Efficient Tool For Face Detection And Face Recognition In Color Group Photos

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Abstract-Face detection and recognition are fascinating problems for image processing researchers during the last decade. The most difficult challenge is to detect faces in clumsier group photos. This is achieved in this paper. While face recognition, in general the faces that retrieved from group photo are not giving sufficient information due to poor clarity. But this problem is overcome by Eigen subspaces.

Key Terms: Image segmentation, Image recognition, Eigen image

I. INTRODUCTION

A number of face detection and recognition algorithms are available. They have their own merits and demerits. In the view of face detection the neural network based system [2] can support only on intensity image. But the proposed system is designed to support the color image also. Gabor filter face detection method [3] finds the isolated faces. It is not suitable for overlapped faces in the group photo. But the proposed system can overcome these drawbacks since the skin and non skin elements are separated. The existing face recognition systems have some demerits such as single face detection at a run, supporting particular pose [5] and etc. These disadvantages can be eliminated since the input image is segmented into Eigen subspaces. In this paper the basic image processing concepts such as color segmentation, image segmentation and template matching techniques will be used in several stages. For color segmentation, YCbCr components will be identified from the given RGB components. From this the skin elements will be identified. Then using image segmentation, the skin and non skin areas will be separated into two segments. Then the skin elements will be marked. The skin elements may include other organs like hand, etc. For this template matching will be used and the unwanted areas will be eliminated based on the rank. In the photo the faces may be overlapped. By merging the adjacent elements exact face can be identified. After face detection, the faces should be recognized. The eigen subspaces of the face image is identified. From this the features are extracted. The same process will be applied on the database face images. The features of the detected face will be compared with the features of the existing database faces and recognized.

The proposed system contains two modules: face detection and face recognition. In a group photo the face regions are detected. Then the detected face is recognized by comparing with the database face image.

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II. SYSTEM OVERVIEW

The face detection part contains five different steps. The image is converted into YCbCr color model.

$$\begin{bmatrix} Y \\ Cb \\ Cr \end{bmatrix} = \begin{bmatrix} 16 \\ 128 \\ 128 \end{bmatrix} + \begin{bmatrix} 65.481 & 128.553 & 24.966 \\ -37.797 & -74.203 & 112.000 \\ 112.000 & -93.786 & -18.214 \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix} \quad (1)$$

By various training set the range of chrominance and hue values are defined as

$$141 \le Cr \le 162 \quad (2)$$

$$99.8 \le Cb \le 150 \quad (3)$$

$$0.1 \le hue \le 1.0 \quad (4)$$

The pixels that satisfied these three conditions are considered as skin elements. Others are considered as non skin elements. Then the image is segmented into two segments called skin elements and non skin elements. To eliminate small elements and holes like eye, spectacles morphological operations such as erosion and binary open are used. Now we have the other organs like hand in the skin segment. To eliminate these we are using template matching.

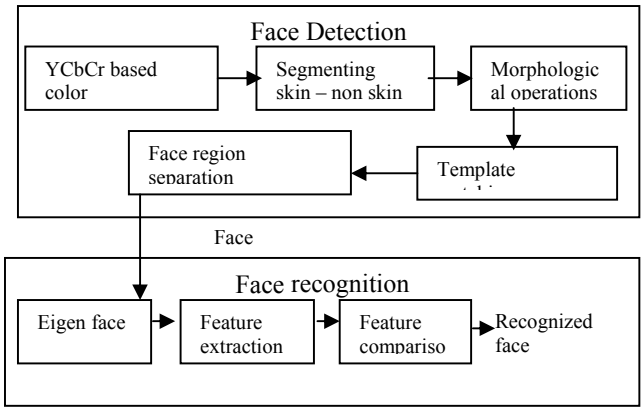

Figure 1. System design

We have a collection of 25 template images with scaling their size between 15 and 135. According to the size of the input skin element, the corresponding template image is taken. Based on the correlation between these two images, the given image is predicted whether it is a face or not. Thus

the other skin elements are eliminated. Now we get the face part.

Face recognition has three steps. From the detected face Eigen image is created. Then the subspaces of the Eigen image will be created. The features are extracted from the Eigen subspaces. These features will be compared with the database Eigen subspaces. The matched image is considered as the recognized image.

III. SYSTEM ANALYSIS

It can support images with their actual size. We need not to resize the image. So the quality of the image will not be affected. Consider the image given in Fig 2 with size 2000×3008 pixels

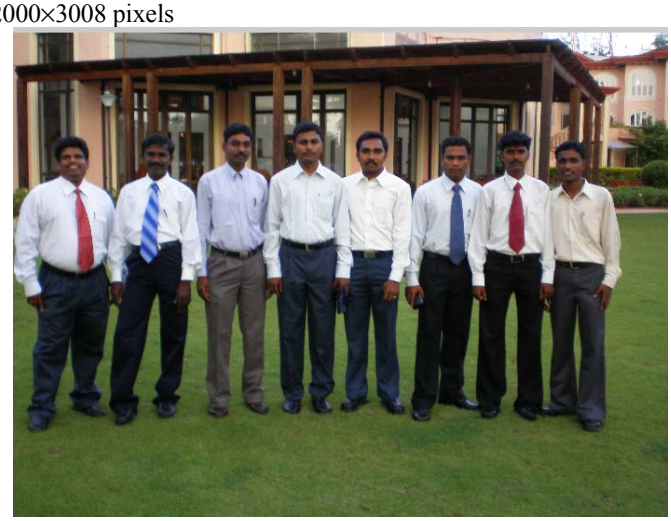

Figure 2. Input Image

After applying the segmentation based on YCbCr color model we obtain the image as in fig.3. It contains some flaws in the skin segments.

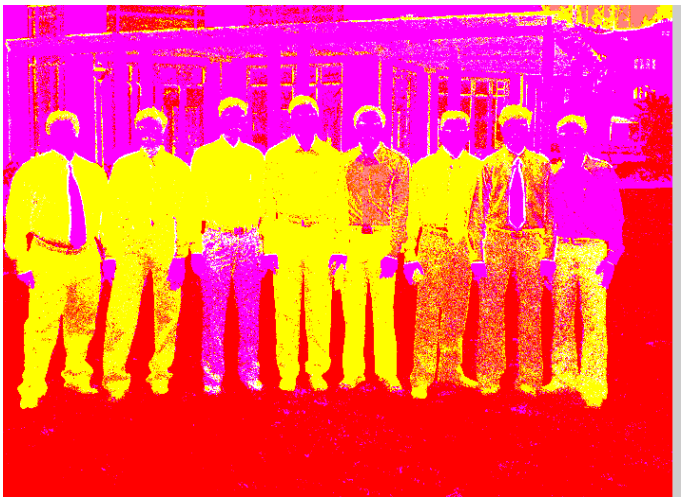

Figure 3. After initial segmentation (YCbCr based)

To fill the flaws a sequence of morphological operations are applied such as fill, open and erosion. Now the clear segments are obtained.

Figure 4. After final segmentation

A set of 25 template images are used to compare these segments. The segments are compared with the template that matches in size.

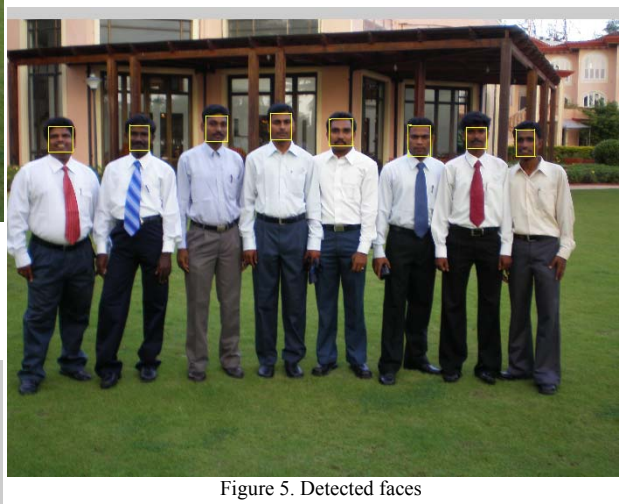

Figure 5. Detected faces

The segments that correlated more with the corresponding template are considered as final face region. Then the detected faces are marked with a rectangle. The system detects the overlapped faces also. So we can detect faces even in clumsy group photos.

IV. WORK YET TO BE DONE

The face recognition is under construction. These detected faces will be converted into Eigen image. The sub spaces will be found. From this the feature will be extracted. These features will be compared with the features of the data base faces.

To make the system supportive for various poses we take four faces of each person. Then the average eigen face of these four faces will be found. The Euclidean distance between the average eigen face and the detected face will be taken as the parameter for matching.

V. RESULT ANALYSIS

After applying the algorithm on various images, the following results were obtained.

TABLE 1. Result Analysis

S.No	Number of faces in image	Number of hits	Hit percentage
1	6	6	100
2	34	33	97
3	8	8	100

VI. CONCLUSION

With the proposed system a high face detection rate is achieved. As the system supports all kind of image size, we can use it for real time applications such as security issues and human tracking, CCTV monitoring can be enhanced for video files. In face recognition as eigen subspaces are used a good recognition rate is expected.

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