Face Recognition Using YCbCr and CIElab Skin Color Segmentation Methods:A Review

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***Abstract*— Skin Color segmentation plays an important role in various applications such as face recognition, gesture recognition, human computer interaction etc. Face recognition is of main concern in skin color segmentation. There are various color models used for skin color segmentation (YCbCr, HSV and CIELAB) but appropriate method should be used for skin color segmentation. In real time the main problem is different light condition due to different backgrounds. In this paper,we propose the skin color segmentation with various color model algorithms,separate the face portion from real time video,analyze the results of segmentation of CIELab color model and match the face gesture in real time video with stored face gestures in memory. It is shown by various experiments that CIELab color space is better than other color spaces. It can improve the performance of face gesture segmentation under poor or strong lighting conditions.**

***Index Terms*— CIELab, image segmentation, YCbCr.**

I. INTRODUCTION

A. Image Segmentation

Image segmentation is the process of partitioning a digital image into multiple segments. The goal of segmentation is to simplify and/or change the representation of an image into something that is meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries(lines,curves etc.).The result of image segmentation is a set of segments that collectively cover the entire image,or a set of contours extracted from the image .Each of the pixel in a region are similar with respect to some characteristic or computed property, such as color,intensity, or texture.Adjacent regions are significantly different with respect to the same characteristic(s)[11].

B. Skin Color Segmentation

Skin Color Segmentation has done to determine the color pixel is a skin color or non-skin color. Good skin color segmentation should provide coverage of all different skin type for example blackish, yellowish, brownish, whitish and give good results under different light conditioning as possible. There are different color spaces have been used for color. Classification is done by using chrominance component because it is expected that skin color segmentation may become more robust to lighting variations if luminance component is discarded[5].

Skin color has many advantages, Skin color is a simple but powerful pixel based feature. Color allows fast processing .Skin color has proved to be useful and robust cue for face detection, localization and tracking. It is useful in human computer interaction (HCI), human face recognition system. Skin color segmentation becomes robust if chrominance component used in analysis. The method is choosing which eliminate the variation in luminance component. Skin color detection faces many problems like different cameras produces different color values even for same person under same light conditioning. The illumination variation is most important problem among current skin detection system that seriously degrades the performance. The choice of color space determine the how efficiently we can model the skin color distribution. Skin color differs from person to person. A disadvantage of color cue is its sensitivity to illumination color change especially in RGB color space[5].

II. LITERATURE REVIEW

A. Analysis and Integration of skin color models used for Human Face Detection

This paper explores method of face detection where skin color models are integrated. In this research work different skin color models are analyzed and integrated to propose new and innovative approaches for face detection .These approaches are combination of uncommon features of most popular color models like YCbCr,YCgCr and HCI.In this study the luminance component is avoided and only chrominance part is taken in proposed integrated approach[1].

B. Skin Segmentation Using YCBCR and RGB Color Models

Face detection is one of the challenging problems in image processing. This report proposes a novel technique for detecting faces in color images using skin color model algorithm combined with skin likely-hood, skin Segmentation, Morphological operation and Template matching. Color images with skin color in the chromatic and pure color space YCrCb, which separates luminance and chrominance components. A Gaussian probability density is estimated from skin samples, collected from different ethnic groups, via the maximum-likelihood criterion. Adaptive thresholding for segmentation to localize the faces within the detected skin regions. Further, mathematical morphological operators are used to remove noisy regions and fill holes in the skin-color region, so that candidate human face regions can be extracted. These systems can achieve high detection accuracy, high detection speed and reduce the false detecting rate. The two methodology used for the Skin Segmentation is YCbCr and RGB Model. In YCbCr model both the skin colour and texture of the image can be used to identify the particular object in the

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image,where as in RGB model only the skin color has to be used for identification of the person.Hence the YCbCr model is better than the RGB model . From our analysis we conclude that the new approach in modeling skin color can achieve good detection success rate. The algorithm gives computationally a very efficient as well as an accurate approach for skin detection. The performance of different color space may be dependent on the method used to model the color for skin pixel[2].

C. Face Detection Algorithm based on Skin Detection, Watershed Method and Gabor Filters

Automatic face detection has been intensively studied for human-related recognition systems. To build fully automated systems that analyze the information contained in face images, robust and efficient face detection algorithms are required. In this paper, a new face detection algorithm is proposed. This speedy and robust solution developed, on the one hand is based on the segmentation of the color image to skin regions using a new approach to detect the pixels of the skin and the water shed segmentation method. On the other hand, using Gabor filters, combined with a proposed model of face, skin regions are classified into two classes: face and non-face. The integration of these tools in our algorithm permits to develop a face detector with very reasonable and efficient performances. Experimental results show that the method mentioned in this paper can achieve high detection rates and low false positives. To evaluate the detection speed of proposed algorithm, a comparison with a recent known algorithm is made too[3].

D. Skin color analysis and segmentation in complex outdoor background

This paper provides a way of skin detection in outdoor image based on multiple color space.The clustering is good in color space YCgCr.Firstly,skin colors are projected in the color space CgCr and the fitting of distribution is carried through in order to wipe off a part of non skin color and gain the intersected image as the result of first detection .Experimental results indicates that this fiiting of distribution can have a good effect on reducing a mass of processing pixels of non skin color .Secondly,skin colors extracted in the first detection are projected in the color space GB in order to further wipe off part of the remaining non skin colors that are not reduced in the first detection by fitting of distribution.Lastly,the relationships among the three components of every pixel of skin colors and non skin colors in the color space HSL are observed and the percentage of pixels corresponding to a certain relationship is calculated ,so part of the non skin color can be further reduced based on the difference we find according to the observed relationship.Experimental results indicates that this algorithm has a good recognition effect and small amount of computation ,it can be used in skin color detection in simple environment[4].

E. Comparison between YCbCr Color Space and CIELab Color Space for Skin Color Segmentation

Skin color is a simple but powerful pixel based feature. Skin color has proven to be a useful and sturdy cue for face detection, localization and tracking, hand detection, etc. Skin color is a useful means for human face detection. In this paper, we propose two color spaces YCbCr and CIELab and compare the results of both color space. Analyze the efficient method for skin color segmentation under varying lighting conditions. Experimental results show that CIELab color space is better than other color space. It can improve the performance of face segmentation under poor or strong lighting conditions[5].

F. An Innovative Face Detection based on Skin Color Segmentation

It is very challenging to recognize a face from an image 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. In this paper, we propose a novel face detection framework that 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 Gaussian model in Cg-Cr color space, and then some constraints are used to get candidates of face. Secondly, a calculation of correlation coefficient is performed between the given template and the candidates. Experimental results demonstrate that our system has achieved high detection rates and low false positives over a wide range of facial variations in color, position and varying lighting conditions[6].

G. Skin segmentation using color pixel classification: analysis and comparison

This work presents a study of three important issues of the color pixel classification approach to skin segmentation: color representation, color quantization, and classification algorithm. Our analysis of several representative color spaces using the Bayesian classifier with the histogram technique shows that skin segmentation based on color pixel classification is largely unaffected by the choice of the color space. However, segmentation performance degrades when only chrominance channels are used in classification. Furthermore, we find that color quantization can be as low as 64 bins per channel, although higher histogram sizes give better segmentation performance. The Bayesian classifier with the histogram technique and the multilayer perceptron classifier are found to perform better compared to other tested classifiers, including three piecewise linear classifiers, three unimodal Gaussian classifiers, and a Gaussian mixture classifier[7].

H. Robust Skin Color Based Face Detection Algorithm

In this paper, 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. We have compared the algorithms based on these color spaces and have combined them to get a new skin color based 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%[8].

III. PROBLEM STATEMENT

- RGB color space is device dependent it means that the same signal or image can look different on different devices. In RGB chrominance and luminance component are mixed that is why RGB is not choose for color analysis and color based recognition algorithm. One way to overcome this problem is change the image means transform RGB image into other color space whiz intensity and chrominance are separated in contrast

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to RGB , the YCbCr color space is luminance independent. YCbCr constructed as weighted sum of RGB values. CIELab is perceptual uniform color space. Perceptual uniformity means how two colors differ to see when human observe that two colors[5]. CIELab is a device independent.

- Sometimes due to different background and light conditions advanced technique is not more efficient and also not efficient if the user would move.
- Performance is degraded by variation in illumination, background and user variance.

IV. TOOLS AND TECHNOLOGY USED

A. The MATLAB System

The MATLAB Language is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both "programming in the small" too rapidly tocreate quick and dirty throw-away programs, and "programming in the large" to create complete large and complex application programs. The language features are organized into six directories in the MATLAB Toolbox[12].

MATLAB is a high-level language and interactive environment for numerical computation, visualization, and programming. Using MATLAB, we can analyze data, develop algorithms, and create models and applications. The language, tools, and built-in math functions enable you to explore multiple approaches and reach a solution faster than with spreadsheets or traditional programming languages, such as C/C++ or Java. We can use MATLAB for a range of applications, including signal processing and communications, image and video processing, control systems, test and measurement, computational finance, and computational biology[13].

V. OBJECTIVES

1. To study the basics of image segmentation of digital image processing and various color models.
2. To implement the skin color segmentation with various color model algorithms like YCbCr and CIELab in REAL time.(Using LAPTOP camera)
3. To analyze the results of segmentation of both color model algorithms YCbCr and CIELab and comparison, that shows which color model is the best for skin color segmentation.
4. To analyze and compare Face recognition methods using skin color segmentation.
5. To perform analysis on many faces of different countries and colors .

VI. CONCLUSION

This project presents a method combining skin color segmentation with facial component localization for face detection. The proposed algorithm can automatically detect the components and relations of a face. In summary, the major advantage of our approach integrated skin color segmentation and component-based localization is the elimination of the need for a separate training or learning phase. It can be not only used as face detection, but also integrated into other application easily as pre processing or verification tool.

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