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Human Face Detection By YCbCrHs Technique

Ravikant Gupta*, Satyaprakash Pandey* Yogesh Tayal**, Pramod Kumar Pandey**, D.V.B Singh**

*M.Tech. Student of Electronics & Instrumentation Department, ITM University, Gwalior, India

**Faculty of Electronics & Instrumentation Department, ITM University, Gwalior, India

Abstract: Human face detection plays important roles in many applications such as video surveillance and face image database management. In our Paper, we have studied worked on face detection By YCbCrHs Techniques and developed algorithms for them. In face detection, we have developed an algorithm that can detect human faces from an image. We have taken skin color as a tool for detection. This technique works well for Indian faces which have a specific complexion varying under certain range. We have taken real life examples and simulated the algorithms in MATLAB successfully. Our aim, which we believe we have reached, was to develop a method of face recognition that is fast, robust, reasonably simple and accurate with a relatively simple and easy to understand algorithms and. techniques. The examples provided in this Paper are real-time and taken from our own surroundings. While the RGB, HSV and YUV (YCbCr) are standard models used in various colour imaging applications, not all of their information are necessary to classify skin colour. In This Paper presents a novel skin colour model, RGB-YCbCrHs for the detection of human faces.

Keywords: Feature based Face Detection, Morphological operation, YCbCrHs algorithm, Color model, Color Segmentation

I. Introduction

The face is our primary focus of attention in social life playing an important role in conveying identity and emotions. We can recognize a number of faces learned throughout our lifespan and identify faces at a glance even after years of separation. This skill is quite robust despite of large variations in visual stimulus due to changing condition, aging and distractions such as beard, glasses or changes in hairstyle [1].

Our aim, which we believe we have reached, was to develop a method of face recognition that is fast, robust, reasonably simple and accurate with a relatively simple and easy to understand algorithms and techniques. The examples provided in this paper are real-time and taken from our own surroundings. 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. 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 YCbCrHs model.

II. Feature based Face Detection

We propose a feature based algorithm for detecting faces that is sufficiently generic and is also easily extensible to cope with more. The algorithm detects feature points from the image using spatial filters and groups them in to face candidates using geometric and gray level constraints. A probabilistic framework is then used to reinforce probabilities and to evaluate the likelihood of the candidate as a face. 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. Nevertheless, the advantages and disadvantages of each are not explicitly investigated. Three model-based detection strategies are outlined, each extracting an increasing amount of information from the spectrogram, and through ROC analysis, it is shown that at increasing levels of extraction the detection rates increase. Nevertheless, further investigation suggests that model-based detection has a limitation—it is not computationally feasible to fully evaluate the model of even a simple sinusoidal track. Therefore, alternative approaches, such as dimensionality reduction, are investigated to reduce the complex search space [2]. This paper we investigated two complementary methods for the detection of moving objects by a moving observer. The first is based on the fact that, in a rigid environment In, the projected velocity at any point in the image is constrained to lie on a 1-D locus in velocity space, known as the constraint ray whose parameters depend only on the observer motion. If the observer motion is known, an independently moving object can, in principle, be detected because its projected velocity is unlikely to fall on this locus.

III. Color Model

A detailed experimental study of face detection algorithms based on “Skin Color” has been made. Three color spaces, RGB, YCbCr and HSI are of main concern [3]. We have compared the algorithms based on these color spaces and have combined them to get a new skin color based (YCbCrHs) face detection algorithm which gives higher accuracy. Experimental results show that the proposed algorithm is good enough to localize a human face in an image with an accuracy of 95.18%.

For detecting face there are various algorithms including skin color based algorithms. 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. 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. 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.

A. RGB Color Model:

RGB color space is the most commonly used color space in digital images. It encodes colors as an additive combination of three primary colors: red(R), green (G) and blue (B).

The RGB color model is an additive color model in which red, green, and blue light are added together in various ways to reproduce a broad array of colors. The name of the model comes from the initials of the three additive primary colors, red, green, and blue. The main purpose of the RGB color model is for the sensing, representation, and display of images in electronic systems, such as televisions and computers, though it has also been used in conventional photography. Before the electronic age, the RGB color model already had a solid theory behind it, based in human perception of colors. To form a color with RGB, three colored light beams (one red, one green, and one blue) must be superimposed (for example by emission from a black screen, or by reflection from a white screen). Each of the three beams is called a component of that color, and each of them can have an arbitrary intensity, from fully off to fully on, in the mixture [4].

B. YCbCr Color Model:

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. Cr represents the difference between the red component and a reference value. (YUV, another color space widely used for digital video, is very similar to YCbCr but not identical.) A different class of color spaces is the orthogonal color spaces used in TV transmission. This includes YUV, YIQ, and YCbCr. YIQ is used in NTSC TV broadcasting while 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 [5]. The Skin portion of an image should satisfy as follows.

$$140 \leq Cr \leq 165; \quad 140 \leq Cb \leq 195;$$

We collect four values from the two color spaces YCbCr and HSV Color model as H, S, Cb, and Cr and whether these values are satisfies the above condition [6].

$$Cb = -0.169R - 0.332G + .500B \quad (1)$$

$$Cr = 0.500R - 0.419G - 0.081B \quad (2)$$

Equation (1) & (2) is used to calculate luma component.

Let us assume all color values have been normalized to the range [0, 1] [7].

C. HSV Color Model:

The HSV color space (Hue, Saturation, Value) is often used by people who are selecting colors (e.g., of paints or inks) from a color wheel or palette, because it corresponds better to how people experience color than the RGB color space does. The functions `rgb2hsv` and `hsv2rgb` convert images between the RGB and HSV color spaces.

Perceptual color spaces, such as HSI, HSV/HSB, and HSL (HLS), have also been popular in skin detection. These color spaces separates three components: the hue (H), the saturation (S) and the brightness (I, V or L). Essentially, HSV-type color spaces are deformations of the RGB color cube and they can be mapped from the RGB space via a nonlinear transformation. One of the advantages of these color spaces in skin detection is that

they allow users to intuitively specify the boundary of the skin color class in terms of the hue and saturation. As I, V or L give the brightness information, they are often dropped to reduce illumination dependency of skin color. These spaces have been used by Shin *et al.* [8] and Albiol *et al.* [9]. From this color space, H and S will provide the necessary information about the skin color. The skin pixel should satisfy the following condition [6].

$$0 \leq H \leq 0.25; 0.15 \leq S \leq 0.9$$

1. Skin Color Based Face Detection in YCbCrHs Color Space:

Skin color classification algorithm with color statistics gathered from YCbCrHs color space. I Studies found that pixels belonging to skin region exhibit similar Cb and Cr Hs values. a pixel is classified to have skin tone if the values [Cr, Cb] fall within the thresholds. The skin color distribution gives the face portion in the color image. The proposed algorithm is that image should a certain skin region. HSV gives the best performance for skin pixel detection. We conducted our own experiments independently and converged to the same fact.

YCbCrHs images

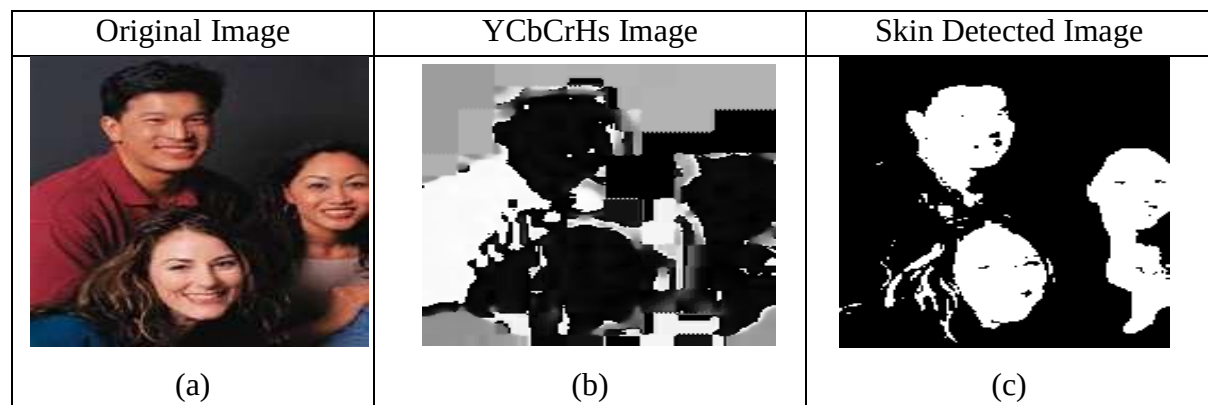


Figure 1: The result of the YCbCrHs model. In this figure (a) represents original image, (b) represents YCbCrHs image, (c) represent the skin detected image or binarized image.

2. Morphological operation:

We understand mathematical morphology as a tool for extracting image components that are useful in the representation and description of region shape, such as boundaries, skeletons, etc. We are also interested in morphological techniques for pre- and post-processing, such as morphological filtering, thinning, and pruning. Start discussion on binary images, whose components are elements of 2D space and then extend it to gray-scale images. The morphological operations are erosion and dilation used to smooth the object boundary without changing their respective area.

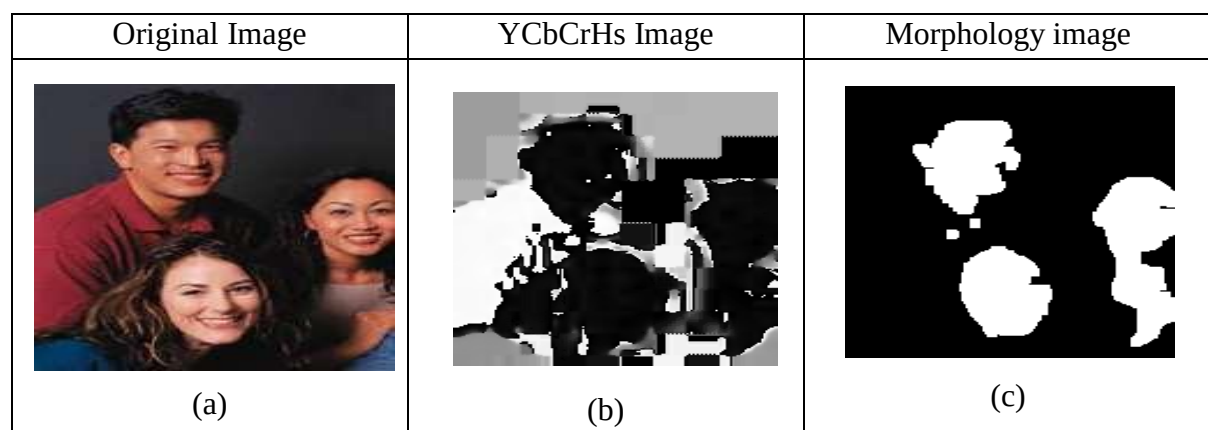


Figure 2: The result of the YCbCrHs model. In this figure (a) represents original image, (b) represents YCbCrHs image, (c) represent the Morphology image.

3. Mask Creation:

Mask Creation is used to create the binary mask which has the value of 0 or 1's. The operation is performed by the MATLAB software.



Figure 3: The result of the YCbCrHs model. In this figure (a) represents original image, (b) represents Resulted image or Mask on RGB image.

IV. Conclusion & Future Scope

We have presented a new method of face detection by using human face geometry. Our study has shown that our method better than the other method of Face detection method in detection time and accuracy, YCbCrHs color model is chosen because it is fast and compatible with human color perception. Hence it can be concluded that the present algorithm demonstrates better performance with respect to speed and high accuracy. This paper proposes an algorithm with good accuracy and running time for face detection based on YCbCrHs skin color segmentation.

In future work, we intend to refine the use of morphological operations in the post-processing of the extracted skin regions. An adaptive training (incremental learning) of the skin colour model can be used to improve the overall classification of skin regions. Primarily, the elimination of false detections and false dismissals is crucial to the success of a robust face detector.

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