# Artificial Intelligence

## Applications in Medicine

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MHA
MEDIHEALTH ACADEMY

Hipokrat
Yayıncılık

**ISBN:** 978-625-7399-97-5



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**Publisher**

Hipokrat Yayınevi

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**Edition-Volume**

Ankara Özgür Matbaacılık Basım Yayın Dağ. San. Tic. A.Ş.

1250 Cadde No: 25 Ostim OSB Yenimahalle / Ankara

Certificate Number: 46821

Hipokrat Yayıncılık

Süleyman Sırrı Cad. No:16/2 Sıhhiye

Tel: (0312) 433 03 05-15 ANKARA

www.hipokratkitabevi.com

# Preface

Dear Colleagues,

In this book, we tried to convey to you some examples of Artificial Intelligence applications, which have an important place in the field of medicine. You can find the importance of artificial intelligence in the field of medicine, its basic applications and its future place in this book. Thanks to the revolutionary applications in the field of health, examples are presented that can easily be achieved by anyone who is interested in the subject in both engineering sciences and medicine.

Especially the increasing population of the country and the number of patients complicate the health management. Failure of the arrangements to be done correctly makes it difficult for patients to reach health services and even apply to the right centers, and makes the work of physicians very difficult at the moment of diagnosis. The contributions of artificial intelligence to physicians are a guide in many places in the health sector. In short, the aim of this book is to increase the knowledge and equipment of our physicians so that they can interpret the applications in the field of Artificial Intelligence, in addition to contributing to the engineering sciences to have better quality and comprehensive information in the field of medicine.

Before the writing process of the book, we created certain topics by examining the problems they encounter most in practice in the surveys and field studies we conducted in the field of medicine. Later, we determined Artificial Intelligence-based decision support systems for these topics. Finally, we finished the writing process of the book by contacting academicians specialized in these subjects in different universities of our country. I would like to thank all my academic friends who wrote chapters in this difficult and tiring journey for their efforts.

Our dear brother and esteemed teacher Prof. Dr. I would like to express my endless thanks to Aydın ÇİFCİ.

I would like to thank our project coordinator Meryem YAVUZ, our graphic-design responsible Fatih Şamil ULUDAĞ and Dilaver Emin KORKMAZ, who have always been with us with their support day and night throughout the whole process, and all the publishing house employees who have supported us throughout the process.

I would like to present my endless love to my dear children Mert and Ela whom I regretfully deprived of my love because of the things I have been working on and to my dear wife Elif Türk for whom I could not spare enough time due to my academic studies and intense work schedule.

On behalf of my entire team, with love and regards....

**Asist. Prof. Fuat TÜRK, PhD**
**Çankırı, 2022**

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# Contents

# Chapter 1 Classification of Skin Cancer by Deep Learning Method

Fuat TÜRK

The skin is a very comprehensive organ that protects the body against risks such as heat, light and infection. In addition, it controls body temperature and plays an important role in the storage of fat and water [1, 2]. Despite the significance of the skin, the fact that it is at high risk and skin cancer is a serious type of cancer should not be forgotten. Skin cancer can be expressed as the abnormal proliferation of skin cells and the formation of malignant tumors [3]. The vast majority of skin cancer cases are generally divided into two groups. These are called melanoma and non-melanoma skin cancer. Melanoma covers about 4% of skin cancer lesions. This species is known to be the most aggressive and lethal among all forms [4]. It originates from melanocytes, the pigment-producing cells of the skin. It is more likely to grow and spread if not adequately treated. Therefore, early diagnosis and treatment is very important for dermatologists.

In melanoma species, the underlying cause is often unknown. However, several factors are predicted to cause the disease, including genetic factors, ultraviolet radiation, and environmental contact. Melanoma arises from malignantly transformed skin melanocytes. Melanocytes are manifested by dark pigments on hair, eye and body spots. These tumors are mostly brown or black in color. On the other hand, in rare cases, melanomas may not produce pigment. In this case, it may appear as pink, red or purple [5]. Sometimes melanoma species spread through the circulatory system and can manifest even in the most distant parts of the body [6]. It is known as the type with the highest probability among various types of skin cancer [7].

Despite all the negative situations, skin cancer has a high chance of recovery. Recent studies indicate that early detection of melanoma helps to significantly reduce the mortality rate [8]. The most serious problem at this point is that early diagnosis of melanoma is difficult, even by specialists. However, image processing and artificial intelligence applications have been an important auxiliary resource for the different uses of medical imaging, which is increasing [9]. The use of these applications can increase the speed of the diagnostic process and reduce human-induced errors. For this reason, it can be used safely by doctors and radiologists.

## MATERIALS AND METHODOLOGY

### Dataset

HAM10000 (“Human Against Machine with 10000”) dataset is used in this section. In the data set, there are 10015 dermatoscopic images published as a training set for use in academic studies and available to everyone through the ISIC archive. In this dataset, images were prepared for 7 different skin cancers. These;

1. Melanocytic nevi (NV)
2. Melanoma (MEL)
3. Benign keratosis-like lesions (BKL)
4. Basal cell carcinoma (BCC)
5. Actinic keratoses (AKIEC)

# Chapter 5

# Effect of Noise Reduction Filters Protecting the Edges in a COVID-19 Infected CT Image

Ufuk TANYERİ
Mahmut KILIÇASLAN

Since 1991, researchers have focused on removing unwanted pixels, or noise, caused by peripheral and imaging devices in medical images. There are 1253 studies in this field registered in Web of Science (WoS), which provides comprehensive citation data for many different academic disciplines and subscription-based access to multiple databases. When the studies are examined in the WoS categories, the first five are Radiology Nuclear Medicine Medical Imaging, Engineering Electrical Electronic, Engineering Biomedical, Imaging Science Photographic Technology, and Computer Science Artificial Intelligence, in that order. The top three institutions that invest the most in the aforementioned fields are the National Natural Science Foundation of China (NSFC), the National Institutes of Health (NIH) USA, and the United States Department of Health and Human Services. According to the citation status of the studies, the field order of the studies is in the categories of Medical Physics, Security, Encryption & Encoding, Brain Imaging, Computer Vision & Graphics, and Imaging & Tomography. **Figure 1** depicts the countries that have conducted the most studies on this subject, as well as the number of studies.

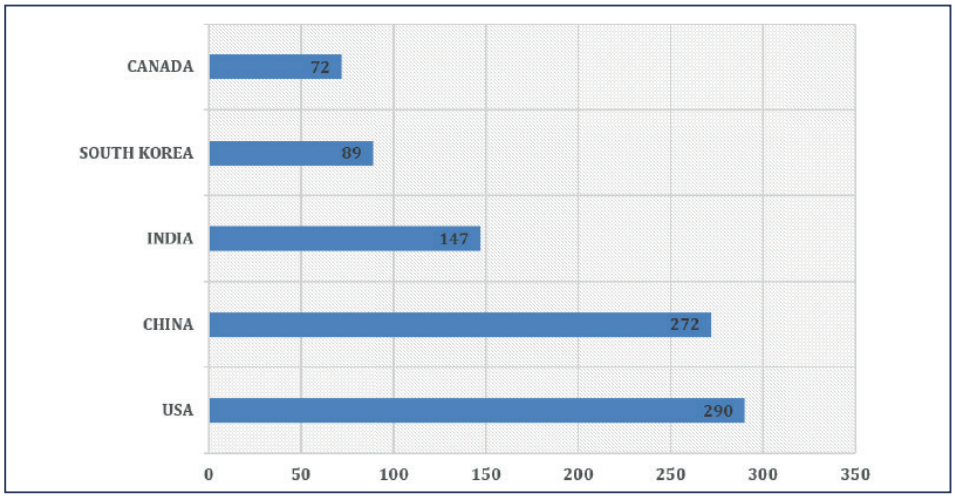


**Figure 1.** Top 5 countries with the highest number of image filtering in medical images

Image filtering or noise reduction is a necessary first step in many applications such as image segmentation, image retrieval, 3D modeling of images, image enhancement, and so on. Because the formation of unwanted pixels in images is a disadvantage in these studies. Image filters are used to remove unwanted values, also known as noise, from an image. It is critical to keep the color values of the edge and region preserve while performing these operations.

The types of noise in medical images such as CT, MRI, Tomography, and satellite and camera images differ. When the noises are examined mathematically, it is discovered that

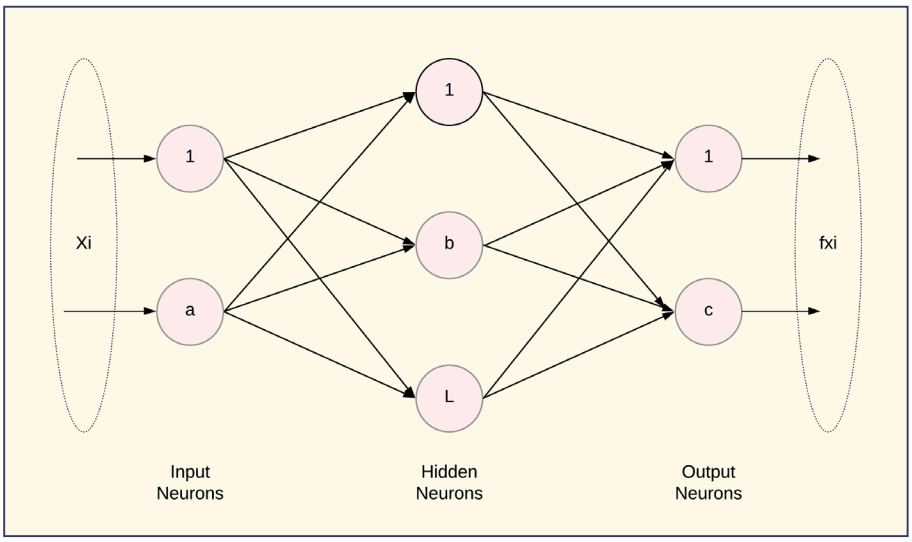


**Figure 4.** ELM Structure

## PERFORMANCE EVALUATION METRICS

It is crucial that the classification is made correctly in the field of health. A series of metrics have been developed to measure the performance of the algorithms used in detecting epileptic seizures. Metrics calculate performance by comparing forecast data with actual values to determine accuracy. It is also necessary to use these metrics to decide which model should be the most accurate.

True Positive and True Negative are areas the model predicts correctly, while False Positive and False Negative are areas that the model predicts incorrectly. True Positive is the state in which a person who actually has the disease also has the disease by the algorithm developed. True Negative is when a person who does not actually have the disease does not have the disease by the algorithm developed. False Positive is a situation in which a person who does not actually have the disease has the disease by the algorithm developed. False Negative, on the other hand, means that a person who actually has the disease does not have the disease by the algorithm developed [22,23].

**Table 1. Confusion Matrix**

| | | ACTUAL VALUES | |
|---|---|---|---|
| | | POSITIVE | NEGATIVE |
| PREDICTED VALUES | POSITIVE | TP | FP |
| | NEGATIVE | FN | TN |

As shown in **Table 1**, accuracy shows the ratio of the part (TP+TN) that the developed model predicts correctly to the total number of patients. Sensitivity refers to the ratio of correctly predicted diseased individuals to correctly predicted cases. Specificity is a