INTERNATIONAL JOURNAL OF
CURRENT MULTIDISCIPLINARY STUDIES

Available Online at http://www.journalijcms.com

VOL. 2, ISSUE, 1, PP. 117-119, JANUARY, 2016

IJCMS

RESEARCH ARTICLE

Face detection using skin colour information and haar features

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ARTICLE INFO

Article History:

Received 15th, December, 2015
Received in revised form
28th, December, 2015
Accepted 16th, January, 2016
Published online
28th, January, 2016

Keywords:

Skin colour detection, Haarfeatures.

ABSTRACT

In today's world security of data, person and information is very important aspects.So biometric systems for user authentication are becoming increasingly popular due to the security control requirement in identity verification, access control, and surveillance applications. For authentication various recognition techniques are used e.g. vein pattern recognition, face recognition. For face recognition accurate face detection is primary need. Here we present two different approaches for face detection. First face detection approach is based on skin colour detection. Second approach is Haar feature based face detection.

INTRODUCTION

User authentication is becoming increasingly popular due to the security control requirement in identity verification, access control, and surveillance applications. Face recognition, among other conventional biometric authentication techniques is most suitable alternative because it is non-intrusive and economic with low cost cameras and embedded systems. Over the past few years, extensive research works on various aspects of face recognition by human and machines have been conducted by psychophysicists, neuroscientist and engineering scientists.

Face recognition is one of the most studied topics in computer vision and one of the most successful applications of image analysis, pattern recognition and machine learning. Although there are many successful applications already, face recognition is still a challenge. This is due to the variance in face images, such as viewpoint, illumination, expression, occlusion, makeup and even aging.

First aim of face recognition is accurate face detection. There are various approaches present for face detection e. g. skin colour based face detection, template matching method based face detection, haar feature based face detection.

Skin detection plays an important role in a wide range of image processing applications starting from face detection up to various human computer interaction domains.

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Various researchers produces various skin colour detection module but these are applied over certain colour spaces. There are many colour spaces have been used by researchers with different ways to label pixels as skin or non-skin. However, there is not a fixed opinion about which colour space is the best choice to achieve skin detection.

Template matching methods use the correlation between pattern in the input image and stored standard patterns of a whole face / face features to determine the presence of a face or face features. Predefined templates as well as deformable templates can be used. The face detection method based on template matching chooses full face feature as the matched template, with which the burden of computing of face search is relatively large. However, most human faces are symmetry obviously. So we can choose half of the full face-template that is choosing the left half face or the right half faceas the template of face matching which can reduce the burden of computing of face search.
On face detection process, images are classified based on values of sample features rather than pixels. These feature values are calculated using haar features, originally given by given by Viola &Jones. This technique quickly rejects the regions which are highly unlikely to contain the face.

Skin Colour Based Face Detection

For skin colour based face detection it is important to choose proper colour space.The distribution of skin colour of different people has proven to be grouped into a small area of the colour space, available colour spaces are YUV(Y- luminance component, U and V chrominance component), YCbCr(Y-

luminance, Cb- blue chrominance, Cr-red chrominance), RGB(red, green, blue), Normalised RGB(normalised red, green, blue), HSV(hue saturation value) [11].

RGB:- Red Green Blue

RGB is the most commonly used colour space for storing and representing digital images, since the data captured by a camera is normally provided as RGB. RGB correspond to the three primary colours: red, green and blue, respectively. To reduce the dependence on lighting, the RGB colour components are normalized so that sum of the normalized components is unity *(r + g + b = 1)*. Since the sum of these components is 1, the third component does not hold any significant information and is normally dropped so as to obtain a reduction in dimensionality. It has been observed that under certain assumptions, the differences in skin-colour pixels due to lighting conditions and due to ethnicity can be greatly reduced in normalized RGB (*rgb*) space. Also, the skin-colour clusters in *rgb* space have relatively lower variance than the corresponding clusters in RGB and hence are shown to be good for skin-color modelling and detection. Due to the above advantages, *rgb* has been a popular choice for skin-detection.[11]

HSV:- Hue Saturation Value

The perceptual features of colour such as hue (H), saturation (S) and intensity (I) cannot be described directly by RGB. Many non-linear transformations are proposed to map RGB on to perceptual features. The HSV space defines colour as *Hue*—the property of a colour that varies in passing from red to green, *Saturation*—the property of a colour that varies in passing from red to pink, *Brightness* (also called *Intensity* or *Lightness* or *Value*)—the property that varies in passing from black to white. The transformation of RGB to HSV is invariant to high intensity at white lights, ambient light and surface orientations relative to the light source and hence, can form a very good choice for skin detection methods.[11]

YCbCr

The mostly used colour space is YCbCr where Y is luminance component, Cb is blue chrominance and Cr is red chrominance. The chroma component is represented only by blue and red as the sum of chroma value of red, green and blue component is always constant. The separate luma and chroma component makes this model illumination invariant. Using the raw input image in the RGB colour space is not suitable tool for skin detection. This is due to that the RGB colour space is highly sensitive to intensity difference. The YCbCr colour space is commonly used in image processing as it separates the luminance, in Y component, form the chrominance described through Cb and Cr components [11].

In proposed method for face detection,skin colour of human different races allocates distinct area of colour space. Face situation can be designated through skin points in image. To determine skin points, first human skin colour is calculated through HSV colour space. Skin colour histogram is calculated using a set of images included skin areas of human different races and the areas related to skin are extracted from among images. After noise elimination, analogous cell value of each pixel increases one unit in histogram until histogram become normal.

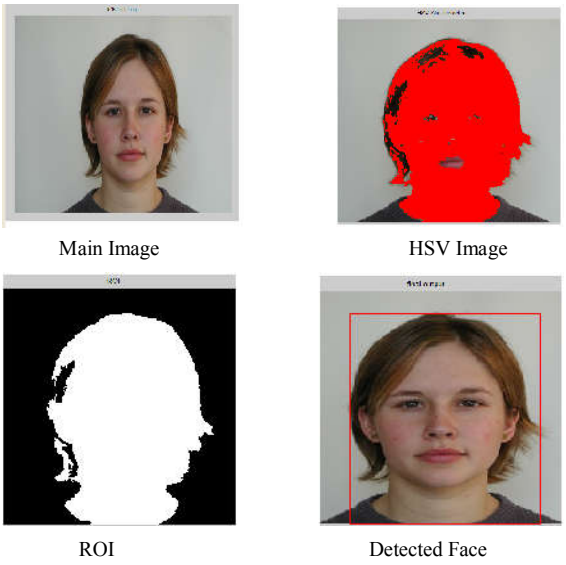

Fig 1 Skin Colour Based Face Detection

Haar Feature Based Face Detection

P.Viola presented an Adaboost algorithm which can be used for fast image retrieval and face detection. The Adaboost algorithm was often used to detect face area in an image. The main idea of this algorithm is to boost up a large number of generally weak classifiers to form strong classifier, and the strong classifier has strong classification ability [2]. Adaboost algorithm implemented using haar cascade feature. This technique quickly rejects the regions which are highly unlikely to contain the face.

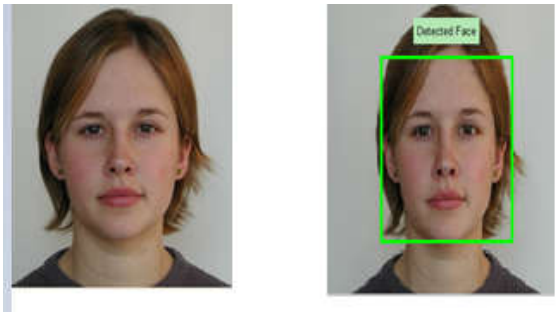

Fig 2 Main Image Detected Face

CONCLUSION AND FUTURE WORK

The paper presented an automatic face detection approach can be considered as the first step in any human computer interaction applications. The paper started with studying and deciding which colour space is best for the human skin-base applications and database in hands. We found that the HSV space is the most optimum in case of using normal lighting and different lighting conditions. Also we study another method for face detection i.e. haar feature based face detection using

Adaboost algorithm presented by P. Viola. This approach gives more accurate result than that of skin colour based approach.

In the future research, we are planning to integrate the proposed face detection approach with a user authentication element in order to represent a new face recognition system. This system may also combine with a depth map calculation to represent a secure and accurate face recognition system.

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