Managing Intellectual Capital
and Innovation for Sustainable
and Inclusive Society
27–29 May 2015
Bari • Italy

make learn
TIIM

Management,
Knowledge and Learning
Joint International Conference 2015
Technology, Innovation
and Industrial Management

DETERMINATION OF WHETHER SKIN OR NON SKIN FROM THE COLOR PIXELS USING NEURAL NETWORK

Ali Yasar
Selcuk University, Turkey
aliyasar@selcuk.edu.tr

Ismail Saritas
Selcuk University, Turkey
isaritas@selcuk.edu.tr

Abstract:
In this study using the artificial neural network method of artificial intelligence techniques, using the pixel values of color which were obtained from people who belong our data such as RGB (RED-GREEN-BLUE), we realized classification process as the skin or non-skin form of people's image. There are 3 entries in the artificial neural network. Hidden layers are included in our system. The skin of the dataset is collected by randomly sampling the R, G, B values from face images of various age groups (young, middle, and old), race groups (white, black, and Asian), and genders obtained from FERET database and PAL database . Total learning sample size is 245057; out of which 50859 is the skin sample and 194198 is non-skin samples. These 3 input reach our 10-layer hidden layer at our net and from here by processing a classification process is done. Classification of artificial neural network of 245057 data are determined as successful as set of real data classification. Regression results of classification process is quite high. Training regression R = 0.99123, test regression R= 0.99056 and validation regression are defined as 0.99131. With the artificial neural networks in the classification process has been shown to be achieved outstanding success.

Keywords: ANN, classification, artificial neural network, skin, non-skin, machine learning database, RGB

1. INTRODUCTION

At present time one of security elements which has great importance for countries is the people's face recognition system. In such systems, determination of parts whether skin or non-skin will allow for easier recognition and image processing techniques in computer. Color space-based models act as efficient approaches for quickly identifying the skin-like regions before performing complicated steps like face and body detection and tracking. Various color space-based approaches have been proposed by researchers (Albiol, Torres and Delp 2001; Brand and Mason 2000; Chai and Bouzerdoum 2000; Gomez 2000; Terrillon et al. 2000). However, skin region segmentation for embedded systems porting needs separate attention because of processing limitations of the devices (Rajen et al. 2009). Collected skin dataset by randomly sampling B,G,R values from face images of various age groups (young, middle, and old), race groups (White, Black, and Asian), and genders obtained from FERET database and PAL database (Color FERET & PAL Face).

Psychological case evaluation is a study depending on facial expression recognition. On account of an ability of facial expression recognition, there are individual differences even in between people.

Classification can be defined simply as regulation of objects in certain groups based on their similarities. In this study using artificial neural networks was carried out the classification process. In Skin segmentation classification (SSC) process UCI Machine Learning Repository (Center for Machine Learning and Intelligent Systems located in (http://archive.ics.uci.edu/ml/datasets.html) utilizing the classification of Skin Segmentation data set is made . The aim of this study is to perform the classification task of data mining and artificial neural network method with information about our dataset.

2. MATERIAL AND METHODS

In this study, the UCI Machine Learning Repository (center for Machine Learning and Intelligent Systems, which is located in (http://archive.ics.uci.edu/ml/datasets.html) data belongs to Skin Segmentation data set are used   With The Red (R) {0-255}, Green (G) {0-255}, Blue (B) {0, -255} data, deciding whether skin or non-skin classification was carried out with neural networks.

Neural Network Toolbox of Matlab R2013b program was used in this study.

2.1. The concept of color

The color is a sensation which comes into by reaching different wavelengths of light to retina of eye. The perception of color by the human body realize with reflection of light through objects and subject's transmitting to the brain thanks to the help of the eyes This perception varies because of detection light on the material and they partly absorb and partly reflect. And this is called as color shade or color. If all wavelengths simultaneously reaches the eye, it is perceived as white but if it does not reach any light, it is perceived as black (Metlek 2009). Colored images are displayed as a 24-bit data in the computer screen. Displaying occurs by transmitting of the image which is as red, green, blue, three gray-level encoded which has the same object on top of the screen. In the electromagnetic spectrum 0.4-0.5 mm wavelength corresponds to blue; 0.5 to 0.6 mm wavelength corresponds to green; 0,6-0,7 mm wavelength corresponds to red. If the three 8-bit image which is obtained from this wave length reflect to computer screen respectively as red-green-blue, colored image can be obtained (Russ 1999). At Grayscale images occur images of different grayscale values. Grey value range is expressed as S = {0,1, 2, ..., 255}. What this means is that the value of 256 different shades of gray in a grayscale image can be found rather different gray values (Diamond 2003). 256 gray values can be defined as a byte, 1 byte = 8 bits and 2^8 corresponds to 256. 0 gray value as a rule corresponds to black color, the gray value of 255 corresponds to white. These values are formed between the gray tones.
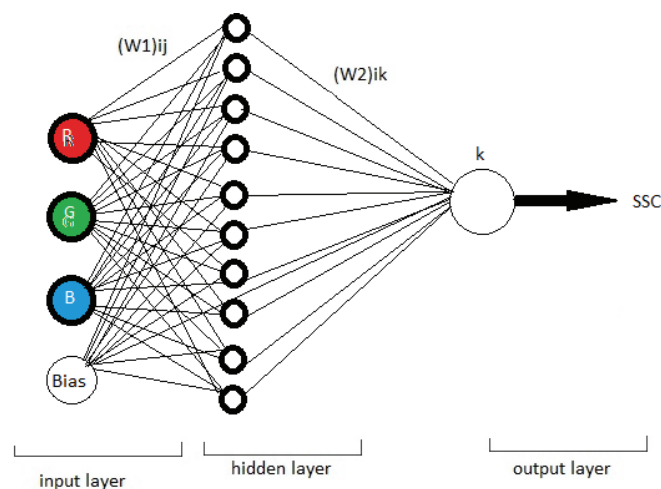
2.2. Artificial neural network

At the present time artificial neural networks (ANN) are used in the solution of various problems that present information classification and interpretation of information found in (Diamond 2003).

Primary output neurons are called as the neurons which take input signal at biological neural network, interprets and transmits the appropriate output. A neuron, consists of three parts as body (cell body), receivers (dendrites) which enter the body signal and the signal transmitting from the body (axon) (Sağiroğlu, Beşdok & Erler 2003).

Artificial neural networks, in general, according to the network; as feedforward and feedback doubled, according to the learning rule; can be divided into 4 including as Hebb, Hopfield, Delta and Kohonen, according to the learning algorithm; supervised, unsupervised and 27 reinforced can be divided into 3; according to practice can be divided into 2 as off-line and on-line . In addition, according to being symmetric or asymmetric of the weight matrices, being fixed or variable of the value of weight matrix, located on the characteristics of the network node, being deterministic or stochastic activation function can be classified. Feedforward networks in pattern recognition problems are widely used in the feedback networks in optimization problems. (Steel 2011)

Artificial neural network model which consists of our system is shown in Figure 1.

Figure 1: The structure of ANN

As it can be seen from the figure, our neural network consists of 4 inputs including input 3 + 1 and a hidden layer which has 10 layers and 1 output layer.

2.3. ARTIFICIAL NEURAL NETWORK APPLICATION ON DATASET

Here, the following transactions were carried out to determine whether it is skin or not from the dataset of 245 057 color pixels:
        a. Random number 36759 (15%) was selected as our test data.
        b. Random number 36759 (15%) data is selected as the data validation.
        c. The remaining 171 539 units (70%) was selected as the training data.

In this study, a feed forward network structure that contains an input layer, a hidden layer and an output layer (Fig. 1) was used. After the ANN structure was designed, the data obtained in the experimental study were normalized in the 0-1 value set using Eq. 1 in order to improve the characteristics of the training. The Back Propagation algorithm was used in the training procedure. Different transfer functions (Purelin, Tansig, Logsig etc.) were used and tried in the neurons in the hidden and output layers and (Tansig) was selected as the transfer function that yielded the best result.

$$x_{norm} = \frac{x - x_{min}}{x_{max} - x_{min}}$$

(1)

The training data set was used to determine ANN neuron and bias weight values. Training was repeated to obtain the lowest level of error by changing the number of neurons and the epoch number. Then, the trained algorithm was applied on the test data set.

First, by giving different values in the hidden layer, network is trained and the results have been observed. For 10-layer network in the hidden layer that the best results are obtained is seen.

At the end of these Procedures, the network structure that yielded the best classification is given in Table 1.

Table 1: The parameters and properties used in ANN

| Parameters	Properties
Number of neurons in the input layer	3
Number of the hidden layers	1
Number of neurons in the hidden layer	10
Number of neurons in the output layer	1
Learning rate (α)	0,3
Coefficient of momentum (β)	0,3
Learning algorithm	Gradient descent (traingd)
Transfer function	Logarithmic sigmoid (logsig)

As a result of this education: Regression graph of training set is on Figure 2.
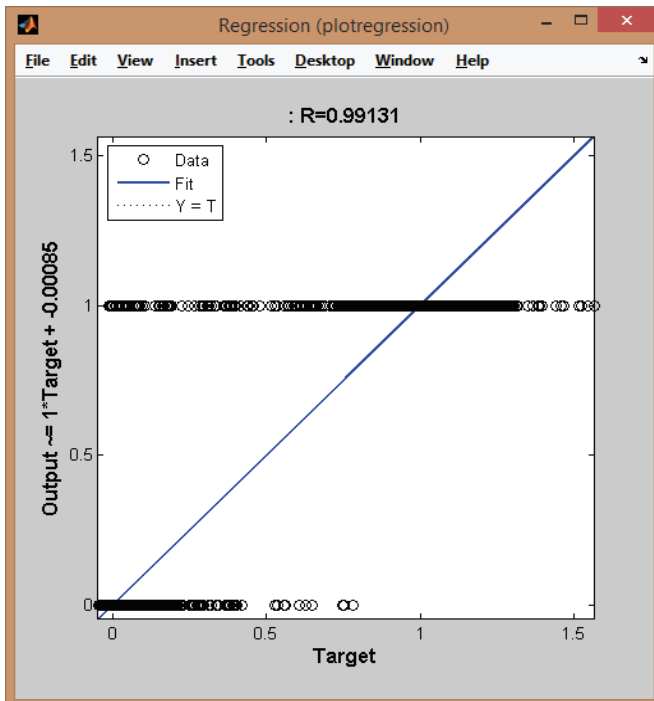
Figure 2: Regression of Train Set
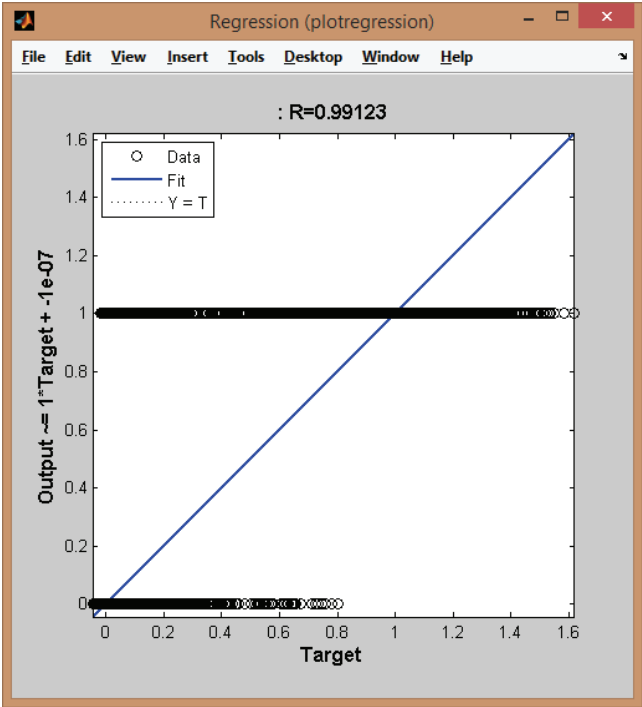
Graphic of data set test of regression is on Figure 3.

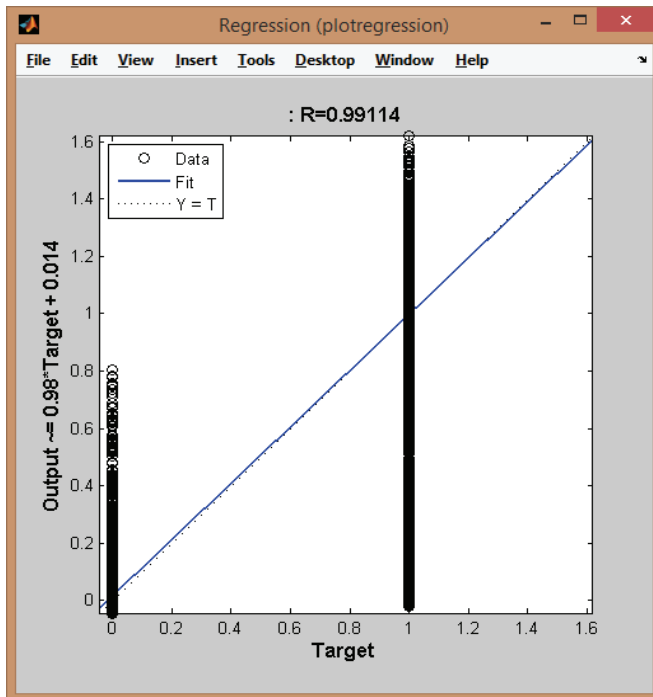**Figure 3:** Regression of Test Set
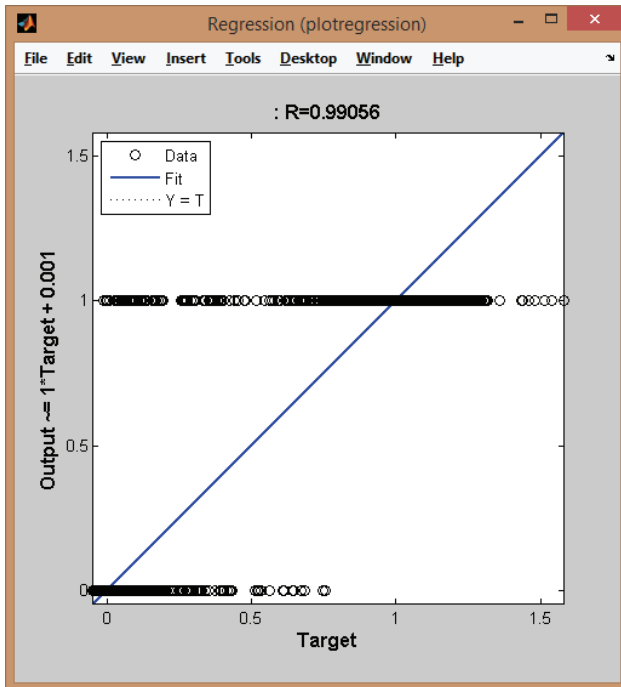
Data Set Validation of Regression Graphic is on Figure 4.

Figure 4: Regression of Validation Graphic

Regression of Output Set is on Figure 5.

Figure 5: Regression of Output Set

3. RESULT AND DISCUSSION

When our study was completed, our system results in our database and rates skin/ non skin compared with our system, it is seen that SSC has made a correct estimation of over 99%. From this point of view, we can say that artificial intelligence techniques show a sufficient success in the classification process of artificial neural networks.

4. CONCLUSIONS

In this study, artificial neural networks can be used in the classification process and it has been shown that good results can be obtained. When we look at the results of "Rajan B. Bhatt, Gaurav Sharma, Abhinav Dhall, Santanu Chaudhury, Efficient Skin Region Segmentation using Low Complexity Fuzzy Decision Tree Model IEEE-INDICO 2009, Dec 16-18, Ahmedabad, India, pp. 1-4. "(Rajen et al. 2009) it is seen that we obtained better results than them. While Rajan B and et all fold cross-validation performance is %94.10, in our study the average of validation performance is over %99.

ACKNOWLEDGEMENTS

REFERENCE LIST

1. Albiol, A., L. Torres, and E.J. Delp. (2001). "Optimal color spaces for skin detection", in Proc. of Int. Conf. on Image Processing, vol. 1, pp. 122-124.
2. Brand J. and J. Mason. (2000). "*A comparative assessment of three approaches to pixel level human skin detection",* in Proc. of Int. Conf. on Pattern Recognition, 1056-1059.
3. Chai D. and A. Bouzerdoum. (2000). "*A Bayesian approach to skin color classification in YCbCr color space",* in Proc. IEEE TENCON vol. 2, 421-424.
4. Color FERET Image Database: http://face.nist.gov/colorferet/request.html.

5. Diamond, Ç. 2003."*Neural Networks (Theory, Architecture, Implementation),"* Outstanding Publications.

6. Gomez, G. (2000). "*On selecting color components for skin detection*", in Proc. of ICPR, vol. 2, 961-964.

7. Metlek, S. (2009). "*Production Line of the colored cylinder Parts Machine Defining the Vision System and Classification*", Master Thesis, Suleyman Demirel University, Institute of Science, Isparta, Turkey, 13-14.

8. PAL Face Database from Productive Aging Laboratory, The University of Texas at Dallas: https://pal.utdallas.edu/facedb/.

9. Rajen B. Bhatt, Gaurav Sharma, Abhinav Dhall, Santanu Chaudhury. (2009). *Efficient Skin Region Segmentation using Low Complexity Fuzzy Decision Tree Model* IEEE-INDICON, Dec 16-18, Ahmedabad, India, 1-4.

10. Russ, J.C. (1999). *"The Image Processing Hand Book",* Third Edition, CRC Press, ISBN:0-8493-2532-3.

11. Sağiroğlu, Ş., Beşdok E., M. Erler .2003. "*Artificial Intelligence Applications of Artificial Neural Networks in Engineering*", Horizons Publishing.

12. Steel E. (2011). "*Based Image Processing Identifying Palm Print With Neural Network.*" Master's Thesis, Marmara University, Istanbul, Turkey.

13. Terrillon, J.-C., M.N. Shirazi, H. Fukamachi, and S. Akamatsu. (2000). *"Comparative performance of different skin chrominance models and chrominance faces for the automatic detection of human faces in color images*", in Proc. of Int. Conf. on Face and Gesture Recognition, 54-61.