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RESEARCH ARTICLE

DETECTION AND RECOGNITION OF HUMAN FACE USING ANN TRAINED BY GENETICAL ALGORITHM

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Abstract— A novel face detection system is presented in this paper. Finding faces in an arbitrary scene and successfully recognizing them have been active topics in Computer Vision for decades. Human skin color is an effective feature used to detect faces, although different people have different skin color, several studies have shown that the basic difference based on their intensity. Textures of human faces have a special texture that can be used to separate them from different objects. This research paper presents a robust and precise scheme for detecting the faces and locating the facial features in the images with complex background using genetic algorithm. The entire propose work has divided into two modules. First is Face Detection using skin colour region and locating various features in skin area. Secondly Face Recognition using Train artificial neural network using Genetic algorithm. Experimental results demonstrate that this face detection and recognition system provides successful results for the image of individuals.

Keywords— Face detection, Face Recognition, Artificial Neural network, Genetic algorithm

I. INTRODUCTION

In this work, it is implemented a coin recognition method by Genetic algorithm. Genetic algorithms are a stochastic search algorithm, which uses probability to guide the search. It can find the near global optimal solution in a large solution space quickly. It has been used extensively in many application areas, such as image processing, pattern recognition, face detection, feature selection, and machine learning. Its power comes from its ability to combine good pieces from different solutions and assemble them into a single super solution.

Human face perception is currently an active research area in the computer vision community. Detecting the location of human faces and then extracting the facial features in an image is an important ability with a wide range of applications, such as human face recognition, surveillance systems, human computer interfacing, video-conferencing, etc [1].

Most of the current face recognition systems presume that faces are readily available for processing. However, in reality, we do not get images with just faces. We need a system, which will detect the face in image, so that this detected face can be given as input to face recognition systems. Given an image, the goal of a face detection algorithm is to identify the location

and scale of all the faces in the image. The task of face detection is so trivial for the human brain, yet it still remains a challenging and difficult problem to enable a computer to do face detection. This is because the human face changes with respect to internal factors like facial expression, beard and moustache, glasses etc and it is also affected by external factors like scale, lightning conditions, contrast between face and background and orientation of the face.

Face recognition is the process of automatically determining whether two faces are the same person [2]. A number of factors make this a challenging problem for computers. Faces in images and video can be captured at various resolutions, quality, and lighting conditions. Different cameras have different imaging properties. Moreover, people's facial expressions as well as their pose with respect to the camera can vary widely, and facial characteristics can change dramatically as people age over time.

Given an image, the goal of a face detection algorithm is to detect the face and extract the features from the given image and to recognize the detected face with the given database of face images which is trained by Artificial Neural Network using Genetic Algorithm.

II. LITERATURE REVIEW

There are various approaches proposed by various researchers for face recognition. We can broadly classify these approaches or techniques based on the face on which they can be applied.

Recently, human face detection algorithms based on color information have been reported [3-5]. The face regions are initially segmented based on the characteristic of skin tone colors. The color signal is usually separated into its luminance and chrominance components in an image or video. Experimental results show that the skin-like regions can be segmented by considering the chrominance components only. Although skin Colors differ from person to person, they are distributed over a very small area on the chrominance plane. However, human face detection and facial feature extraction in gray-level images may be more difficult because the characteristics of skin tone color are not available. K. K. Sung proposed an example-based learning approach for locating vertical frontal views of human faces in complex scenes. A decision-making procedure is trained based on a sequence office and non-face examples. Six face clusters and six non-face clusters are obtained according to 4150 normalized frontal face patterns. The face regions are located by matching the window patterns at different image locations and scales against the distribution-base face model. T. J. Yuang proposed a hierarchical knowledge-based method consisting of three levels for detecting the face region and then locating facial component in an unknown picture. Images of different resolutions are used in the two higher levels. Two sets of rules based on the characteristics of a human face region are applied to the images. At third level, the edge of facial components is extracted for the verification of face candidates. However, the computational requirements of these methods may be too high for some applications, which may be unable to detect and locate a tilted human face reliably. Extraction of facial features by evaluating the topographic gray-level relief has been introduced [3, 6, 7]. Since the intensity is low for the facial components, the position of the facial features can be determined by checking the mean gray-level in each row and then in each column.

In [7,8] facial feature detection based on the geometrical face model was proposed. The model is constructed based on the relationships among facial organs such as nose, eyes, and mouth. However, these methods can work properly only under well-lit conditions. Therefore, the pre-processing step for reducing the lighting effect is very important for the methods. In previous work, possible face candidates in a gray-level image with a complex background were identified by means of valley features on the human eyes.

III. ARTIFICIAL NEURAL NETWORK

An Artificial Neural Network (ANN) is an information processing paradigm that is inspired by the way biological nervous systems, such as the brain, process information. The key element of this paradigm is the novel structure of the information processing system. It is composed of a large number of highly interconnected processing elements (neurones) working in unison to solve specific problems. ANNs, like people, learn by example [9]. An ANN is configured for a specific application, such as pattern recognition or data classification, through a learning process. Learning in biological systems involves adjustments to the synaptic connections that exist between the neurones. This is true of ANNs as well. The back-propagation algorithm [10] consists of four steps:

1. Compute how fast the error changes as the activity of an output unit is changed. This error derivative (EA) is the difference between the actual and the desired activity.

$$EA_j = \frac{\partial E}{\partial y_j} = y_j - d_j$$

2. Compute how fast the error changes as the total input received by an output unit is changed. This quantity (EI) is the answer from step 1 multiplied by the rate at which the output of a unit changes as its total input is changed.

$$EI_j = \frac{\partial E}{\partial x_j} = \frac{\partial E}{\partial y_j} \times \frac{dy_j}{dx_j} = EA_j y_j (1 - y_j)$$

3. Compute how fast the error changes as a weight on the connection into an output unit is changed. This quantity (EW) is the answer from step 2 multiplied by the activity level of the unit from which the connection emanates.

$$EW_{ij} = \frac{\partial E}{\partial W_{ij}} = \frac{\partial E}{\partial x_j} \times \frac{\partial x_j}{\partial W_{ij}} = EI_j y_i$$

4. Compute how fast the error changes as the activity of a unit in the previous layer is changed. This crucial step allows back propagation to be applied to multilayer networks. When the activity of a unit in the previous layer changes, it affects the activities of all the output units to which it is connected. So to compute the overall effect on the error, we add together all these separate effects on output units. But each effect is simple to calculate. It is the answer in step 2 multiplied by the weight on the connection to that output unit.

$$EA_i = \frac{\partial E}{\partial y_i} = \sum_j \frac{\partial E}{\partial x_j} \times \frac{\partial x_j}{\partial y_i} = \sum_j EI_j W_{ij}$$

By using steps 2 and 4, we can convert the EAs of one layer of units into EAs for the previous layer. This procedure can be repeated to get the EAs for as many previous layers as desired. Once we know the EA of a unit, we can use steps 2 and 3 to compute the EWs on its incoming connections.

IV. GENETICAL ALGORITHM

In the computer science field of artificial intelligence, a genetic algorithm (GA) is a search heuristic that mimics the process of natural evolution. This heuristic is routinely used to generate useful solutions to optimization and search problems. Genetic algorithms belong to the larger class of evolutionary algorithms (EA), which generate solutions to optimization problems using techniques inspired by natural evolution, such as inheritance, mutation, selection, and crossover [11].

```
Procedure of the standard GA
begin
        τ←0        // τ: number of iteration
initialize P(τ)                    //P(τ): population for iteration τ
      evaluate f(P(τ))             // f(P(τ)):fitness function
while (not termination condition) do
    begin
        τ←τ+1
        select 2 parents p1 and p2 from P(τ−1)
        perform genetic operations (crossover and mutation)
        reproduce a new P(τ)
        evaluate f(P(τ))
     end
end
```

Figure 1: Procedure of Genetic Algorithm

In a genetic algorithm, a population of strings (called chromosomes or the genotype of the genome), which encode candidate solutions (called individuals, creatures, or phenotypes) to an optimization problem, is evolved toward better solutions. Traditionally, solutions are represented in binary as strings of 0s and 1s, but other encodings are also possible. The evolution usually starts from a population of randomly generated individuals and happens in generations. In each generation, the fitness of every individual in the population is evaluated, multiple individuals are stochastically selected from the current population (based on their fitness), and modified (recombined and possibly randomly mutated) to form a new population. The new population is then used in the next iteration of the algorithm. Commonly, the algorithm terminates when either a maximum number of generations has been produced, or a satisfactory fitness level has been reached for the population. If the algorithm has terminated due to a maximum number of generations, a satisfactory solution may or may not have been reached.

V. FACE DETECTION AND RECOGNITION PROCESS

The entire propose work has divided into two modules. First is Face Detection using skin colour region and locating various features in skin area. Secondly Face Recognition using Train artificial neural network using Genetic algorithm.

a) Face detection:

The main function of this step is to determine (1) whether human faces appear in a given image, and (2) where these faces are located at. The expected outputs of this step are patches containing each face in the input image. In order to make further

face recognition system more robust and easy to design, face alignment are performed to justify the scales and orientations of these patches. Besides serving as the pre-processing for face recognition, face detection could be used for region-of-interest detection, retargeting, video and image classification, etc.

- First we consider a color image as an input for a system. Here we are concentrating on color image because; we require a color skin region of a human face.
- After receiving a color image there is a need to detect a skin region by color patterns.
- If the skin region of a human face is detected and accepted properly, then first we will load the features images which are available in database and then secondly, locate various features in skin area.
- At last, we present the output in the form of "Face regions with features".
- If skin region is not present in the image, then we discard this image and no further processing is done.

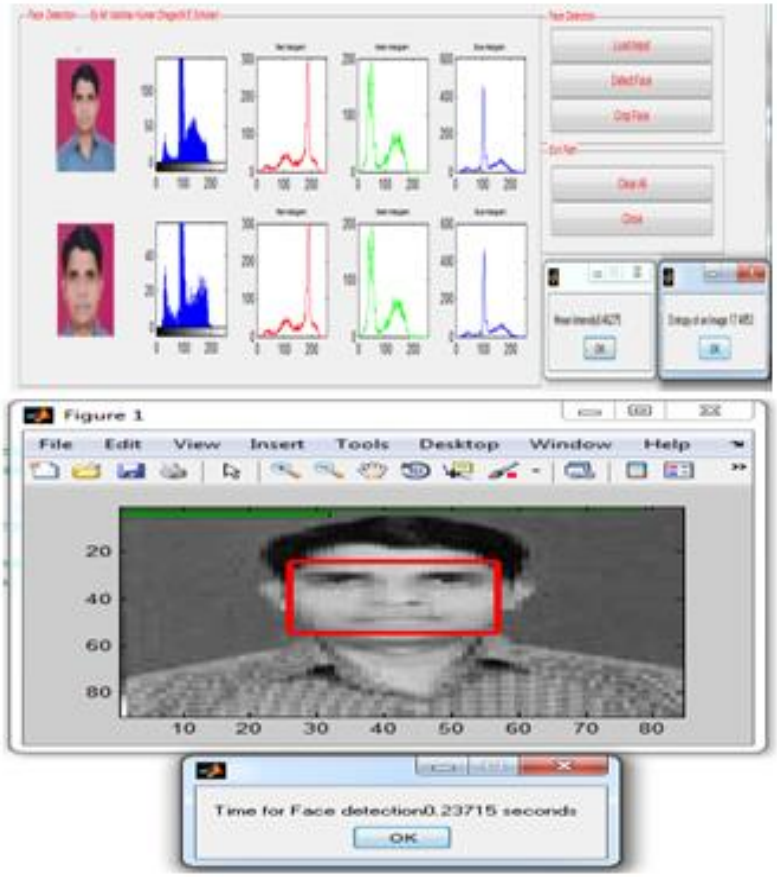

Figure 2: GUI of Face detection Process

b) Face Recognition:

After formulizing the representation of each face, the last step is to recognize the identities of these faces. In order to achieve automatic recognition, a face database is required to build. For each person, several images are taken and their features are extracted and stored in the database. Then when an input face image comes in, we perform face detection and feature extraction, and compare its feature to each faces stored in the database. There have been many researches and algorithms proposed to deal with this classification problem, but here we used Artificial Neural Network which is trained by Genetic Algorithm. Genetic Algorithm is search algorithms which analyse the faces stored in database and fetch the result with recognise face.

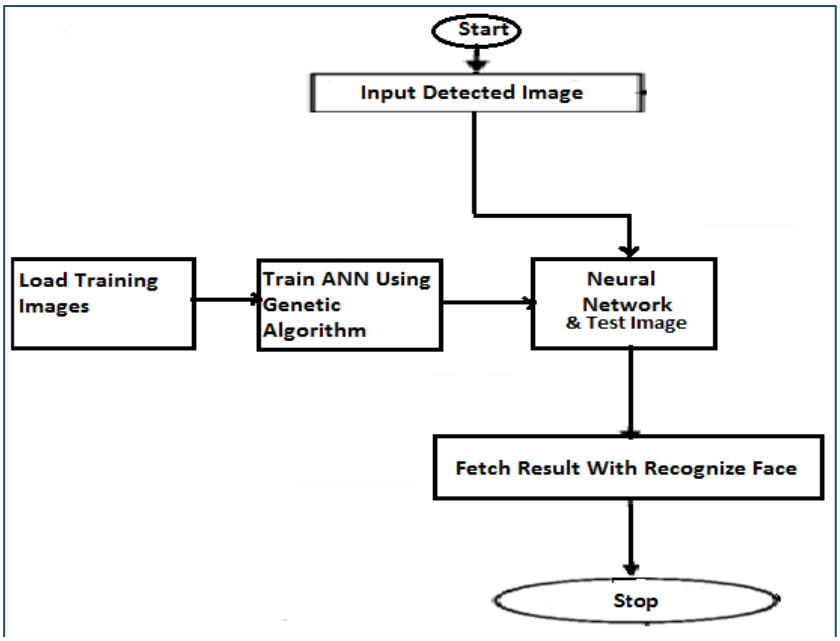

Figure 3: Proposed Method for Face recognition

Following are the steps for the face detection and recognition process:

1. **Input Image**: Select color image or RGB image as an input for a system.
2. **Detect Face**: Detect the human Face image. In This step, it will detect whether human faces appear in a given image or not.
3. **Enhance Image**: In this process, it first loads the input image i.e. Detected Face Image, then denoise the image using Gabor wavelet filter as shown in figure….. Calculate PSNR of wavelet denoise image with respect to input image.
4. **Segment Input Image**: Segment the input human face image and detect the edges of image using canny edge detector.
5. **Segment the template image**: Segment the template human face images i.e. the images which are stored in the database, segment that images and pass to the neural network.
6. **ANN Training**: Train the edges of image in neural network using genetic algorithm and generate the fitness weights and create the neural network file and save it.
7. Open the trained artificial neural network file.
8. **Start face recognition:** Load the input image segment and start face recognition. ANN will locate patterns from train images directory into input face image.
9. **Result:** Detect area of face in an input image and show result. Human faces are classified into different categories. The neural network classifies the given human face image into one of these class and based on the classification the results get generated. Similarly, for other classes we give an appropriate result.

Following figure shows face detection and recognition process:

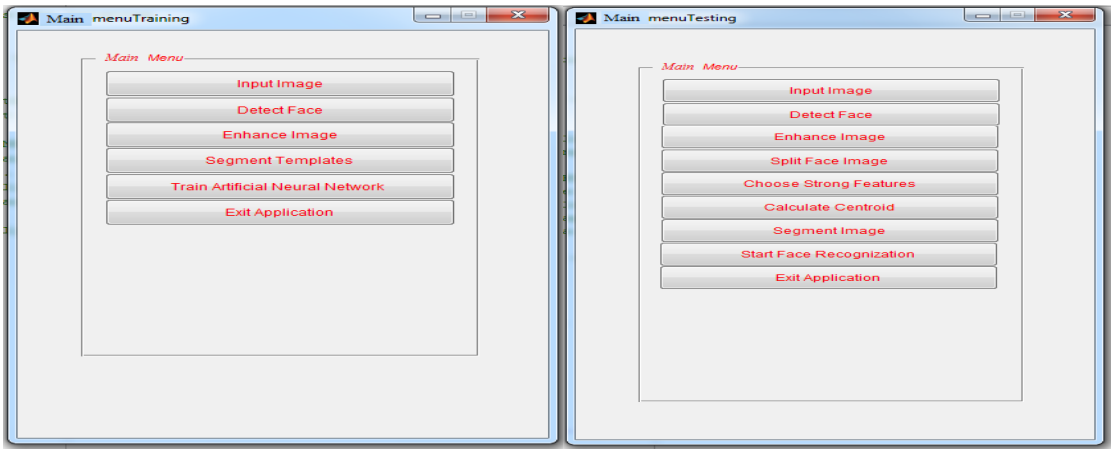

Figure4: Face Detection and Recognition Process

VI. EXPERIMENTAL RESULT

The following table shows the face detection rate. There are various four types of input images i.e. out of four, three are human faces and one is animal. If the skin region of a human face is detected and accepted properly, then first we will load the features images which are available in database and then secondly, locate various features in skin area. If skin region is not present in the image, then we discard this image and no further processing is done. Animal koala gets more time for detection i.e. 27.7623sec because that image does contain the human skin region. The graph shows the time face recognition and features of face detected.

Sr. No.	Input Image	Mean Intensity	Entropy of Image	Time for Detection	Human Face Detected
01	VND.jpg	0.55686	17.5443	1.7257sec	YES
02	Baby_01.png	0.43922	17.7677	0.99293sec	YES
03	AUD.tif	0.54118	16.8826	0.60085sec	YES
04	Koala-animal.jpg	0.46275	17.8254	27.7623sec	NO

Table 1: Face Detection

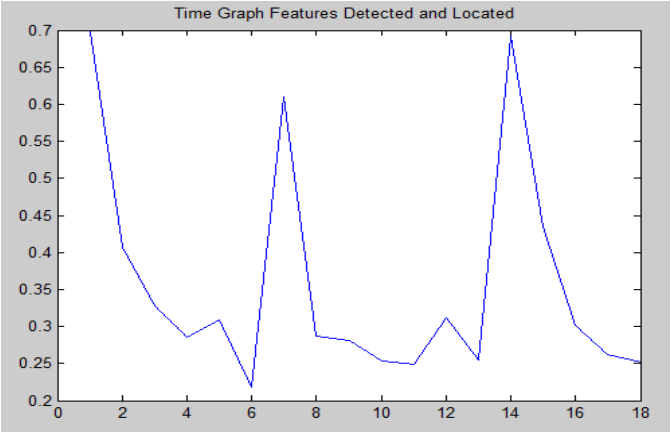

Figure 5: Time Graph for Face Recognition

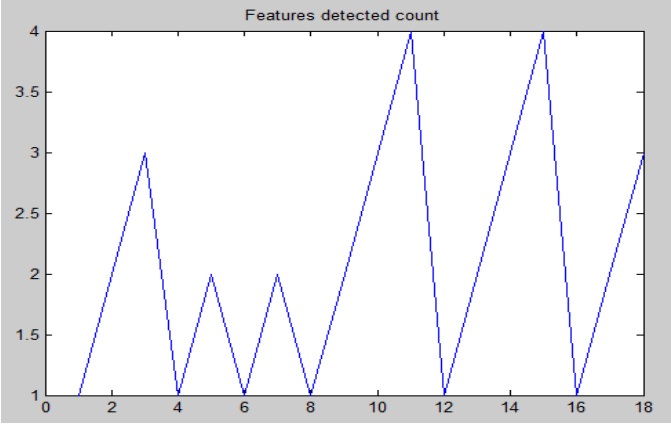

Figure 6: Features Detected Graph

VII. CONCLUSION

This paper presents an efficient and accurate method for face detection. We have used a specific method for generating features vector of the whole face in an image, by first detecting face regions using the colour of skin which presents a robust overlooked in different background, accessory and clothing. It is a fast algorithm for extracting human faces in colour images and easy to implement. GA is then applied to perform the recognition task. This solution was implemented using Matlab environment. Results indicate that the proposed method achieves good results. It gives the correct recognition rate. Maximum 100% faces are recognized. There are two general applications of face recognition, one is called identification and another one is called verification. Face identification means given a face image, we want the system to tell who he / she is or the most

probable identification; while in face verification, given a face image and a guess of the identification, we want the system to tell true or false about the guess Load detected image as input to the face recognition system.

REFERENCES

[1] K. Sandeep and A.N. Rajagopalan *"Human Face Detection in Cluttered Color Images Using Skin Color and Edge Information*", ICVGIP Proceeding, 2002.

[2] Matthew A. Turk and Alex P. Pentland. "*Eigenfaces for recognisation"*. Journal of cognitive nerosciences, Volume 3, Number 1, Nov 27, 2002.

[3] K. Sobottka, I. Pitas, A novel method for automatic face segmentation, facial feature extraction and tracking, Signal Process. Image Commun. 12 (1998) 263-281.

[4] K. Sandeep and A.N. Rajagopalan "Human Face Detection in Cluttered Color Images Using Skin Color and Edge Information".

[5] A.M. Mohamed, A. Elgammal, Face detection in complex environments from color images, Proceedings of International Conference on Image Processing 3 (1999) 622-626.

[6] F.C. Wu, T.J. Yang, M. Ouhyoung, Automatic feature extraction and face synthesis in facial image coding, Sixth Paci"c Conference on Computer Graphics and Applications, 1998, pp. 218-219.

[7] A.M. Alattar, S.A. Rajala, Facial features localization in front view head and shoulders images, Proceedings of the IEEE International Conference on Acoustics, Speech, and Signal Processing, Vol. 6, 1999, pp. 3557-3560.

[8] S.H. Jeng, H. Yuan, M. Liao, C.C. Han, M.Y. Chern, Y.T. Liu, Facial feature detection using geometrical face model: an efficient approach, Pattern Recognition 31 (3) (1998) 273-282.

[9] Aamer .S.S.Mohamed, Ying Weng, Stan S Ipson, Jianmin Jiang, "Face Detection based on Skin Color in Image by Neural Networks", School of Informatics, University of Bradford.

[10] Zhen-Guo Che, Tzu-An Chiang, "Feed-Forward Neural Networks Training: A Comparison Between Genetic Algorithm And Back-Propagation Learning Algorithm", International Journal of Innovative Computing, Information and Control, Volume 7, Number 10, October 2011.

[11] Ashkan Parsi, Mehrdad Salehi, Ali Doostmohammadi "Swap Training: A Genetic Algorithm Based Feature Selection Method Applied on Face Recognition System", World of Computer Science and Information Technology Journal (WCSIT) ISSN: 2221-0741,Vol. 2, No. 4, 125-130, 2012.

