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YCbCr Technique based Human Face Recognition

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Abstract

Face detection is a necessary first-step in face recognition systems, with the reason of localize and extract the face region from the background. It also has a number of applications in areas such as content-based image recovery, video coding, video conferencing, crowd observation, and intelligent human–computer interfaces. We have taken skin color as a tool for detection. This technique works well for all types' faces which have a specific complexion varying under definite range. We have taken real life examples and simulated the algorithms in MATLAB successfully. This paper concentrates on the input images are converted to the YCbCr model to collect the value Y,Cb,Cr. and check whether these values are satisfied with the threshold values. If the pixels are in the range of threshold then that pixels will be considered as skin region otherwise it is a non skin region. This paper defined algorithm has been tested on various real time frontal images and gets better results for the YCbCr color model.

1. Introduction

Biometric is automated method of identifying a person or verifying the based on a physiological or behavioral characteristic. Examples of physiological characteristics include hand or finger images, facial characteristics. Behavioral characteristics are traits that are learned or acquired. Dynamic signature verification, voice verification and keystroke dynamics are examples of behavioral characteristics. But we used physiological characteristics in Face detection technique [1]. Face detection 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, color based, feature based (mouth, eyes, nose), neural network. The approach studied and applied in this paper is the skin color based approach. Face detection plays a very important role in human computer interaction field. It represents the first step in fully automatic face recognition, facial facial appearance detection, and expression recognition. Our aim, which we believe we have reached, was to develop a method of face recognition that is quick, robust, reasonably simple and accurate with a relatively simple and easy to understand algorithms and techniques [2]. 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 color used here is the YCbCr model.

2. Face Detection System

Face detection is an interdisciplinary field which integrates different techniques such as

(i) Image Processing
(ii) Pattern Recognition
(iii) Computer Vision
(iv) Computer Graphics
(v) Physiology
(vi) Evaluation Approaches

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In general, the computerized face detection includes four steps.

(i) Face image is acquired, enhanced and segmented
(ii) Face boundary and facial features are detected
(iii) The extracted facial features are matched against the features stored in the database
(iv) The classification of the face image into one or more persons is achieved

Figure 1 shows the basic block diagram of face recognition system. The first step of face recognition is to acquire an image either online or offline. After acquisition of image, preprocessing operation is carried out. The unique features of the image are extracted with the help of different image processing algorithm. After the features are extracted, it is matched with the feature data base and the final result is obtained.

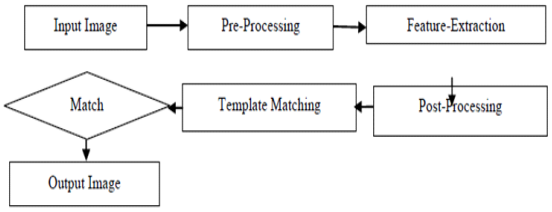


Fig: 1. Block Diagram of Face Detection

There are different approaches for face detection system. Mainly these are divided in to four parts i.e.

(i) Knowledge Based
(ii) Feature Based
(iii) Image or Appearance Based
(iv) Template Based

The approach studied and applied in this paper feature based approaches.

3. Feature Based Face Detection

The development of the feature-based approach can be further divided into three areas. Given a typical face detection problem in locating a face in a cluttered scene, low-level analysis first deals with the segmentation of visual features using pixel properties such as gray-scale and color.

Because of the low-level nature, features generated from this analysis are ambiguous. In feature analysis, visual features are organized into a more global concept of face and facial features using information of face geometry [3]. Through feature analysis, feature ambiguities are reduced and locations of the face and facial features are determined. We provide results to support the validity of the approach and demonstrate its capability to detect faces under different scale, orientation and view point with the advancement in computer and automated systems. One is seldom applicable to many visual tasks in on production lines inspect foods for our consumption and law-enforcement agencies use computer systems to search data base of finger print records. This paper presents a systematic investigation into low-level feature detection in spectrogram images. The result of which is the identification of frequency tracks. Analysis of the literature identifies different strategies for accomplishing low-level feature detection.

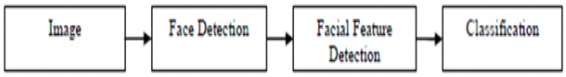


Fig: 2. Feature Based Face Detection

4. Skin Color Model

Color is an important feature of human faces. Using skin-color as a feature for tracking a face has several advantages. Color processing is much faster than processing other facial features. Under certain lighting conditions, color is orientation invariant. This property makes motion estimation much easier because only a translation model is needed for motion estimation [4]. However, color is not a physical phenomenon; it is a perceptual phenomenon that is related to the spectral characteristics of electromagnetic radiation in the visible wavelengths striking the retina. Tracking human faces using color as a feature has several problems like the color representation of a face obtained by a camera is influenced by many factors (ambient light, object movement, etc.), different cameras produce significantly different color values even for the same person under the same lighting conditions and skin color differs from person to person[5]. In order to use color as a feature for face tracking, we have to solve these problems. It is also robust towards changes in orientation and scaling and can tolerate occlusion well. A disadvantage of the color cue is its sensitivity to illumination color changes and, especially in the case of RGB, sensitivity to illumination intensity. One way to increase tolerance toward intensity changes in images is to transform the RGB image into a color space whose intensity and chromaticity are separate and use only chromaticity part for detection. The main goal of skin color detection or classification is to build a decision rule that will discriminate between skin and non-skin pixels. Identifying skin colure pixels involves finding the range of values for which most skin pixels would fall in a given color space. In general, a good skin color model must have a high detection rate and allow false positive rate [6]. That is, it must detect most skin pixels while minimizing the amount of non-skin pixels classified as skin.

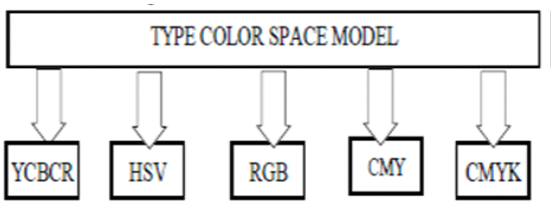


Fig: 3. Types of Color Space Model

5. The Proposed Algorithm

YCbCr is a family of color spaces used as a part of the color image pipeline in video and digital photography systems. Y is the luma component and CB and CR are the blue-difference and red difference chrome components. Y (with prime) is distinguished from Y which is luminance, meaning that light intensity is non-linearly encoded using gamma correction [7]. YCbCr color model wedge the digital image into two parts, luma or luminance component and chrome or chrominance component. Due to luminance and chrominance effect, it becomes most important in digital video camera to handle video information [8].

The YCbCr color space is widely used for digital video. In this paper, luminance information is stored as a single component (Y), and chrominance information is stored as two color-difference components (Cb and Cr). Cb represents the difference between the blue component and a reference value [9]. Cr represents the difference between the red component and a reference value. YCbCr is used in JPEG image compression and MPEG video compression. One advantage of using these color spaces is that most video media are already encoded using these color spaces. Transforming from RGB into any of these spaces is a straight forward linear transformation. The first step of face detection is to segment the color image into skin and non skin region. Different color space has different ranges of pixels which represents skin region and non skin region.

$140 <= Cr <= 165$; $140 <= Cb <= 195$;

The Skin portion of an image should satisfy as follows.

From the above ranges the skin and non skin segmentation is performed. So now the output image only shows the skin regions and non skin regions are blackened. After segmentation, morphological operators are implemented with a structuring element [10]. After application of morphological operators, the standard deviation of the area is calculated and rectangles are drawn in the skin regions. If any unwanted rectangles are created, it is then removed. The complete step of Algorithm shown in below

(A) Step of Proposed Algorithm

- Read RGB Image.
- Convert RGB to YCbCr .
- Find y,cb,cr component.
- Set threshold value.
- Check threshold value lies in the range or not.
- Convert resultant image into Binary image.
- Applying morphological processing.
- Calculate Centroid of BI.
- Calculate Standard deviation.
- Check the standard deviation.
- Retain that faces.
- Draw the rectangles on retained faces.
- End.

Table: 1(a). Resultant Image of all Part Proposed Algorithm YCbCr Model

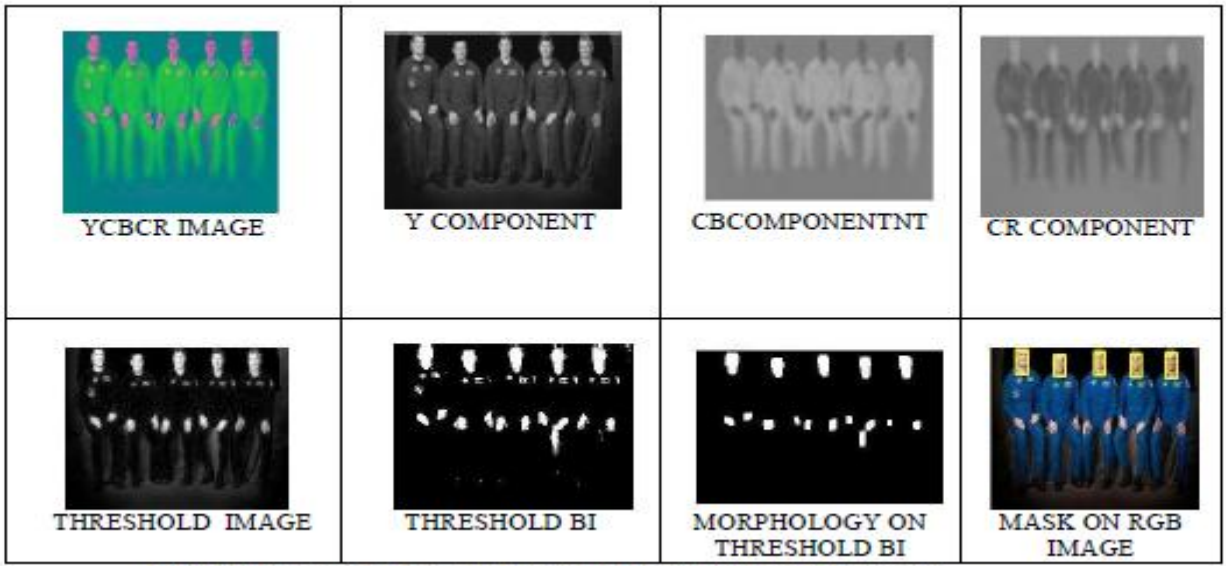
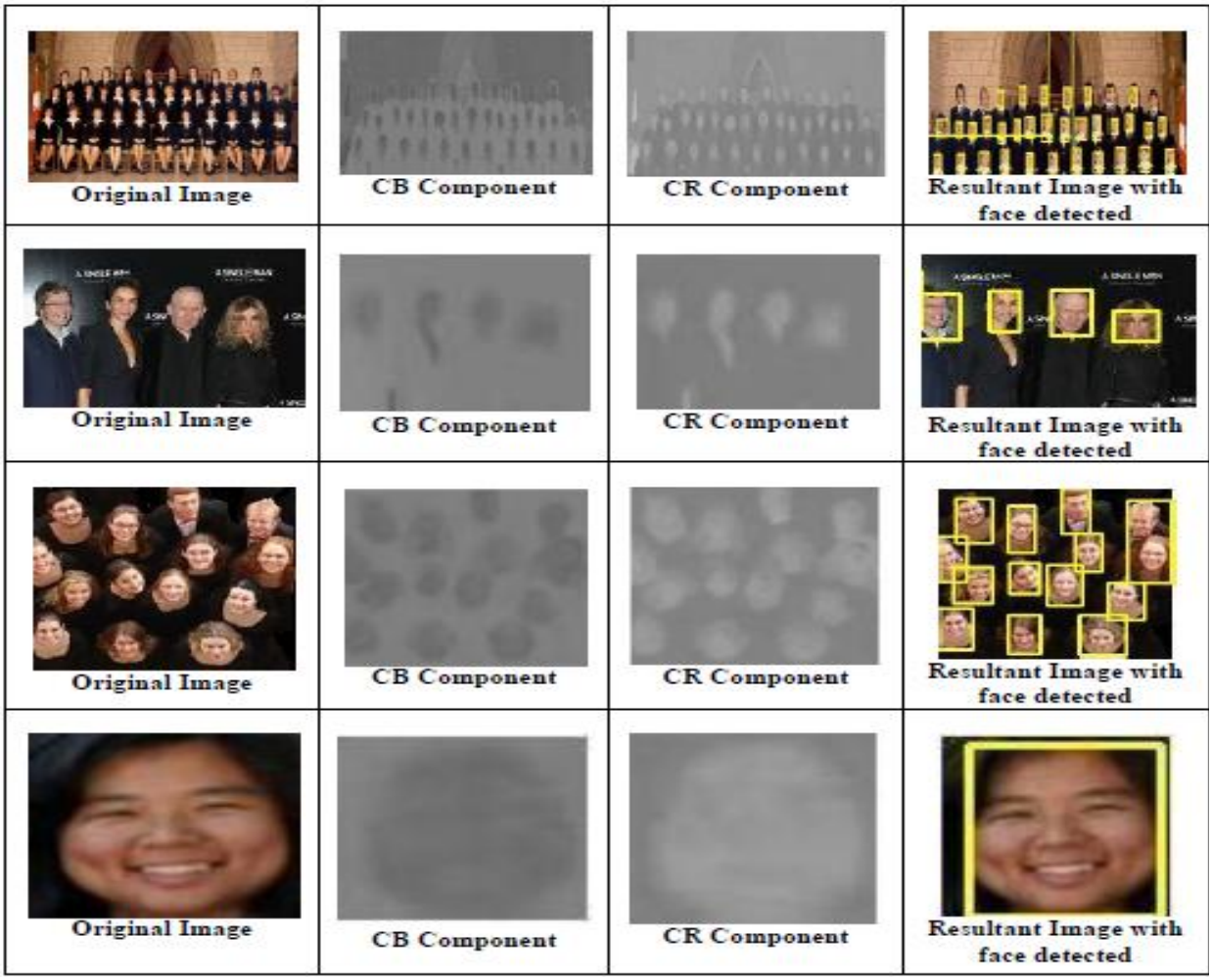


Table: 1(b). Resultant Image of YCbCr Model



Evaluate the performance of the algorithm and find out Resultant image based on YCbCr are compared based on various parameters. Table1 (a) shows the results of proposed algorithm table defined all step of face detection using ycbcr model resulted image. Table1 (b) also defined resultant images. It is observed that the proposed algorithm is giving better results than the existing one in terms of accuracy.

Table: 2. Performance Evaluation of the Proposed Algorithm

Image	No. Of Faces	Size	Time Taken	False Positive	Face Detection	Accuracy
1	10	260*150	7.50842	0	0	100
2	32	550*360	9.5687	4	28	87.5
3	5	170*120	11.6542	0	4	100
4	15	180*150	24.5685	1	14	93.33
5	2	70*70	11.1897	0	1	100

Table 2. shows the performance evaluation of the proposed algorithm and the overall accuracy of the algorithm are found out to be 5 images.

6. Conclusion & Future Scope

This paper proposes an algorithm with good accuracy and running time for face detection based on YCbCr skin color segmentation. The computational models, which were implemented in this project, were chosen after extensive research, and the successful testing results confirm that the choices made by the researcher were reliable .The overall performance of the proposed algorithm is quite satisfactory. The training images on which the algorithm is tested are natural images taken under uncontrolled conditions. The efficiency of the face detection was found to be 96%. In addition, YCbCr color model is chosen because it is fast and compatible with human color perception. The Combination Of three Components Y, Cb, and Cr gives the better performance for illumination problem. The all performance of this Model is reasonable compare to the Other Model.

Hence it can be concluded that the present algorithm demonstrates better performance with respect to speed, less time take and high accuracy. In future we are going to use such type of model created in which time and accuracy is much better this model. In future we can apply this thesis in real time application and we can also used in hardware.

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