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Comparison of Skin Colour Detection Techniques for Face Recognition

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ABSTRACT: Skin tone classification is a critical subset of this field and is useful when it is necessary to extract parts of an image that could possibly contain parts of a person. This paper aims to compare the efficiency of different colour spaces (RGB, HSV, YCbCr) and compare them to see which one is the best for human skin detection. Skin colour has proven to be a useful and robust cue for face detection, localization and tracking. Image content filtering, content aware video compression and image colour balancing applications can also benefit from automatic detection of skin in images.

KEY WORDS: Human skin colour detection, Colour model, face recognition, Comparative study of colour models.

I.INTRODUCTION

Human skin colour detection plays an important role in the applications of skin segmentation, face recognition, and tracking for security. Colour segmentation is an important aspect of digital image analysis**.** Upon recognition of a skin region, one could perform simple detection for a security application, or apply gesture analysis for the sake of human-computer interaction (such as for control or gaming). Electronic skin tone detection is made possible by analyzing the different properties of pixels, which will be the attributes learned by the system [1]. These attributes simply refer to the location of a pixel in a colour space that defines that pixel based on its Red, Green, and Blue contents, or it's Hue, Saturation, and Value, or any parameter from any imaginable colour space.

The aim of this paper is to compare the efficiency of different colour spaces and to evaluate them that which one is the best for face recognition. Skin detection is useful in face detection, face tracking for security and video indexing applications, model-based video coding, etc. There are some difficulties when detecting skin pixels. Skin colour is affected by ambient light which is unknown in many situations; different cameras produce different colours, even from the same person, under the same illumination and finally skin colour changes from person to person. The methodology of determining some object in a large collection that depicts some particular types of properties [2]. Imaging noise can appear as speckles of skin like colour and many other objects like wood, cooper and some clothes are often confused as skin.

II.LITERATURE SURVEY

One method of building a skin classifier is to define explicitly the boundaries of skin cluster in some colour space. The obvious advantage of this method is simplicity of skin detection rules. The main difficulty is in achieving high recognition rates [3]. Other method is non-parametric skin modeling to estimate skin colour distribution from the training data without deriving an explicit model of the skin colour. One more method is designed and tuned specifically for skin detection during face tracking. This task makes skin detection different from the static images analysis in several aspects.

III.COLOUR MODELS

We can define the colour model as the digital representation of possibly contained colours, a different definition is found which is defined as the way that we can recognize colour, where human can visualize colour through its attributes such as: hue and brightness [4]. Colour model is a system for measuring colours that can be perceived by human and a process of combining different values as a set of primary colours. Typically colour models have three or four colour components. Different colour spaces are available for different applications. RGB colour space is the most commonly used colour space in digital images. It is a device-dependant colour model. It encodes colours as an additive combination of three primary colours: Red(R), Green (G) and Blue (B) [5]. RGB Colour space is often visualized as a 3-D cube where R, G and B are the three perpendicular axes. One main advantage of the RGB space is its simplicity. HSV is a transformation of an RGB colour space and its components and colourimetry are relative to the RGB colour space from which it was derived. Typically, the first thing that is usually noticed about a colour is its hue. Hue describes the shade of colour and where that colour is found in the colour spectrum. Red, yellow and purple are words that describe hue. The next most significant aspect of colour is typically the saturation S. The saturation describes how pure the hue is with respect to a white reference. Finally a colour also has brightness. This is a relative description of how much light is coming from the colour. If the colour reflects a lot of light, it is said that it is bright. The image in RGB was converted to HSV colour space, because it is more related to human colour perception. Consider H with values ranging within a threshold and a mix of morphological and smooth filters to minimize the noise. The YCbCr colour space is widely used for digital video. In this format, luminance information is stored as a single component (Y) and chrominance information is stored as two colour-difference components (Cb and Cr) [6].

- Cb represents the difference between the blue component and a reference value.
- Cr represents the difference between the red component and a reference value.

IV.COMPARITIVE STUDY OF COLOUR MODELS

In this paper, each colour model which is proposed has its own applications, advantages and disadvantages. A system that is designed using RGB colour space can take an advantage of a large number of existing software routines, since this colour space has been around a number of years. RGB is not efficient when dealing with Real-world images and processing an image in RGB colour space is usually not the most efficient method. The most compelling reason to adopt an RGB workflow is to increase the print provider's ability to "match the original"-the RGB colour space simply allows for a wider range of colours [5]. Clearly, the more data you input to the device, the more you can output. RGB is a convenient colour model for computer graphics because the human visual system works in a way that is similar though not quite identical to an RGB colour space. No transformations required to display information on the screen, for this reason it considered as the base colour space for various applications used in video display because of additive property it is considered as computationally practical system. The cons in RGB colour model are, these are Non useful for objects specification and recognition of colours. It is difficult to determine specific colour in RGB model. The applications of RGB colour model are Computer graphics, Image processing, Analysis, Storage. HSV implementation over RGB is that unlike RGB, HSV separates luma, or the image intensity, from chroma or the colour information [7]. This is very useful in many applications. While performing histogram equalization of a colour image, for not getting strange colours it will separate the intensity component from colour components. HSV is often used simply because the code for converting between RGB and HSV is widely available and can also be easily implemented. HSV is often used simply because the code for converting between RGB and HSV is widely available and can also be easily implemented. While HSL, HSV, and related spaces serve well enough to, for instance, choose a single colour, they ignore much of the complexity of colour appearance. Essentially, they trade off perceptual relevance for computation speed, from a time in computing history when more sophisticated models would have been too computationally expensive. Application areas of HSV colour model are Human visual perception, Computer graphics, processing, Computer Vision, Image Analysis, design image, Human vision, Image editing software, Video editor. YCbCr is not an absolute colour space rather it is a way of encoding RGB information. The actual colour displayed depends on the actual RGB primaries used to display the signal. Therefore a value expressed as YCbCr is predictable only if standard RGB primary chromaticities are used. The YCbCr colour space is widely used in digital video, image processing etc.

In this format, luminance information is represented by a single component Y and colour information is stored as two colour-difference components, Cb and Cr. This method is perfect in image compression. It is used in saving images as

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a file format for image. Y luminance can be used separately for storage in high resolution and the chromaticity components treated separately to improve the performance [8]. Disadvantages of this colour model are, the colour range is restricted in the colour TV images because of the information compression required for the displayed image.

V. RESULT AND DISCUSSION

i. SKIN DETECTED OUTPUTS OF RGB COLOUR SPACE TECHNIQUE

Fig (i, a): Input image

Fig (i, A) illustrates the web captured image i.e., input image which is given as the input for the pre-processing stage so that the skin detected image is obtained.

Fig (i, b): RGB colour model skin detected image

Fig(i, B) illustrates the image after pre-processing and detecting skin pixels which are thresholded and highlighted to show the difference between skin and non-skin pixels of humans.

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Fig (i, c): Face recognized image

Fig (i, C) illustrates the face recognized image which is obtained from the skin detected image and a bounding box which is in rectangular shape is fitted on the face region.

ii. SKIN DETECTED OUTPUTS OF HSV COLOUR SPACE TECHNIQUE

Fig (ii, a): Face recognized image

Fig (ii, A) illustrates the face recognized image for HSV colour space technique. This face recognized image will be obtained from the input image where there is more number of skin pixels.

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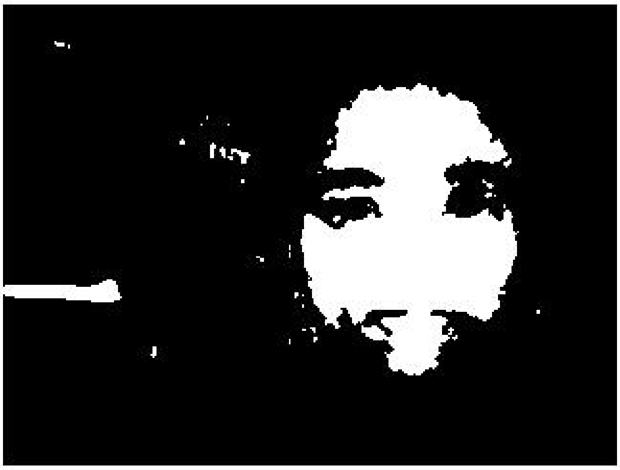

Fig (ii, B): HSV segmented image

Fig(ii, B) illustrated the skin detected image using HSV colour space technique after pre- processing and morphological operations.

iii. SKIN DETECTED OUTPUTS OF YCbCr COLOUR SPACE TECHNIQUE

Fig (iii, a): Input image

Fig (iii, A) illustrates the input image which is captured from the webcam, which is then given to further pre-processing block, where the image is segmented using YCbCr technique.

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Fig (iii, b): YCbCr segmented image

Fig (iii, B) illustrates the skin detected image using YCbCr colour space technique. Here, the skin pixels were detected and the non-skin pixels were not detected.

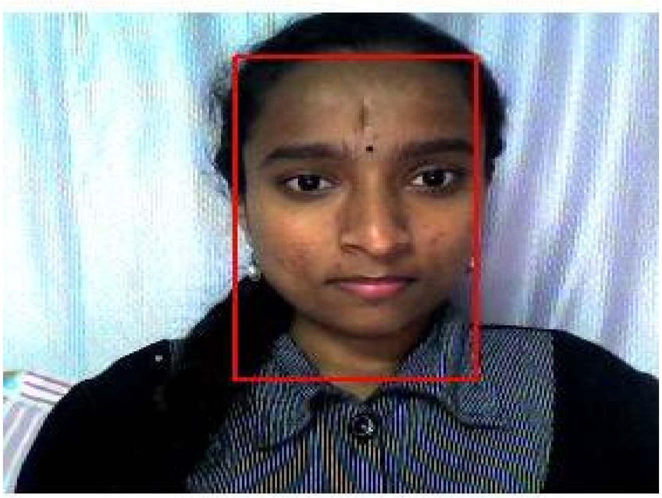

Fig (iii, c): Face recognized image

Fig (iii, C) illustrates the face recognized image from the skin detected image which indicates the face region. The face is detection is done where there is more number of skin pixels in human body.

iv COMPARISON OF SKIN COLOUR DETECTION TECHNIQUES

Table 1

TYPE OF COLOUR MODEL	DETECTION RATE %	FALSE DETECTION %
RGB	65%	35%
HSV	70%	30%
YCbCr	90%	10%

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V.CONCLUSION

Thus From the result analysis, we can say that YCbCr gives an efficient output compare to RGB and HSV skin colour detection methods. After that, HSV is efficient and finally RGB model. RGB is easy and can be applied for more no. of images but the accuracy is less. As we discussed earlier, RGB model is less efficient to real time inputs and detecting skin similar coloured images as skin region. The time required for retrieval of the images using HSV colour space is more than the time required for retrieval of the images using YCbCr colour space.

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