Skin Tone Based Face Recognition and Training using Neural Network

Anjana Mall¹, Susmita Ghosh Mazumdar²

¹M.Tech Student RCET Bhilai(C.G)
²Reader,ETC Department RCET Bhilai (C.G)

Abstract— Within today’s environment of increased importance of security and organization, identification, and authentication methods have developed into a key technology. Face recognition is an important means of identifying facial expression, gender. Human faces provides important visual information for gender classification from face perception. Face can be recognized by many methods but we utilized face detection using skin color and on the basis of skin color information face is recognized from already trained database of individual persons. The back propagation neural network is utilised to train the database The skin color is feature based techniques which is robust in nature and it is not effected by scale, illumination, orientation, changes in facial features due to accidents etc. In our project there is an advantage that if skin color is changed due to makeup or background variation i.e due to misperception then recognition is done through principal component analysis or Eigen faces. The basic sobel filter is used initially to detect face and then recognition is done through template matching method. System is further enhanced using neural network backpropagation algorithm to train database. In future this can be utilised for number of faces taken together that is in group and can also be utilised in individuals identification in groups. The processing time is faster and 83 percent efficient.

Keywords— Backpropogation algorithm, Face detection, Face recognition, skin segmentation.

I. INTRODUCTION

As authentication based systems are growing in demand, personal identification is very important. These system has great important in security, video surveillance. A person can be identified from numbers of features these are face, height, speech, gait etc. Face is the most important among all these for personal identification today’s new emerging and most demanding security system. Face consists of 80 nodal points on human face and few faces nodal points are measured by software these are width of nose, depth of eye sockets, jaw line, cheekbones, and chin. Face recognition has become a valuable and routine forensic tool used by criminal investigators.

Compared to automated face recognition, forensic face recognition is more demanding because it must be able to handle facial images captured under non-ideal conditions and it has high liability for following legal procedures. Will discuss about what are the techniques applied so far and what it limitation and application in future are taking skin feature as basis of face recognition. Finally, current limitations and future research direction would be discussed.

II. MOTIVATION

Skin based face detection and recognition is feature invariant based technique which is Robust in nature. The first step of any face recognition is detection of face or non face there are several algorithm proposed but we choose skin color as it doesn't vary with development of any change in face of person like occlusion or illumination and gives the result accurately. Many algorithm were there to detect skin region .There are several advantages of using skin color as processing is faster than other features. Color is lightening in variant and it is perceptual phenomena related to spectral characterizes [3].The most widely used color model is RGB whose property is best utilized when changed to Y Cb Cr color model. After calculating all skin features we had trained these features using Neural Network which had also made our system efficient.

III. FACE DETECTION AND RECOGNITION

A. Basic Scheme

Finding faces in an arbitrary scene and successfully recognizing them have been active topics in Computer Vision for decades. A general statement of the face recognition problem (in computer vision) can be formulated as follows: Given still or video images of a scene, identify or verify one or more persons in the scene using a stored database of faces. Although face detection and recognition is still an unsolved problem meaning there is no 100% accurate face detection and recognition system, however during the past decade, many methods and techniques have been gradually developed and applied to solve the problem. Basically there are three types of methods in automatic face recognition verification, identification and watch-list. In the verification method, a comparison of only two images is considered.
The comparison is positive if the two images are matched. In the identification method, more than one comparison should be done to return the closest match of the input image. The watch-list method works similar to the identification method with a difference that the input face can also be rejected (no match). The method presented in this consists of three steps: skin detection, face detection, and face recognition. The novelty of the proposed method is using a skin detection filter as a pre-processing step for face detection. A scheme of main tasks is shown in Figure 1.

C. Methodology.

The basic scheme is started with collection of database that is images of different person in different background, illumination, variation, poses etc. The basic flow chart is shown below Figure 2.

![Flow Chart of proposed Methodology](image)

**Fig: 2 Flow Chart of proposed Methodology**

1. Input an Image ,Image is face of a person taken from webcam ,or mobile camera.
2. Collect all Images from train directory & Select only Face Images. (Because we are doing face detection based on skin color & for that an Images must have face within an image).
3. Load Test Images into “Test” directory.
4. Detect face in training & testing images based on the skin color segmentation.
5. Train neural Network on training & Testing Images using back propagation neural network.
6. While training set Input layer neurons size 24(Because an input images in training & Testing Directories are of 24 Bits).
7. Set three hidden layers of size 24 neurons & output layer of single neurons.
8. While Testing Calculate an Eigen Value for both test & train Images & Compare them. While Comparing Find out matched images with Training images by having its nearest Eigen value [1] with test image.

Display result with both training & Test Images. Figure 2 shows the working of the project. In this system we first take the image as an input image from whom we want to recognize the face.

**Fig: 1 Basic Scheme of face recognition**

**B. Types of face detection**

- These are divided into four categories. These categories may overlap, so an algorithm could belong to two or more categories. This classification can be made as follows:
  - **Knowledge-based methods** - Ruled-based methods that encode our knowledge of human faces. They try to capture our knowledge of faces and translate them into a set of rules such as eyes area is darker than the cheeks. Facial features such as distance between eyes or color intensity difference between eye and low zone.
  - **Feature-invariant methods** - Algorithms that try to find invariant features of a face despite it’s angle or position, like skin color.
  - **Template matching method** - These algorithms compare input images with stored patterns of faces or features. Different features can be independently defined eyes, face contour, nose and mouth. But this method is also limited to upright frontal face and unoccluded one.
  - **Appearance-base method** - A template matching method whose pattern database is learnt from a set of training images. These rely on techniques from statistical analysis and machine learning to fine face characteristics. These method also used in feature extraction for face recognition.
After taking the input image we process the image to determine the skin color of the image. If skin color image is present then we move towards identifying the features of the face. Once we get all the parameter from the image we move towards the segmentation process. Segmentation of the image can be done on the basis of color content of the image. After segmentation we compare the input image segment with the directory image segment. This procedure is useful to find the similarity between the input image and the directory image. After comparison we get the output that is we are able to recognize the face from the image. If during the process we not get the skin color or features we stop the process.

The system uses Y Cb Cr color model as is less affected by light. Skin detection under varying illumination in image sequences is addressed in [6,7]. These approaches try to map the illuminance of the image into a common range. They compensate for the variance of changing lighting to equalize the appearance of skin color throughout different scenes. These methods are dependent heavily on the lighting correction techniques and their ability to estimate the illuminant.

D. Feature (skin region segmentation) Extraction.

Skin region is segmented to detect face area from database and then its further proceeded to face recognition. for face detection in color images with multiple faces and skin tone regions is proposed. Algorithm ingeniously uses a novel skin color model, RGB-HS-CbCr for the detection of human faces. Skin regions are extracted using a set of bounding rules based on the skin color distribution obtained from a training [2]. As we have taken faces in different orientation and poses and detected the face in each case using skin color of the person and on that basis face is recognized using template matching N.Revathy,T.Guhan 2012 [4] use back propagation neural network for implementation of face recognition. It is an information processing system that has been developed as a generalization of the mathematical model of human recognition. The function of a neural network is to produce an output pattern when presented with an input pattern. The back propagation type of neural network is a feed forward system with training input pattern and weight adjustment with the associated error. The input neurons receive input signal and propagates into each hidden neuron, which again computes the activation to obtain the net output. This face recognition system is implemented using a MATLAB software package. The Author found the transformation for different inputs and compared with unknown face that the given face is in database or not. Dealing with method of main disadvantages was that there are possibilities that certain skin regions may belongs to exposed limbs. Hence output may show erroneous output. Mr. Mayur S. Burange, S.V. Dhopte 2012 [5] This paper present an approach to recognize human face expression and emotions based on some fuzzy pattern rules.

Facial features for this specially eye and lips are extracted an approximated into curves which represents the relationship between the motion of features and change of expression. This paper focuses the concepts like face detections, skin color segmentation, face features extractions and approximation and fuzzy rules formation. Conclusion based on fuzzy patterns never been accurate but still our intension is to put more accurate results. From the study it is observe that skin color pixels have a decimal value in the range of 120 to 140. In this project, we used a trial and error method to locate skin color and non skin color pixels. But many of the times, system fails to detect whether an image contains human face or not (i.e. for those images where there is a skin color background), an image is segmented into skin color and non-skin color pixels with the equations.

If

\[
\lim_{n \to 1} \left( \frac{y}{y} \right) \leq 120 \leq 140 = 1 \tag{1}
\]

Else

\[
\lim_{n \to 1} \left( \frac{y}{y} \right) \leq 120 \leq 140 = 0 \tag{2}
\]

Were n is total nos. pixel.

E. BACKPROPOGATION ALGORITHM

To train Network to achieve a balance between the network’s ability to respond and the ability to give a reasonable response to the input that is similar, but not identical to the one used in the training. The training of a back propagation network involves the three stages. The feed forward of the input training pattern the calculation and the back propagation of the associated error and the weighted adjustment. After the network has been trained, its application involves only the feed forward phase. A multi layer network can learn only input patterns to an arbitrary accuracy. A weight in a neural network is a segment of the information about the input signal that has to be stored.

IV. RESULTS.

The project has detected the face region using pixels of skin and these are following results which we achieve. The test cases are shown below and step we have used is shown GUI SNAPSHOTS.

The table 1 shows that the result accuracy increases as compared images in train folder increases.
Table 1 Various Test cases of matching of image.

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Images in Database</th>
<th>Compared Images</th>
<th>Matching %</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>50</td>
<td>33</td>
<td>66</td>
</tr>
<tr>
<td>02</td>
<td>50</td>
<td>35</td>
<td>70</td>
</tr>
<tr>
<td>03</td>
<td>50</td>
<td>37</td>
<td>74</td>
</tr>
<tr>
<td>04</td>
<td>50</td>
<td>38</td>
<td>76</td>
</tr>
<tr>
<td>05</td>
<td>50</td>
<td>39</td>
<td>78</td>
</tr>
<tr>
<td>06</td>
<td>50</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>07</td>
<td>50</td>
<td>41</td>
<td>82</td>
</tr>
<tr>
<td>08</td>
<td>50</td>
<td>43</td>
<td>86</td>
</tr>
<tr>
<td>09</td>
<td>50</td>
<td>46</td>
<td>92</td>
</tr>
<tr>
<td>10</td>
<td>50</td>
<td>48</td>
<td>96</td>
</tr>
</tbody>
</table>

**V. CONCLUSION AND FUTURE SCOPE**

The project is feature based technique in which face is first detected using YCbCr and then by proper information of pixels variation skin is detected on that basis face is recognized. Our process is nearly 83 percent accurate and in future it can be improved embedding our proposed techniques with other improved techniques. In Future the system can be utilized to detect faces in group and recognize the individuals that are personal identification in group. In future skin pixel range can be increased it may give more accurate result. And even other color models which have been tested by many researchers can also be utilized.
References.


