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Prediction of Human Gender based on Two Level Decision using 3 Sigma Limits on Neural Network

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Abstract - A person's face provides a lot of information such as age, gender and identity. Faces play an important role in the prediction of gender. In this research, an attempt is made to classify human gender using two level decision based on Neural Networks. In this paper a feed forward propagation neural networks are constructed for human gender classification system for male and female. The performance of the system is further improved by employing second level decision using three sigma control limits applied on the output of the neural network classifier. The efficiency of the system is demonstrated through the experimental results using benchmark database images.

Keywords-Gender prediction, Facial Features, Feed Forward Propagation, Neural Network.

I. INTRODUCTION

Human facial image processing has been an active and interesting research issue for years. Since human faces provide a lot of information, many topics have drawn lots of attentions and thus have been studied intensively. Automatic human facial expression recognition, Human mood analysis system are the thrust research area in video surveillance and law enforcement applications as a prerequisite for face recognition. Until now much research work has been done on detecting the human faces based on templates and example-based techniques. However, some of these methods are computationally expensive and also complex.In information technology, a neural network is a system of programs and data structures that approximates the operation of the human brain. A neuron is a basic information processing unit. A neuron consists of a cell body called Soma, a number of fibers called Dendrites, and a single long fiber called Axon. Soma fires at different frequencies, Dendrites receives electrical signals affected by chemical processes. A perceptron is a simplest form of neural network. The connections between neurons are called Synapses. Neurons in a network are connected by directed, weighted paths. The weights may be Positive(Excitatory) or Negative(Inhibitory). Figure-1 shows a typical structure of a Neuron.

II. LITERATURE SURVEY

H. Ai and G.Wei [1], proposed a method Face Gender Classification on Consumer Images in a Multiethnic Environment. In this approach the classification of the faces is done on facial features. J.Bekios-Calfa et al [2], invented an algorithm Revisiting Linear Discriminant Techniques in Gender Recognition, that recognize the gender of the person. Changqin Huang, et al [3], proposed a methodology on Gender Recognition with Face images Based on PARCONE Mode.Chu W.S et al [4], introduced a method for Identifying gender from unaligned facial images by set classification. X. Geng et al [5], introduced an algorithm of Automatic Age Estimation Based on Facial Aging Patterns. GudongGuo et al [7], defined a problem based on Image-Based Human Age Estimation by Manifold Learning and Locally Adjusted Robust Regression. J. Hayashi et al [8],developed a system on Age and Gender Estimation from Facial Image Processing.HlaingHtakeKhaung Tin [9], developed an algorithm on Facial Extraction and Lip Tracking Using Facial Points.HlaingHtakeKhaung Tin [10], given a solution to classify the gender based on images called Perceived Gender Classification from Face Images. HlaingHtakeKhaung Tin [11], given a method Subjective Age Prediction of Face Images Using PCA.W. B. Horng et al [12], defined a methodology on Classification of age groups based on facial features. JinliSuo et al [13], developed a model on Compositional and Dynamic Model for Face Aging. Their study was based on geometric ratios and skin wrinkle analysis. Their method was tested on a database of only 47 high resolution face images containing babies, young and middle aged adults. They reported 100% classification accuracy on these data. In this paper two categories of genders vizMale and Female are considered. An algorithm has been proposed to predict genders of the different people using two level decision using 3 Sigma limits on Neural Network classifier. The accuracy of the proposed method is good compared to other methodologies. For implementation images from different databases and internet are considered. The rest of this paper is being organized as follows. Section 3 presents the Proposed Methodology. Section 4 provides the Proposed Algorithm. Section 5 gives the Experimental Results. Finally, the conclusions are given in section 6.

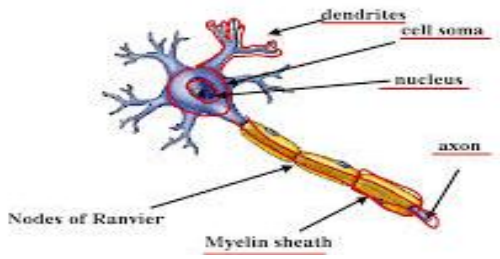

Figure-1**:** Structure of a Neuron

III. PROPOSED METHODOLOGY

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This paper proposes an effective method for human genderprediction/classification from facial images. Here, the classification of the facial images is done at two levels, namely

- Primary Level
- Secondary Level

The Proposed algorithm has been implemented to classify input images into one of two groups viz Male and female using Feed-Forward ANN. In the Primary Level, the facial images are classified using Neural Network. The second level decision includes, the classification based on the outcome of the Primary level to improve the detection rate

effectively.The proposed methodology is experimented on database of the face images. This dataset is used as

A. First Level Decision

In the first level decision, Neural Network classifies the faces based on the different gendersvizMale and Female. This outcome cannot be used as a conclusion as there may be the chances of misdetection.To enhance the first level decision, an algorithm for second Level Decision is proposed to reduce the misdetection rate and improve the success rate of detection as given in the next section.Figure-2 gives the diagrammatic representation of "First level decision".

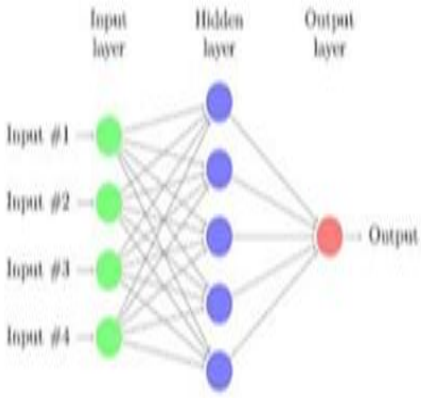

Figure-2**:** First Level Decision

The output of the built in NN classifier is a standard value that predicts the gender of a person in the first level. This can be represented by,

$$y = F(N, I) \quad (1)$$

Where y represents the predicted gender of a person in the first level decision. Fisa function that represents the simulation of the Neural Network.N is the vector that represents the trained value in the Neural Network$I$is the matrix that represents the testing image.

B. Second Level Decision

In which, the gender of a person is identified by second level decision using Neural Network. In which three sigma control limits are applied on the neural network classifier. Three sigma controls cover more than 90% of the population

thebenchmark database for Performance Comparisonsof Gender Prediction. In this method, first the images containing the face will be read and intensity values of each of the image ranges from 0 to 255. In order to improve the efficiency of the performance, instead of considering all Neurons (64 x 64)into the Neural Network, the mean of each of the image will be given as input to the Neural Network. Mean of each image is represented by 64 standard values.In this method, first the images containing the face will be read and intensity values of each of the image ranges from 0 to 255. In order to improve the efficiency of the performance, instead of considering all Neurons (64 x 64) into the Neural Network, the mean of each of the image will be given as input to the Neural Network. Mean of each image is represented by 64 standard values.

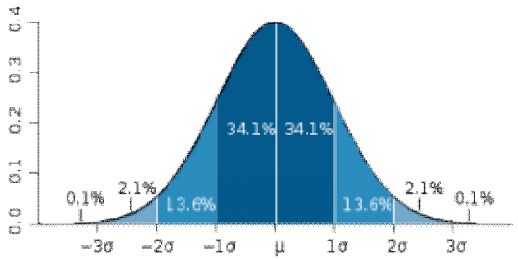

Figure-3:3σ limit dispersed around their averages.

In the Second level decision, 3 sigma control limits are determined by their spread around the mean using the equation (2) and (3).

$$l_m = \overline{y}_m - 3\sigma_m \quad (2)$$

$$u_m = \overline{y}_m + 3\sigma_m \quad (3)$$

Where, l_m, andu_m are the Lower Limit and Upper Limit of Male faces, respectively.

$\overline{y}_m$: mean of intensity values of male faces

σ_m : standard deviations of male faces

The Mean $\overline{y}_m$ of male face imagesisdetermined using the equation (4)

$$\overline{y}_m = \frac{\sum y_m}{n} \quad (4)$$

Where, y_m represents the predicted gender of male faces obtained in First level decision.

$n$isthe number of Male faces.

The standard deviation$\sigma_m$of male face images is determined using the equation (5)

$$\sigma_m = \sqrt{\frac{\sum (y_m - \overline{y}_m)^2}{n-1}} \quad (5)$$

Similarly, l_f and u_f are determined for female faces. The reasonable threshold value is empirically determined by considering the face images of the database. The mean $\overline{y}_f$ and σ_f of female images are also determined using the similar equations given in (4) and (5). The output generated in the first

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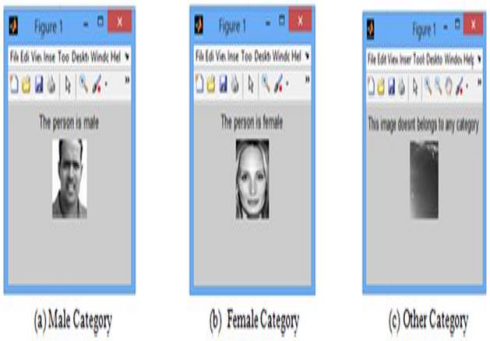
level, from the standard classifier ANN cannot be considered as the final output. It is not possible to rely on the output that is generated by the ANN since the conclusion should not be dependent on standard classifier. Based on the output generated from the first level, again the classification is done in the Second level by applying 3 sigma control limits on Neural Network. The application of 3 sigma control limits on Neural Network is so efficient that, it can classify the data with greater marginal levels in terms of range. The upcoming section describes the proposed Second Level Decision.In testing the query image, gender y is determined using the equation (1) as first level decision. The final decision on gender is determined using equation(6) as second level decision.

$$\begin{cases} male & if\ l_m < y < u_m \\ female & if\ l_f < y < u_f \\ misdetection & else \end{cases} \quad (6)$$

The experimental results of prediction of gender are shown in the figure-4.



(a) Male Category (b) Female Category (c) Other Category

Figure-4: Sample experimental results of Proposed Methodology.

IV. PROPOSED ALGORITHM

Proposed algorithm for gender prediction from the given image is as given below:

Input: Query face
Output: Determine Gender i,e male or female
*Step 1:*ToTrain,Inputall male and female face images to the Neural Network.
Step 2: Set the Target for the classification of Male and Female categories.
Step 3: Create & train the Neural Network.
Step 4: Determine the gendery_m and y_f for male and female using eq(1) in first level decision.
Step 5: Define lower and upper boundsformale and female using 3 Sigma Control limits at Second Level Decision using equations (2) and (3) respectively.
Step 6: To Test the query image, and find the gender$y$using equation(1)
Step 7: Second level decision on gender is determined using the equation (6)

V. EXPERIMENTAL RESULTS

In this research, there are 600 gray-scale with 256 gray levels facial images used for experiment. Each image size is normalized to 64×64. Among the 600 experimental images, 400 images are used as training data, and the remaining are used as test images. The male face images are trained using to neural network, and second level classification is done three sigma limits. There are 600 grayscale facial images in this database. Each image normalized to a size of 64 × 64 dimensions.In the testing phase, among 200 images, 100 images were taken as Male images and remaining 100 images were taken as Female ones. Thus, the success rate for male and female is 92.00% and 94.00% respectively. Therefore, the overall success rate for test images is 93.00%. The average recognition time of each test image is 0.45 seconds on a Pentium Quad Core processor with 2 GB RAM.However, proposed method fails to detect the side-view faces, occluded faces and partial face images. This is due to the fact that the proposed model is constrained to detect only the frontal view face. Our proposed method is compared with the methods"Automatic gender detection using on-line and off-line information Pattern" [15] proposed by M Liwicki et al, 2011 also "Human Age Prediction and Classification Using Facial Image" [21] proposed by SithuUbaid et al, May 2013 and found higher success rate as shown in figure-5 and figure-6.

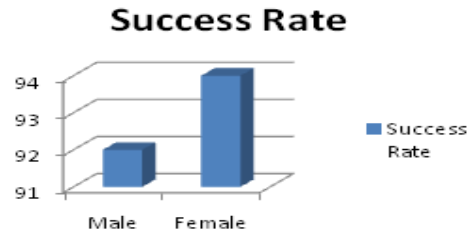


Figure-5:Success rate of the proposed Second Level Decision Model

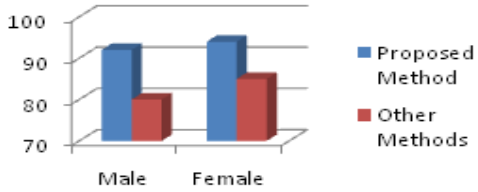


Figure-6:Comparing proposed Second Level Decision model with other model [15,21].

VI. CONCLUSIONS AND DISCUSSIONS

In this paper, a fast and efficient human gender classification system is proposed to classify a facial image into male and femaleusing feed forward neural network. The final decision is madeby employing validation based on three sigma control limits applied on the output of the neural network classifier.The proposed method is better in terms of speed and accuracy. Single frontal human faces with two gender groups are detected successfully with success rate of 93%.

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Figure-7: Images which has been mis-detected.

In future studies, misclassifications are reduced by using fuzzy logic approach for further improvement in the proposed system so that it becomes more pertinent to the design of a real-time video surveillance system.

REFERENCES

[1] H. Ai and G.Wei, "Face Gender Classification onConsumer Images in a Multiethnic Environment," Proc.Conf.Advances in Biometrics, (2009).
[2] J.Bekios-Calfa, J. M. Buenaposada, and L. Baumela, "Revisiting Linear Discriminant Techniques in GenderRecognition", IEEE Transactions on Pattern Analysis andMachine Intelligence, Vol. 33, No. 4, (2011).
[3] Changqin Huang, Wei Pan, and Shu Lin, "Gender Recognition with Face images Based on PARCONE Mode", Proc. Of the Second Symposium International Computer Science and Computational technology (ISCSCT) pp.222-226 (2009).
[4] Chu W.S., Rong C. and Song Chen C., Identifying gender from unaligned facial images by set classification, In Proceeding of 20th IEEE International Conference on Pattern Recognition, 2636 -2739,(2010).
[5] X. Geng, Z. Zhou, and K. Smith-Miles, "Automatic Age Estimation Based on Facial Aging Patterns" IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 29,no. 12, pp. 2234-2240,(2007).
[6] Gonzalez R.C and Woods R.E, Digital Image Processing Third edition, Pearson Education. Gonzalez R.C , Woods R.E and Eddins L.," Digital Image Processing Using MATLAB", Pearson Education, (2008).
[7] GudongGuo, Yun Fu,Charles R. Dyer, Thomas S. Huang, "Image-Based Human Age Estimation by Manifold Learning and LocallyAdjusted Robust Regression", IEEE Transaction On Image Processing, vol. 17, (2008).
[8] J. Hayashi, M. Yasumoto, H. Ito, Y. Niwa, and H. Koshimizu, "Age and Gender Estimation from Facial Image Processing," in Proc. of the 41 st SICE Annual Conference.pp.13-18, (2010).
[9] HlaingHtakeKhaung Tin, "Facial Extraction and Lip Tracking Using Facial Points", International Journal of Computer Science, Engineering and Information Technology (IJCSEIT), Vol. 1, No. 1, March 2011.
[10] HlaingHtakeKhaung Tin "Perceived Gender Classification from Face Images" I.J.Modern Education and Computer Science, vol 1, pp 12-18, (2012).
[11] HlaingHtakeKhaung Tin, "Subjective Age Prediction of Face Images Using PCA", International Journal of Information andElectronicsEngineering, vol. 2, no. 3, (2012).
[12] W. B. Horng, C. P. Lee, C. W. Chen, "Classification of age groups based on facial features", Tam kang Journal of Science andEngineering ,vol. 4, pp. 183-192, (2001).
[13] JinliSuo, Song-Chun Zhu, Shiguang Shan, "ACompositional and Dynamic Model for Face Aging", IEEETransactions on Pattern Analysis and MachineIntelligence, Vol. 32, No.3, March 2010.

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