Face Recognition and Information Reclamation System in Video Sequences

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***Abstract*—Face recognition is a very challenging task to recognize a face from a video due to the wide variety of face and the uncertain of face position. The research on detecting human faces in color image and in video sequence has been attracted with more and more people. For face detection and recognition, a novel face detection framework has been proposed which achieves better detection rates. The new face detection algorithms based on skin color model in YCgCr chrominance space and HSV color space. Firstly, we build a skin based color space, and then some constraints are used to get candidate's face. Secondly, a calculation of correlation coefficient is performed between the candidate's face and the given template which is extracted from the public data base and also duplication avoidance is done here. The system has achieved high detection rates and low false positives over a wide range of facial variations in color, position and varying lighting conditions. Finally, the recognized face information is provided.**

***Keywords*—Face detection; Face recognition; Skin color model; Template matching**

1 INTRODUCTION

Face detection and recognition is interesting to study because it is an application area where computer vision research is being utilized in both military and commercial products. Much effort has been spent on this problem, yet there is still plenty of work to be done.

Basic research related to this field is currently active. Often, practical applications can grow out of improvements in theoretical understanding and it seems that this problem will continue to demonstrate this growth.

Personally, we are interested in this project because it's a pattern recognition problem in which humans are very adept, whereas it can be quite challenging to teach a machine to do it. The intermediate and final visual results are interesting to observe in order to understand failures and successes of the various approaches.

Face detection and recognition is challenging because it is a real world problem. Applications of face detection and recognition are widespread. One could make computers easier to use if when one simply sat down at a computer terminal, the computer could identify the user by name and automatically load personal preferences. Human face detection and recognition technology could also have uses in the security domain. Recognition of the face [4][3] could be one of several mechanisms employed to identify an individual. Face recognition as a security measure has the advantage that it can be done with high speed, in real time, and does not require any extensive equipment to implement. However, this is not a foolproof method of authentication, since human face appearance is subject to various sporadic changes on a day-to-day basis (shaving, hair style, acne, etc), as well gradual changes over time (aging). Because of this, face recognition is perhaps best used as an augmentation for other identification techniques.

A final domain in which face recognition techniques could be useful is search engine technologies. In combination with face detection systems [1][2]. One could enable users to search for specific people in images. This could be done by either having the user provide an image of the person to be found, or simply providing the name of the person for well-known individuals. A specific application of this technology is criminal mug shot databases. This environment is perfectly suited for automated face recognition[8] since all poses are standardized and lighting and scale are held constant. Clearly, this type of technology could extend online searches beyond the textual clues that are typically used when indexing information.

Every face or image that we can see on machine is in its 2 dimensional form. To uniquely identify a person's identity, many technologies available today. Many of which like Password/PIN known as Personal Identification Number systems are the most common in practice today. However these systems have their own intrinsic drawbacks. Passwords can be forgotten and worse if they are lost or stolen, person identity can be misused by somebody else. In order to overcome these problems there has been a considerable interest in "biometrics" identification systems, which use pattern recognition techniques to identify people using their unique characteristics [3]. Some of those methods are fingerprints and retina and iris recognition. But these are obtrusive and expensive.2D face recognition has a natural place in the present and the future environment because it's unobtrusive and passive in nature. It does not restrict the movements of an individual during recognition.

2 LITERATURE REVIEW

Kamarul, hawari,bin, ghazali, jiemaandruixiao proposed. A research on detecting human faces[2] in color images using the skin color model YCgCr chrominance space and HSV color space then the template matching is done at high speed here the detection rate is high.

Sanjay, chauhan, mayank and richa proposed face detection algorithms based on skin color [1] in the concern of RGB, YCbCr and HSI values, which gives high accuracy of 95.18%. Whereas, the RGB classified the skin region YCbCr apply threshold to mask skin part HSI is to extract the face image exactly.

Sudhana proposed an object detection system which uses the template matching [5] approach in order to provide accuracy . in this technique each pixel is mapped on a point in mm-dimensional space it is necessary to specify a data point which performs comparing each pixel of template between the test imaged the reference image here the image gets normalized this means it must be standardized in terms of size, pose, illumination etc., this is used for face recognition.

Riddhi, patel and shruti proposed a study on face recognition techniques [3]. Basically, three approaches for face recognition. First, feature based approach is to segment the features like nose, eyes and used as input to face recognition. Second, holistic approach is taking it as whole face and input to the system. Third, hybrid approach is the combination of above two approach and two techniques used is Eigen face and neural networks. Eigen faces are the principle component divide the face into feature vectors eigen vector M is matched with face the best eigen values matched is called face space. Neural networks are to get best performance in complex images. It has to be extensively tuned number of layers, rates, nodes. The accuracy achieved is 96.2% in face recognition and it provides partial invariance to translation, rotation, scale and deformation. Abby A. Goodrum proposed a research about the image information retrieval [7] the retrieval can be of three aspects text based retrieval, content based retrieval, and image information retrieval system. To provide the information about the image the CBIR technique is used, by providing color, texture and shape. Retrieving the images can be achieved by computing a color histogram for each image that identifies the proportion of pixels the identification of specific texture is done by modeling texture as 2-d gray level variation. This also includes pixel cluster indexing in that certain range of pixel values from gray scale or colored image.

3 PROPOSED SYSTEM

This system is designed to recognize[4][3][5][9] the face of the people who are all in the video sequence the system takes the video as input and splits the video into number of frames using VLC tool. From the splitted frame the quality is improved [6] by using color balance ratio. Then face detection is performed by using two algorithms called YCbCr and HSV algorithm. The detected face[1][2][9] is compared with the image which is taken from the public database by using the technique called template matching[5]. If the face and template gets matched, the information about the person is provided.

A.TO CONVERT VIDEO INTO FRAMES

We can take the video in 2 formats: .mpg or .avi. We have implemented our project by taking the video in .avi format. The image of the person is captured and scaled down to appropriate levels.

B.TO PERFORM FACE DETECTION

Face detection [2] is the first step of face recognition as it automatically detects a face from a complex background to which the face recognition algorithm can be applied. But detection itself involves many complexities such as background, poses, illumination etc. There are many approaches for face detection such as, colour based, feature based (mouth, eyes, nose), neural network.

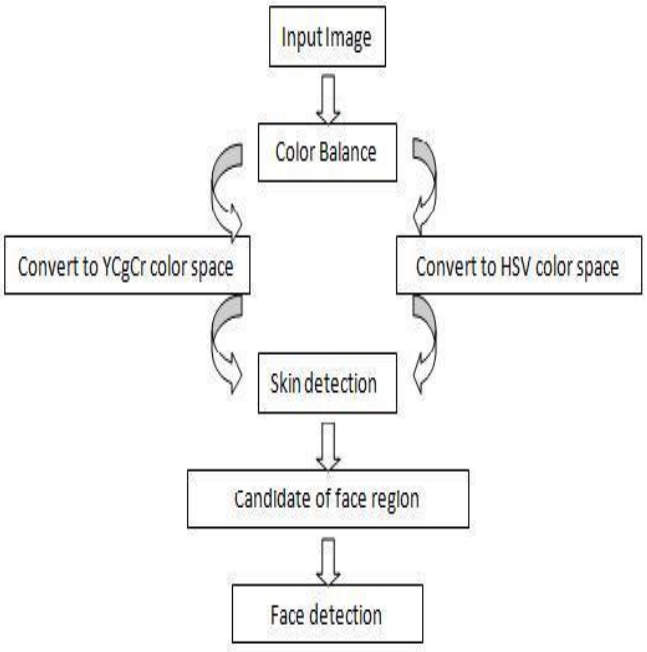


Fig:1 Architecture of face detection

The framework can be divided into 5 phases, namely, Color balance, color space convert, skin detection, Morphological operation, template matching. The flow chart of the framework is given in figure 6. Some of phases already discussed in foregoing paragraphs. In this paper, one novel combination of color space were proposed to detect skin color, according to experiments they can improve the performance of skin color detection.

C. YCbCr MODEL

The approach studied and applied is the skin colour based approach. The algorithm is pretty robust as the faces of many people can be detected at once from an image consisting of a group of people. The model to detect skin colour used here is the YCbCr model [1]. YCbCr or YCbCr

is a family of color space used generally in digital image processing. Y is the luminance, Y' is the luma component while Cb and Cr are the blue difference and red difference of the chroma component. YCbCr is encoded from RGB colour space. If the original RGB information of the image is available, YCbCr values can be obtained.

Y = 0.299R + 0.587G +

0.114B Cb = -0.169R -0.332G

+ 0.500B Cr = 0.500R -0.419G

-0.081B

RGB [1] components are subject to the lighting conditions thus the face detection may fail if the lighting condition changes. Human skin colour has a specific range of chrominance values while luminance is dependent on external variables.

D.HSV COLOR SPACE

HSV [2] color space represents colors in terms of Hue, Saturation and Intensity of the Value. It is also known as HSB (Hue, Saturation, and Brightness) or HIS (Hue, Saturation, Intensity). Hue refers to color type, such as red, blue, or yellow. Saturation refers to the vibrancy or purity of the color. Value component refers to the brightness of the color.

The intuitiveness of the color space components and explicit discrimination between luminance and chrominance properties made these color spaces popular in the works on skin color segmentation. Several good properties if Hue color space were submitted in it is invariant to highlights at white light sources, and also, for matte surfaces, to ambient light and surface orientation relative to the light source. The transformation between HSV and RGB is defined by the following expressions

$$\begin{cases} H = \arccos \dfrac{\frac{1}{2}((R-G)+(R-B))}{\sqrt{((R-G)^2+(R-B)(G-B)}} \\ S = 1 - 3\dfrac{\min(R,G,B)}{R+G+B} \\ V = \dfrac{1}{3}(R+G+B) \end{cases}$$

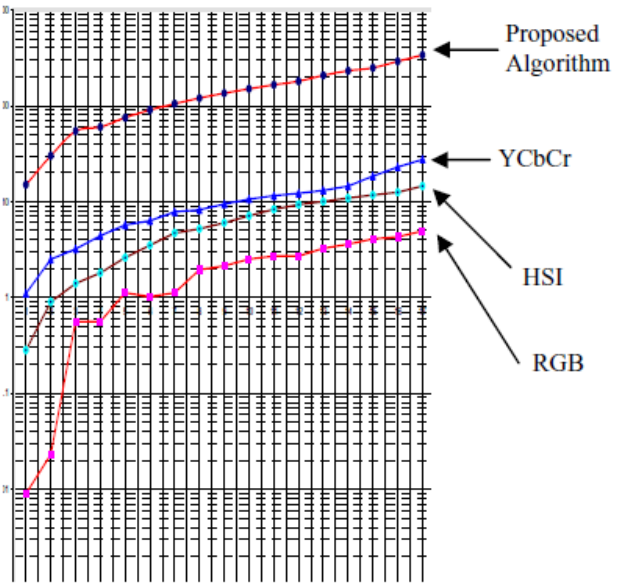


Fig 2: Comparative chart

In fig 2, the lowest dotted line represents the result of RGB color space, 2 and 3 represents the results of HSV and YCbCr. The upper one shows the results of proposed algorithm which is the combination of HSV and YCbCr.

E.SKIN DETECTION

After the image doing color balance operation, then one copy is converted into YCgCr color space; another one is converted into HSV color space. In the YCgCr color space, we use Gaussian Skin-Color Model to get a black-white image named BW1. We can get another black-white image named BW2 using such constraints:

$$\begin{cases} Y > 80; \\ 100 < Cg < 130; \\ 135 < Cr < 175; \\ 0.05 < H < 0.9412; \end{cases}$$

According experiments, we found such constraints can divide skin and non-skin clearly. Finally we can get BW3 by doing and operation between BW1 and BW2. The candidate of face region will be selected from BW3. From under Figure (from up left to downright is original image BW1, BW2 and BW3), the Gaussian skin-color model can extract the pixels of skin very well, but some background with similar color also been selected. As the top picture shown, the pink color and yellow color clothes were selected by the Gaussian skin-color model. However, the pink color clothe is not selected in other algorithm using constraints. In low picture, dark yellow trousers can erase by the Gaussian skin-color, but still be in the other detection algorithm. After logical operation, many interferential elements can be erased. So it is self-evident that this approach of skin detection can improve the robustness and accuracy in face detection.

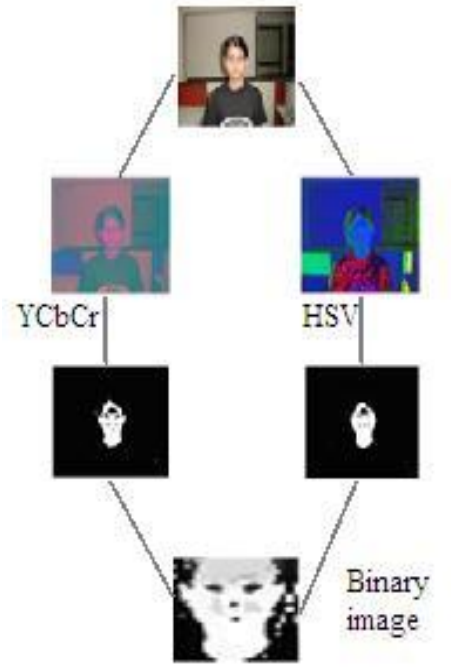


Fig 3: Skin color detection

F. MORPHOLOGICAL OPERATION

The aim of Morphological operation [2] is to transform the signals into simpler ones by removing irrelevant information. So morphological operation can reserve essential shape feature and eliminate irrelevancies. Firstly, erosion function is used to get rid of some small pieces, compared with face area, which is unwanted fragment. After that step, dilation operation will help to recover face area. This procedure can be done several times to get good result.

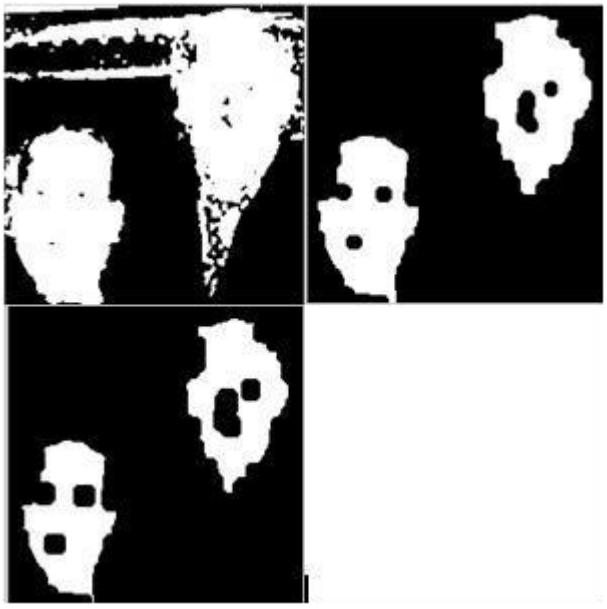


Fig 4: Morphological operation

G. TEMPLATE MATCHING AND ESTIMATION OF FACE

The target of using template matching is to select face segment from skin segments. First, we select a skin segment which has hole in his region and then close the holes in the region. The template face will be resized and rotated in the same coordinate as the skin segment image. At last, the cross-correlation value between the selected skin segment and the template face will be computed. By empirically determined, from our experiments, the threshold value for classifying a segment as a face is 0.6. If the resulting autocorrelation value is greater than the threshold, the skin segment will be classified as face area. After template matching operation, the number of criteria will be used to estimate face:

The ration of height (H) and width (W) of the candidate of face is in a range between 0.5 and 3. i.e. $0.5<W/H<3$

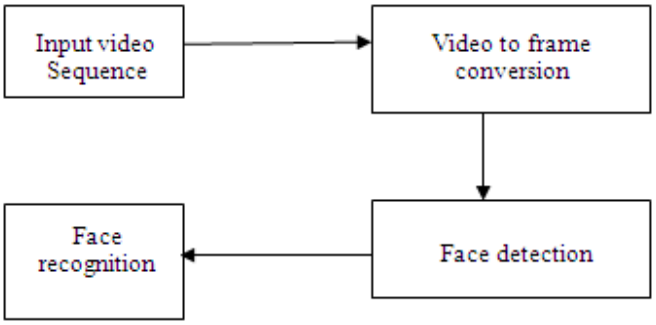
The area of candidate of face is defined A ($A=H*W$); the number of pixel in A is define N. the ration of A and N is in a range between 0.3 and 0.9. i.e. $0.3<N/A<0.9$

H. TO PERFORM FACE RECOGNITION

We have used the technique of Template Matching. Template matching [5] method is normally implemented by firstly creating a sub image (the template), we will call this sub image 'w(x, y)' where x and y represent the coordinates of each pixel. We then simply move the center of this sub image w over each (x,y) point in the a candidate image, which we will call 'o(x,y)' and calculate the sum of products between the coefficients in o and the corresponding neighborhood pixels in the area spanned by the filter mask. This method is sometimes referred to as 'Linear Spatial Filtering'.

The algorithm that we are using for face recognition [3][8] is template matching because it has a higher success rate as

compared to other algorithms. Initially we create a database of images which are considered as template images. Now the algorithm compares the template images with the detected images. The basic method of template matching is to loop through all the pixels in the detected images and compare them to the template images. While this method is simple to implement and understand, it is one of the slowest methods. This procedure is repeated for all the detected images. If a match is found then the image is displayed along with its name. Hence the faces are successfully recognized with acceptable accuracy.



Initially, the input is taken in video format. This video obtained has to be analyzed for face recognition. The first step is converting the video into frames. This is done by sampling the input video at a predefined rate .The frames obtained are pre-processed. Any image obtained through the capturing devices contains noise due to imperfections in lighting conditions, problems in the capturing device. Also, there is information that is irrelevant to the problem being solved. Preprocessing is applied for image enhancement, noise removal and localization. Then the face detection algorithm is applied on the pre- processed image. The face detection algorithm which we are using for face detection is **Skin Color Based Space.** Then these images act as input images which are stored in a separate folder (detected faces). Now the face recognition algorithm is applied. The algorithm that we are using is template matching because it has a higher success rate as compared to other algorithms. Initially we create a database of images which are considered as template images. Now the algorithm compares the template images with the detected images. The basic method of template matching is to loop through all the pixels in the detected images and compare them to the template images. While this method is simple to implement and understand, it is one of the slowest methods. This procedure is repeated for all the detected images. If a match is found then the image is displayed along with its name. Hence the faces are successfully recognized with acceptable accuracy.

4 . CONCLUSION AND FUTURE WORK

In this paper, the combination of face detection, face recognition and information retrieval operation are performed using the video sequence for providing description about the people who are all in the video. It can be applied for criminal identification, social media and celebrity identification, etc...

The future work may be enhanced as in following ways.

First, by identifying the morphed faces of people, the forgeries can be avoided. Second, the postures, actions of the people are analyzed to identify the intention of the people in the video sequences.

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