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Face Detection and Recognization through Skin and Color Based Approach Using Genetic Algorithm

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Abstract*— one of the challenging problems in image processing is face detection. As we know, different people have different skin color, and Human skin color is an effective feature used to detect faces based on their intensity, several studies have shown that the basic difference. It is implemented with the combinations of Genetic Algorithm (GA) and Back Propagation Neural Networks (BPNN) for Face Recognition problems. This research paper addresses a robust face detection method with images in diversified backgrounds employing genetic algorithm. The effectiveness of this system has been verified over experimental procedures which conceal that the proposed face detector implements better than existing methods in terms of success rate and capability of allowing divergent illumination circumstance.

Keywords*— Genetic Algorithm, Back Propagation Neural Networks, Pattern Recognition.

I. INTRODUCTION

Face is an important component of human body so valuable to human life. Humans make use of face as an important hint for identifying people. This makes automatic face recognition very crucial from the point of view of a wide range of commercial and law enforcement applications. Although significant work has been done the current systems are still not close to the human perceptual system [3]. Traditionally, face recognition research has been limited to recognizing faces from still images. Most of these approaches discount the inherent 3-D structure of the face and therefore are very susceptible to pose changes [5]. One way to overcome this is to generate 3-D models using multiple still images or video and then use them while testing any probe image. Even if the resolution of the images/video is high (which is usually not the case), the face model generated by the known techniques is usually far from perfect which makes this approach often not practical for face recognition. Recently, methods based on multiple images/video sequences that do not involve creating an explicit 3-D model have been suggested. Such an approach is supported by many psychophysics works like, where authors argue that a 3-D object is represented as a set of 2-D images in our brains. Leaving out the algorithms based on simple voting, most of these methods make use of either the natural variability in a face or the information present in the temporal variation of face. In, book all recognize a face from a sequence of rotating head images by computing the Euclidean distances between trajectories formed by face sequences in PCA feature space. The Mutual Sub-space Method (MSM) considers the angle between input and reference subspaces formed by the principal components of the image sequences as the measure of similarity [12]. This approach discounts the inherent temporal coherence present in a face sequence that might be crucial for recognition. Face recognition is cast as a statistical hypothesis testing problem, where a set of images is classified using the Kullback-Leibler divergence between the estimated density of the probe set and that of gallery sets [14]. This method is based on the underlying assumption that face recognition can be performed by matching distributions. However, two such distributions for the same subject might look very different depending on the range of poses and expressions covered by the two sets. Moreover, this approach is sensitive to illumination changes.

II. GENETIC ALGORITHM

The training of feed-forward Neural Networks (NNs) by back propagation (BP) is much time-consuming and complex task of great importance. To overcome this problem, we apply Genetic Algorithm (GA) to determine parameters of NN automatically and propose efficient GA which reduces its iterative computation time for enhancing the training capacity of NN. Proposed GA is based on steady-state model among continuous generation model and used the modified tournament selection, as well as special survival condition. To show the validity of the proposed method, we compare with conventional and the survival -based GA using mathematical optimization problems and set covering problem. In addition, we estimate the performance of training the layered feed forward NN with GA. Genetic algorithms are often thought of, discussed and implemented using binary strings, or bit strings. Each gene or bit represents the expression of a state. If the bit is turned on, then the gene corresponding to that bit can be said to be "expressed". In this application a bit represents the state of either a variable being included ("1") or not included ("0") in the final solution. Genetic algorithms sometimes require the use of special operators in order to simulate the evolutionary processes which they emulate. The most common operators are crossover and mutation. The crossover operator takes two parent chromosomes and combines them to produce an offspring. A common form of

crossover operator is uniform crossover. In uniform crossover, if a specific gene is turned on in both parents, then it will be turned on in the offspring. If a gene is turned on in only one of the parents, then it may be turned on in the offspring. Uniform crossover was used in this project. The mutation operator is applied independently but immediately following the crossover operator.

A mutation is a random change of a gene in a chromosome, and is applied according to a preset mutation rate. A survival rate that determines what percentage of the population i.e. the fittest members would survive into the next generation was employed. Because the computational cost of building and training neural network models from scratch can be high, another feature employed in this work was to guarantee that when a new offspr ing is generated it does not duplicate any chromosome currently in the population or which has been previously built and tested.

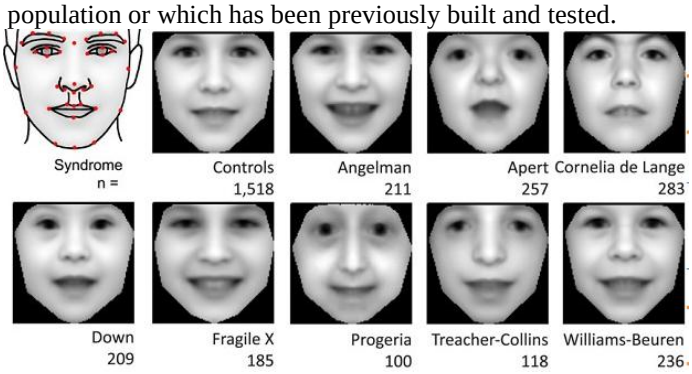

Fig 5: Genetic system face decetion

III. LITERATURE REVIEW

Anchal Chauhan et al [7]: author idea is to increase the security in range of application domains Face recognition in video has gained wide attention as a covert method for surveillance. As compared to still face images it is expected that a video which contains temporal information as well as multiple instances of face leads to improved face recognition performance. Here we should investigate the aspects of genetic in face recognition. Genetic Algorithms (GA's) are characterized as one search technique inspired by Darwin Evolutionist Theory. This paper deals with the combinations basics of Genetic Algorithm (GA) and Back Propagation Neural Networks (BPNN) and their applications in Pattern Recognition for Face Recognition problems. These models are expected to deal with problem solving in a manner different from conventional computing. The neural network has the ability to adapt to unknown situations & it trains itself by learning through datasets and is fault tolerant while the Genetic algorithm is an optimization technique used in computing to find the exact or approximate solutions. It handles large & poorly understood search spaces easily and handles noisy functions well.

Tanvi Chauhan et al [1] Face recognition in video has gained wide attention as a covert method for surveillance to enhance security in variety of application domains (e.g., airports, traffic, Terrorist attack).A video contains temporal information as well as multiple instances of a face, so it is expected to lead to better face recognition performance compared to still face images. However, faces appearing in avideo have substantial variations in pose and lighting. We propose a face recognition system that identifies faces in video. The system utilizes the rich information in video. The description of the proposed method and reliminary results are provided.

H. Deng et al [3] This paper proposes a facial expression recognition system based on Gabor feature using a novel local Gabor filter bank. Traditionally, a global Gabor filter bank with 5 frequencies and 8 orientations is often used to extract the Gabor feature. A lot of time will be involved to extract feature and the dimensions of such Gabor feature vector are prohibitively high. A novel local Gabor filter bank with part of frequency and orientation parameters is proposed. In order to evaluate the performance of the local Gabor filter bank, we first employed a two-stage feature compression method PCA plus LDA to select and compress the Gabor feature, then adopted minimum distance classifier to recognize facial expression. Experimental results show that the method is effective for both dimension reduction and good recognition performance in comparison with traditional entire Gabor filter bank. The best average recognition rate achieves 97.33% for JAFFE facial expression database.

IV. PROPOSED METHODOLOGY

In this proposed work, the training phase consists of following steps—

a) Input an image by capturing through web camera.
b) Skin region detection and enhance in an input images.
c) Save Image into database.
d) Train Neural Network using genetic algorithm on training Images directory.
e) Detect skin region in an input images.
f) Now add and update the image to database.
g) Display result.

Input Image—

A system camera is used to capture an image and to provide an input to this current project. A camera must be of 2.0 or 3.5 pixel resolution to get a more precise result.

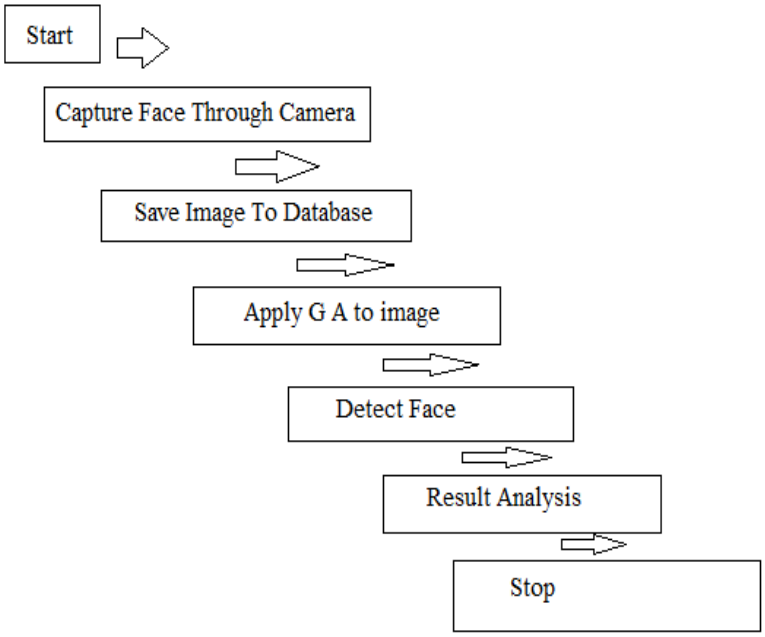

Figure 2: Proposed Flowchart for our system.

Detect Skin Region—

To avoid unnecessary image region (region other than face), we first of all detect skin color in input captured image. From the previous study it is observed that skin color pixels are in the range of 121 to 179 of their decimal value.

$$121 \leq sp \leq 179$$

$$\text{Where } Sp = (Pr + Pg + Pb) / 3$$

The face detection base on skin color is vital step of project that illuminates processing of wrong input image. The below data flow diagram shows the face detection base on skin color. Detection of skin color in color images is a very popular and useful technique for face detection. Many techniques have reported for locating skin color regions in the input image. While the input color image is typically in the RGB format, these techniques usually use color components in the color space, such as the HSV or YIQ formats. That is because RGB components are subject to the lighting conditions thus the face detection may fail if the lighting condition changes. In the skin color detection process, each pixel was classified as skin or non-skin based on its color components.

Training Neural Network using Genetic algorithm (Training Phase) –

The training of feed-forward Neural Networks (NNs) by back propagation (BP) is much time-consuming and complex task of great importance. To overcome this problem, we apply Genetic Algorithm (GA) to determine parameters of NN automatically and propose efficient GA which reduces its iterative computation time for enhancing the training capacity of NN. Proposed GA is based on steady-state model among continuous generation model and used the modified tournament selection, as well as special survival condition. To show the validity of the proposed method, we compare with conventional and the survival-based GA using mathematical optimization problems and set covering problem. In addition, we estimate the performance of training the layered feed forward NN with GA. Genetic algorithms are often thought of, discussed and implemented using binary strings, or bit strings. Each gene or bit represents the expression of a state. If the bit is turned on, then the gene corresponding to that bit can be said to be "expressed". In this application a bit represents the state of either a variable being included ("1") or not included ("0") in the final solution. Genetic algorithms sometimes require the use of special operators in order to simulate the evolutionary processes which they emulate. The most common operators are crossover and mutation. The crossover operator takes two parent chromosomes and combines them to produce an offspring. A common form of crossover operator is uniform crossover. If a gene is turned on in only one of the parents, then it may be turned on in the offspring. Uniform crossover was used in this project. A survival rate that determines what percentage of the population i.e. the fittest members would survive into the next generation was employed. Because the computational cost of building and training neural network models from scratch can be high, another feature employed in this work was to guarantee that when a new offspring is generated it does not duplicate any chromosome currently in the population or which has been previously built and tested.

Face Reorganization with Trained Directory Images (Testing)—

The pattern set of images are obtained and the mean faces is taken as the reference for a face structure. All the images in the training directory are compared with the input face and the correlation between them is found out. Non-face areas will have low correlation while face areas will have high correlation. Then the training images (Except first three) having less value of correlation are discarded. Since the training images can be of any size, the face is stored in different sizes starting from 30 pixels to 220 pixels at the step of 10 pixels (boxes are square boxes).

V. RESULT ANALYSIS

Time Complexity

Sr. No	Face Images	Face Recognization with Genetic Algorithm	Face Recognization Color Base
1	10	0.001 Min	0.0018 Min
2	20	0.010 Min	0.019 Min
3	30	0.035 Min	0.055 Min
4	40	0.5 Min	0.78 Min
5	50	1 Mm	1.30 Mm

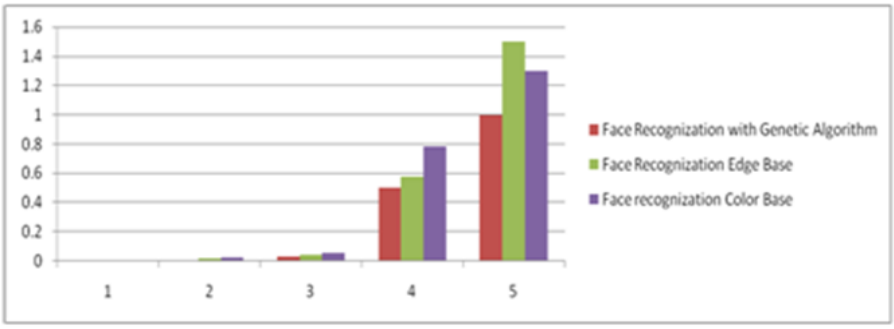

Figure 3: Time Complexity

VI. CONCLUSION

This system is very useful for security such as access control, comparing surveillance images to know terrorists, legislature i.e. identify of voter prior to vote, Banking minimize fraud by verifying identity of person. Many times video sequences that captures an image sequence from a camera, detects proficiently a human face. It is an optimal model likely to be performed at every hardware as per criteria. Matlab is used as a tool to implement using genetic algorithm concept in our implementation and we have got an experimental result which shows that genetic algorithm is even faster than BPN Neural network. Thereby, this research proves that overall performance of our project is not only reliable but also gives quicker and accurate output.

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