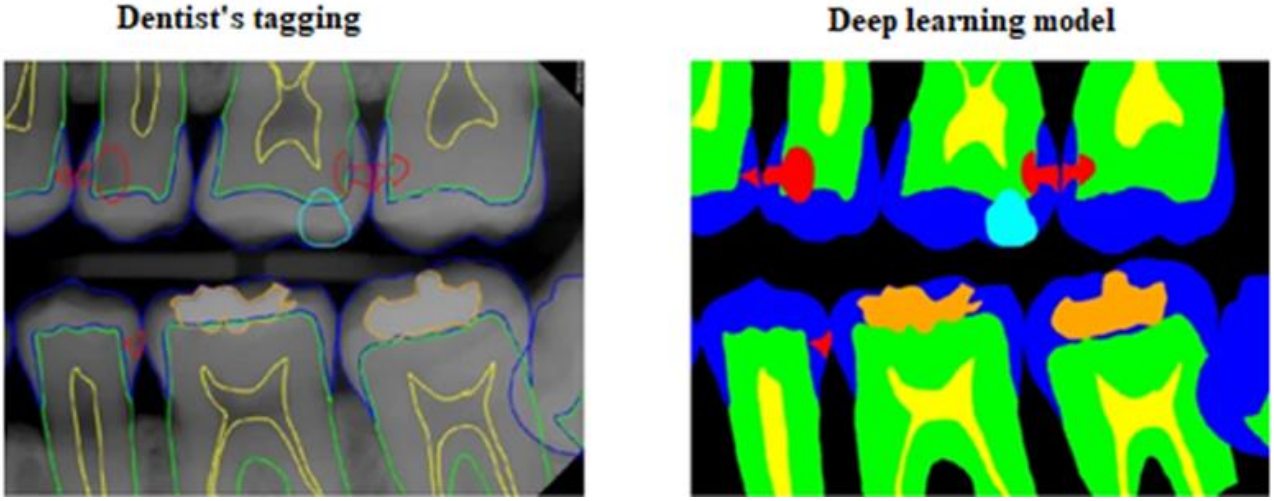


Figure 2. An example of tooth structure analysis [26]

Red: Caries, Blue: Enamel, Green: Dentin, Yellow: Pulp, Orange: Metal restoration, Sky blue: Restoration, Brown: Gutta percha, Black: Background [26].

In a different study, evaluations were calculated at the caries component level to evaluate the performance of dental caries detection [26-27].

For each object class, An Average Precision (AP) is defined [27].

FP-False Positive,
FN-False Negative,

$$AP = \frac{1}{11} \sum_{r \in \{0.0, 0.1, \ldots, 1.0\}} p_{interp}(r) \tag{7}$$

Where P_{interp} (r) is the maximum precision for any recall values exceeding [27].

$$p_{interp}(r) = \max_{\tilde{r} \geq r} p(\tilde{r}) \tag{8}$$

Finally, the mean average precision (mAP) is calculated as an average of Aps for all object classes:

$$mAP = \frac{1}{N_{class}} \sum AP \tag{9}$$

It is known that there will be a number of innovations in human life with robotic applications that are the basis of artificial intelligence. With robotic applications, computers and electronic robots are integrated with the principle of compatibility, the result of which is artificial intelligence, especially used in industry and cutting-edge technology, production and design robots are made with the help of computers. Figure 3 shows a symbolic robot produced by coding [28]. Artificial neural networks are a branch developed inspired by the human brain. Each one with its own memory and processing elements are connected through weighted links of parallel and distributed information processing structure. Artificial neural networks find wide application in many fields of science today due to these learning and generalization features and demonstrate the ability to solve complex problems successfully. Genetic algorithms, a sub-Dec branch of artificial intelligence, are a search and optimization method that works in a similar way to the evolutionary process observed in nature. It seeks the holistic best solution according to the principle of survival of the Dec in the complex multidimensional search space [28-30]. It has been researched with a literature study that it can be applied in the field of Artificial Intelligence, Food Engineering, Epidemic Artificial Intelligence (Robots) and Law [31-32]. As a situation where artificial intelligence becomes visible in every field as in the health sector. A photo of AI and Machine Learning is provided [33]. A photo of AI and Machine Learning is given in Figure 3.

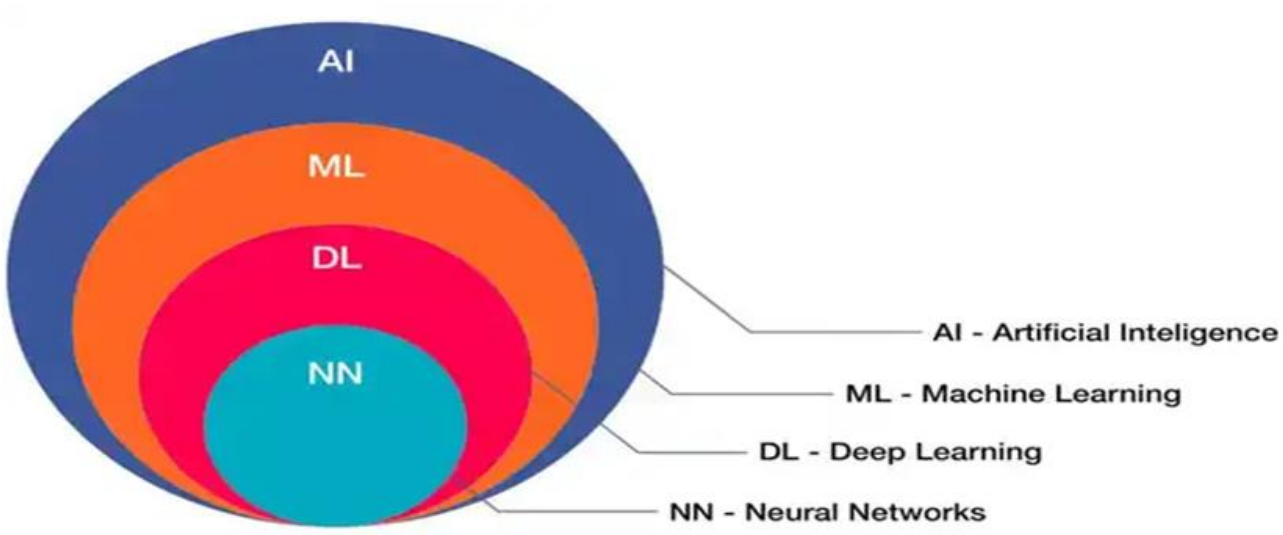


Figure 3. A photo of AI and Machine Learning [34]

Deep Learning is a large family of methods for machine learning based on artificial neural networks. Artificial neural networks are computational models based on the simplification of biological neural networks. Figure 4 shows an example of a neural network [35].

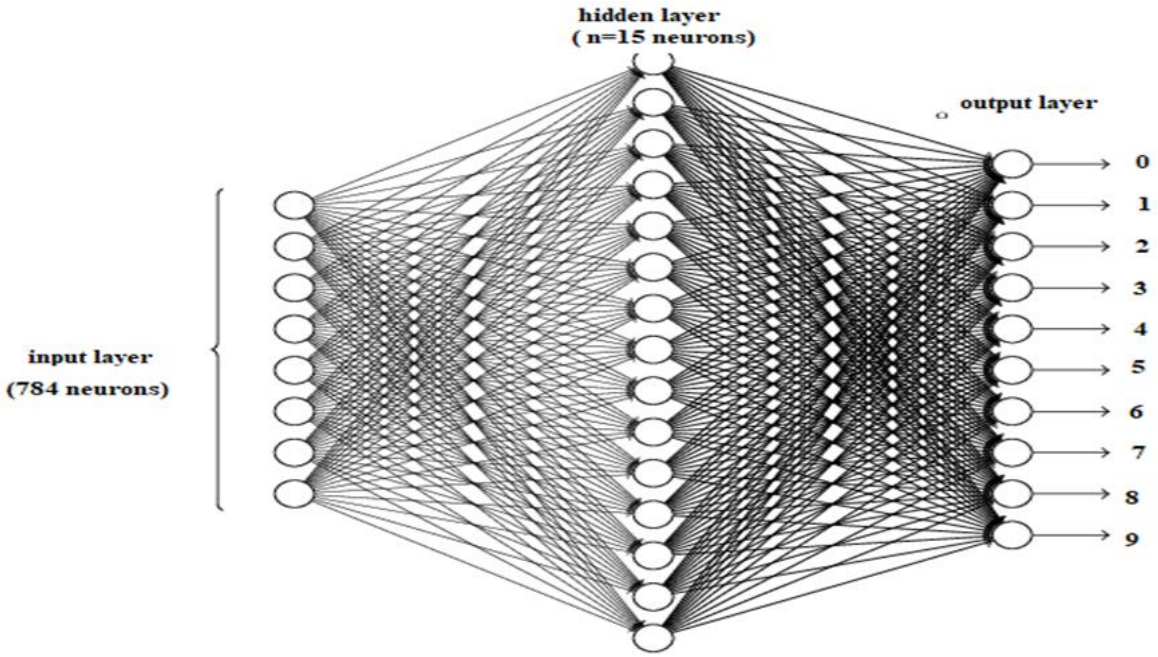


Figure 4. Example of neural network [35]

As can be seen in Figure 6, they can consist of many nodes or neurons and multiple layers of neurons. As the number of neurons and layers increases, the network can represent more complex nonlinear functions [36]. In a study, the classification of brain tumor images by deep learning methods was investigated. In another study, it was investigated that doctors can diagnose sick people early. In the study, Alexnet, Googlenet and Resnet50 architectures, which are deep learning architectures, were used to detect brain tumor images. The highest accuracy rate was achieved on the Resnet50 architecture. It is thought that the accuracy value of 85.71 percent obtained as a result of the experiments will be improved in future studies [37]. The experiment was conducted for automatic segmentation of the brain system. The BRATS2015 data set was used in the experiment [38]. In a different study, the semantic segmentation approach for volumetric 3D brain tumor segmentation from multimodal 3D MRI was investigated. The photo of the study is given in Figure 5.

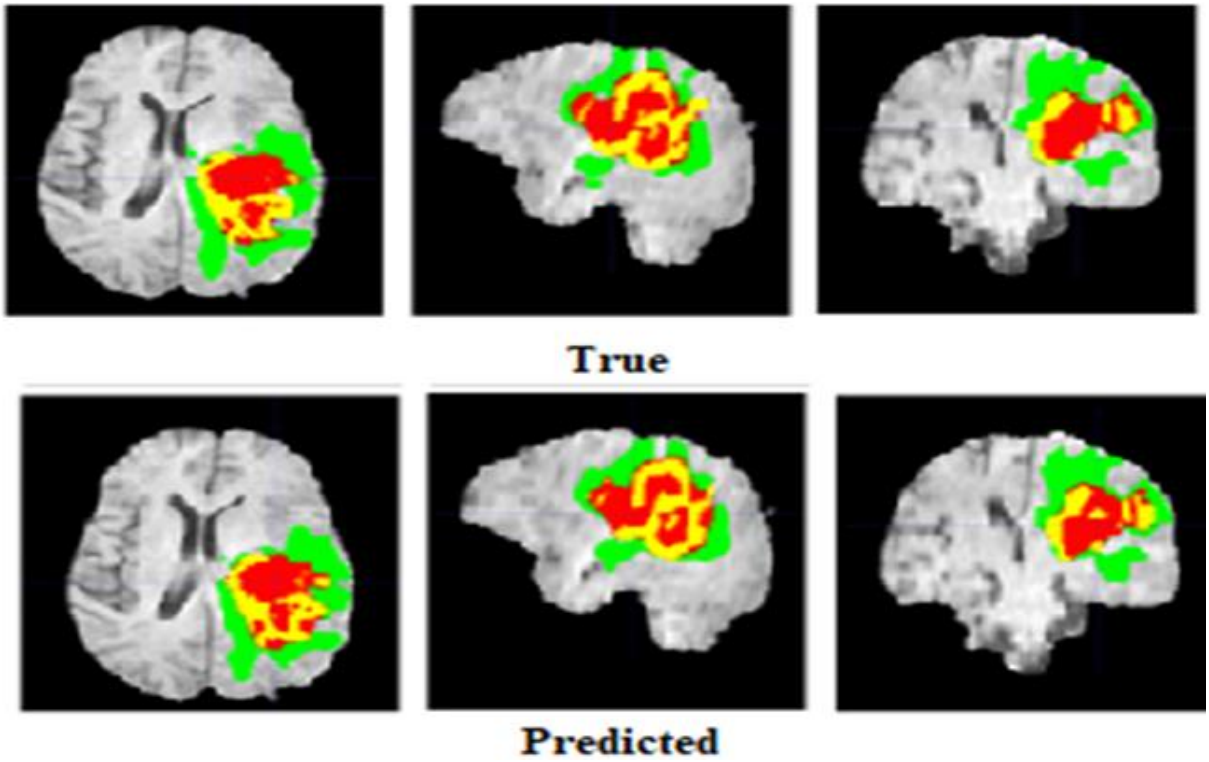


Figure 5. 3D brain tumor segmentation from multimodal 3D MRIs [38]

In a different study, it was estimated how quickly a malfunction in the machine could occur. Algorithm models between the generated sensor data and the malfunctions Decayed in the machines were used [39]. The segmentations obtained by Deciphering a Distinction between brain tumors and deep learning in a different study are given in Figure 6 [39].

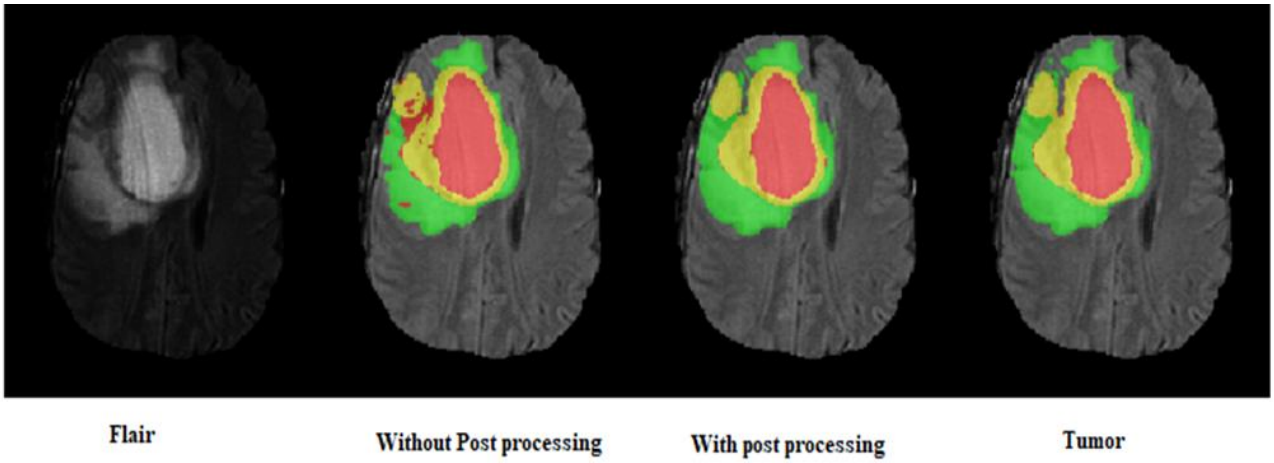
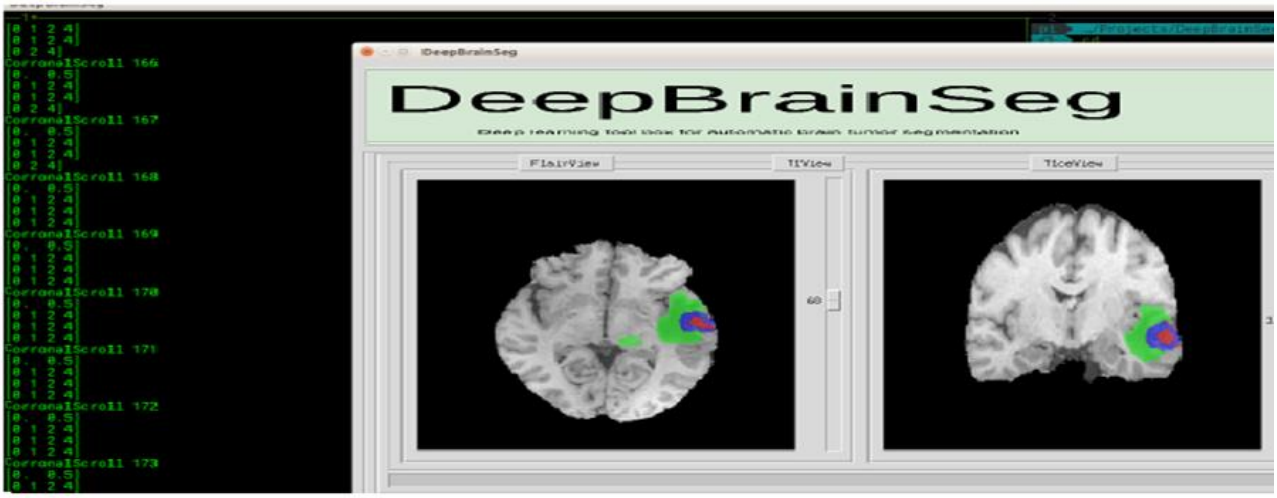


Figure 6. Telemetry data example literature [39]

In a different study; a user interface-based tool was produced for tumor segmentation visualization. The interfaced program obtained from brain tumor segmentation and commands is given in Figure 7 [40].



for data in BraTs format

```
from DeepBrainSeg import deepSeg
segmentor = deepSeg(quick=True)
segmentor.get_segmentation_brats(path)
```

for other formats

```
from DeepBrainSeg import deepSeg
t1_path =
t2_path =
t1ce_path =
flair_path =

segmentor = deepSeg(quick=True)
segmentor.get_segmentation(t1_path, t2_path, t1ce_path, flair_path, save = True)
```

Figure 7. Brain tumor segmentation and creation of commands [40]

Deep learning has been highly preferred in the field of health. Previous studies related to this are given in Table 1 [41].

Table 1. The use of deep learning in the field of health [41]

S/n	Author	Year Published	Title
1	Shin et al. [24]	2016	Deep convolutional neural networks for computer-aided detection: CNN architectures, dataset characteristics and transfer learning
2	Esteva et al. [69]	2017	Dermatologist-level classification of skin cancer with deep neural networks
3	Havaei et al. [78]	2017	Brain tumor segmentation with deep neural networks
4	Kamnitsas et al. [21]	2017	Efficient multi-scale 3D CNN with fully connected CRF for accurate brain lesion segmentation
5	Zhang et al. [120]	2015	Deep convolutional neural networks for multi-modality isointense infant brain image segmentation
6	Iglesias et al. [121]	2015	Multi-atlas segmentation of biomedical images: a survey
7	Greenspan et al. [14]	2016	Guest editorial deep learning in medical imaging: Overview and future promise of an exciting new technique
8	Tajbakhsh et al. [26]	2016	Convolutional neural networks for medical image analysis: Full training or fine tuning?
9	Pereira et al. [77]	2016	Brain tumor segmentation using convolutional neural networks in MRI images
10	Milletari et al. [20]	2016	V-net: Fully convolutional neural networks for volumetric medical image segmentation
11	Roth et al. [122]	2016	Improving computer-aided detection using convolutional neural networks and random view aggregation
12	Çiçek et al. [123]	2016	3D U-Net: learning dense volumetric segmentation from sparse annotation
13	Sirinukunwattana et al. [72]	2016	Locality sensitive deep learning for detection and classification of nuclei in routine colon cancer histology images
14	Anthimopoulos et al. [124]	2016	Lung pattern classification for interstitial lung diseases using a deep convolutional neural network
15	Setio et al. [125]	2016	Pulmonary nodule detection in CT images: false positive reduction using multi-view convolutional networks
16	Xu et al. [73]	2016	Stacked sparse autoencoder (SSAE) for nuclei detection on breast cancer histopathology images
17	Roth et al. [126]	2015	Deeporgan: Multi-level deep convolutional networks for automated pancreas segmentation
18	Moeskops et al. [76]	2016	Automatic segmentation of MR brain images with a convolutional neural network
19	Suk et al. [97]	2015	Latent feature representation with stacked auto-encoder for AD/MCI diagnosis
20	Bar et al. [127]	2015	Deep learning with non-medical training used for chest pathology identification

As can be seen in Table 1, there are studies related to cancer cells and tumors, especially through artificial intelligence. These studies are very important for the early diagnosis of diabetes, brain disorders, cysts that occur in the tooth and other diseases. Studies related to the analyzes made using artificial intelligence and mathematical programming are currently included in the literature [41-43].

3. Conclusion

In this study, literature studies on the applicability of Artificial Intelligence and its sub-branches in the field of health were examined. In the study, the definition of artificial intelligence, its sub-branches, and its applicability in health fields were investigated. The availability of artificial intelligence in the health and medical sector has emerged. As a result of the study, the following results were obtained: It is believed that artificial intelligence techniques can be successfully applied in the field of health and medical. It was concluded that it can be achieved with a high degree of success in solving various dental problems. It is thought that the use of robots can contribute to the health sector and physicians. It is thought that the desired goals can be fully achieved in the field of the health sector with the lower branches of artificial intelligence. Using the records in the hospital database, it is thought that online doctor robots, robots that can perform surgical procedures and nurse robots will play an important role in our lives in the future. In the field of health and medicine, health management with machine learning and artificial intelligence, artificial limb (arm, eye, etc.) applications, analysis of heart sounds, sound analysis for the deaf, classification of respiratory sounds, analysis of side effects of drugs, it is believed that useful studies can be produced by people.

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Conflicts of interest

The authors declare no conflicts of interest.

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