ESKİŞEHİR TEKNİK ÜNİVERSİTESİ BİLİM VE TEKNOLOJİ DERGİSİ
B- TEORİK BİLİMLER

Eskişehir Technical University Journal of Science and Technology B- Theoretical Sciences

Internatıonal Conference on Natural Sciences and Technologies
Iconat Special Issue 2021

2021, Vol:9, pp. 65-68, DOI: 10.20290/estubtdb.1011591

COMPARISON OF DEEP LEARNING WITH MACHINE LEARNING ON SKIN SEGMENTATION

Utku KAYA [1,*], Mehmet FİDAN [2]

[1] Vocational School of Transportation, Eskişehir Technical University Eskisehir, Turkey
[2] Vocational School of Transportation, Eskişehir Technical University Eskisehir, Turkey

ABSTRACT

In this study, a skin segmentation study is investigated with deep learning methods. The skin segmentation problem is chosen as a case study. The main reason for this is that there are numerous studies on this subject and the abundance of available data sets. In addition, images containing skin pixels contain multiple attributes. That's why human images are very suitable for comparative studies on machine learning and deep learning. In the first stage of this study, skin segmentation will be done by using RGB space, which contains deep information as an attribute in machine learning. At the same time, to show the success of the deep learning algorithm, the effect of deep learning will be tested by converting images to grayscale, and success differences will be given.

Keywords: Skin segmentation, Deep learning, Machine learning, Semantic segmentation

1. INTRODUCTION

Distinguishing human skin from images is an interesting process. Because the races of the people in each image, blur in the images, ambient light, etc. factors make skin differentiation difficult. That's why researchers have been working for a long time [1-5]. Skin segmentation is of great importance, especially in areas such as human-computer communication, a type of field, and face identification, sign language.

Each image contains multiple different attributes and millions of pixels for processing. To solve this challenging problem, researchers are working on several machine learning algorithms [6-10]. The first step in machine learning is usually to learn the images previously labeled as skin and nonskin pixels by the human eye. At this stage, the features of each tagged pixel and pixel neighborhood are extracted. The relationship between the skin and nonskin pixels corresponding to these features is learned by the computer by algorithms.

Numerous features have been proposed in the literature to be used in skin detection with machine learning [6-10]. A few of them are RGB, YCbCr, HSV, GLCM, etc. RGB, which is widely used among them, usually aims to train machine learning with the colors of images and its success rate is remarkable. However, this does not indicate that the RGB attribute alone is sufficient. RGB, YCbCr combination, RGB + GLCM, etc. combinations can increase success. Which combinations are the best is the question mark. Therefore, there are also studies on feature selection.

Deep learning is a subset of machine learning. Recently, the importance of deep learning has started to increase gradually. One of the reasons that make deep learning attractive is that it can detect skin without prior feature extraction which is extracting hundreds of different features from hundreds of different pixels. Human contribution in deep learning algorithms is very small compared to machine learning [11, 12].

2. METHODS

In this study, the Pratheepan database [13], which has a relatively small number of data, was chosen. Using the data in this database, skin segmentation will be done with both machine learning and deep learning.

*Corresponding Author: utkukaya@eskisehir.edu.tr
Received:18.10.2010 Published:24.12.2021

From the first stage, SVM classification which is a machine learning algorithm will be investigating. The resolutions of the images are used to train the algorithm will be kept original. In addition, an SVM-based machine learning application will be made using RGB, which is a defining and highly successful attribute.

In the second stage, semantic segmentation will be done using a deep learning network. The images we use in the deep learning network will be converted to gray format and the network will be trained. The main reason why we convert images to gray format; is to be able to prove the success of deep learning with lacking color space.

3. RESULTS

In the first stage, machine learning was performed with SVM classification. RGB, which is the most defining feature, was chosen as the main feature. The average success values of our network for 78 images are given in Table 1.

Table 1. Success metrics of SVM machine learning algorithm by using RGB features

Classification method	**Classifier type**	**Sensitivity**	**Specificity**
RGB	SVM	0.7953	0.8936

With the machine learning application is applied by using the SVM algorithm, the prediction rate of skin pixels as the skin was 79.53%, and the rate of detection of nonskin pixels as nonskin is 89.36%.

In the second stage, the images were converted to black and white format, and the RGB attribute, which was given in the table and is very successful, was eliminated. The deep learning network is trained with the semantic segmentation algorithm given in Figure 1.

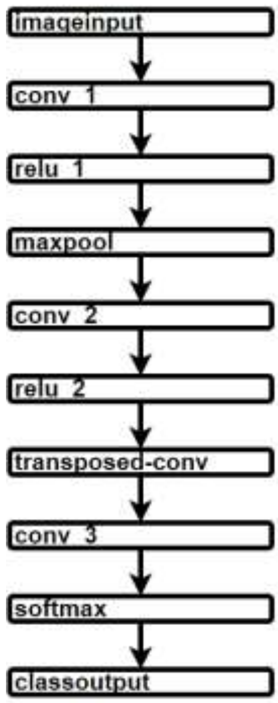

Figure 1. The purposed semantic segmentation algorithm

Table 2. Success metrics of the semantic segmentation network

Classification method	Classifier type	Sensitivity	Specificity
Deep Learning	Semantic segmentation	0.8799	0.7289

Deep learning application is applied with the proposed Semantic segmentation network, the rate of estimating Skin pixels as the skin was 87.99%, and the rate of detecting nonskin pixels as nonskin was 72.89%.

As seen in Table 1, the skin segmentation success of the RGB attribute is significant. Although the RGB attributes of the images used to train the semantic segmentation algorithm are eliminated and the resolution is reduced as much as possible, the success of the network is higher than the SVM algorithm. In particular, the Sensitivity value increased from 79% to 87.99%. Specificity rates decreased from 89.36% to 72.89%. This decrease is normal as the features that play an important role in detecting the images used are eliminated.

Figure 2. Result images with Iou score=0.9633(Left=original, Middle= ground truth, Right= predicted)

IoU is one of the frequently used metrics in semantic segmentation. It is an extremely simple and effective measurement. The IoU is the expression of the overlap area between the predicted segmentation and the ground truth. The IoU value is between 0 and 1. A value close to 1 indicates that the semantic segmentation algorithm is very successful. In Figure 2. The Iou score is found to be very high (IoU=0.9633), which shows the remarkable success of the purposed algorithm.

4. CONCLUSION

With the release of new powerful systems and graphics cards, the importance of deep learning applications has increased. In this study, skin segmentation, which has been studied extensively, has been chosen as the main application. High success has been achieved with the application of machine learning such as SVM. However, such classification applications are shifting to the deep learning side. In our study, a deep learning application, which is trained without using the machine learning algorithm and feature extraction, has been implemented. The results give better success metrics than the SVM algorithm, although the images are applied as gray and low resolution.

CONFLICT OF INTEREST

The authors stated that there are no conflicts of interest regarding the publication of this article.

REFERENCES

[1] Phung Son Lam, Abdesselam Bouzerdoum and Douglas Chai. Skin segmentation using color pixel classification: analysis and comparison. IEEE transactions on pattern analysis and machine intelligence, 2005; 27(1) 148-154.

[2] Phung Son Lam, Douglas Chai and Abdesselam Bouzerdoum. Adaptive skin segmentation in color images. IEEE International Conference on Acoustics, Speech, and Signal Processing, Proceedings.(ICASSP'03);Vol. 3. IEEE, 2003.

[3] Phung Son Lam, Abdesselam Bouzerdoum and Douglas Chai. Skin segmentation using color and edge information. Seventh International Symposium on Signal Processing and Its Applications, Proceedings, Vol. 1. IEEE, 2003.

[4] Al-Tairi Zaher Hamid et al. Skin segmentation using YUV and RGB color spaces. Journal of Information Processing Systems, 2014; 10(2) 283-299.

[5] Gasparini Francesca, and Raimondo Schettini. Skin segmentation using multiple thresholding. Internet Imaging. International Society for Optics and Photonics, 2006; VII. Vol., 6061.

[6] Saini Harpreet Kaur and Onkar Chand. Skin segmentation using RGB color model and implementation of switching conditions. Skin 2013; 3(1): 1781-1787.

[7] bin Abdul Rahman Nusirwan Anwar, Kit Chong Wei and John See. Rgb-h-cbcr skin colour model for human face detection. Faculty of Information Technology, Multimedia University 4 2007.

[8] Phung Son Lam, Abdesselam Bouzerdoum and Douglas Chai. Skin segmentation using color and edge information. Seventh International Symposium on Signal Processing and Its Applications, Proceedings. Vol. 1. IEEE, 2003.

[9] Abbas Zeeshan et al. An efficient gray-level co-occurrence matrix (GLCM) based approach towards classification of skin lesion. Amity International Conference on Artificial Intelligence (AICAI). IEEE, 2019.

[10] Hall Mark Andrew. Correlation-based feature selection for machine learning, 1999.

[11] Cai Jie et al. Feature selection in machine learning: A new perspective. Neurocomputing 300; 2018; 70-79.

[12] http://cs-chan.com/downloads_skin_dataset.html