RGB Ratio Based Face Detection and Skin Detection: A Review

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Abstract - One of the best application of image analysis and understanding is face detection.Face detection is one of the challenging task. For face detection the number of algorithm have been developed in last few years. In this review paper we deals with the of colour spaces which are used for face detection and skin detection, different operations performs like thresholding and morphological filtering. In this paper an improved segmentation algorithm for face detection in colour images with multiple faces and skin tone regions proposed. Skin regions are extracted using a set of bounding rules based on the skin colour distribution obtained from a training set. A segmentated regions of face are further classified using a parallel combination of morphological operations. In the preprocessing step skin colour is detected using colour space model. Filters and morphological operators will be used to fill the wholes that will be created after the segmentation process. Then edge detection method will be used to detect the face edges and then masking is done and faces are detected. The goal is to develop an algorithm to detect faces from an images so that it will upgrade the exact detection rate.

Keywords - Colourspace, RGB Model, face detection, skin colour, morphological filtering, thresholding
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I. INTRODUCTION

Face detection is essential step in biometric application[1]such as video surveillance,face recognition[2] and large-scale face image retrieval system.In colour images face detection has also gained much attention and notice in recent years. Most of the techniques up to date are pixel -based skin detection methods, which classify each pixel as skin or non-skin individually. For instant,,template- matching methods[4]are used for face detection.The feature invariant approaches are used for feature detection of eyes,mouth,ears,nose etc. neural network method is used for face detection.Some of the early methods used various statistical colour models such as a single Gaussian model and histogram based model.

Various colour spaces furnish us various acumen between skin pixels and non-skin pixels over various illumination conditions. Faces are not uniform in size and vary with the subject distance from camera . Take a picture from digital camera, we would like to know that where his/ her face is situated.

Fig 1:- Input image

The main task of face detection is to determine [i] where the face is situated in a given image and[ii] where the faces are located at. The expected output of this step containing face detection from the above input image.
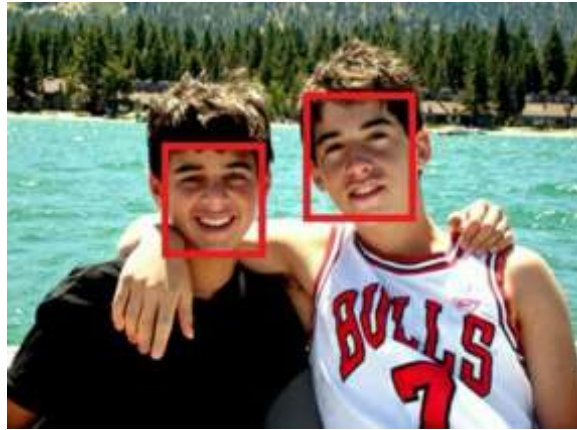
Fig 2: Example of face detection.

II. METHODS OF FACE DETECTION

1. Detecting faces in the images with mono-colour(controlled background) - To find the face in the controlled background is always the easiest method. Such method utilizes the colour or appearace based filtering in order to recognized the face area.
2. Using skin colour model - RGB colour and intensity values are normalized in the image then the pixels are match with the skin colour and mark. Provience that are not representing face are removed and face appearance is confirmed by checking features of human faces.
3. Feature-based methods - Geometric relation between eyes, mouth and nose are taken to used to avoid geometric confusion there is a neceesity of at least one face should be present and its having the good quality of image and thus the computation is expensive. Eg- Adaboost, viola jones.

Other techniques (PCA, LDA, MPCA):

- Principal component Analysis (PCA) - PCA is also known as karhunen-loeve method is one of the popular method for feature selection and dimension reduction. PCA provides an optimal linear transformation from the original image space to an orthogonal eigen space with reduces dimetionality in the sense of least mean squared reconstruction error.
- Multi-linear Principal component Analysis (MPCA) - Multi-linear Principal component Analysis is a modification of PCA. It uses multi-linear algebra. While PCA uses only one vector, in MPCA a no of transformation vectors are used.[7]
- Linear Discriminants Analysis (LDA) - Linear Discriminants Analysis helps in evaluating the importance of varied facial features in relation to their discriminant power. [7][9]

III. COLOUR MODELS

Colour space is a mathematical model to represent colour information as three or four different colorcomponents. Different colour models are used for different applications such as computer graphics, image processing, TV broadcasting.
There are different colour spaces that can be used for skin modelling namely RGB, normalised RGB, hue, saturation and value (HSV), hue, saturation and intensity (HSI), hue, saturation and lightness (HSL), tint, saturation and luminance (TSL) and YCbCr. The goal of colour model is to facilitate the specification of colour in a certain standard. In general colour model is the specification of a coordinate system; this subspace colour is to represent each colour in a single point.

RGB Colour space

RGB is a colour space originated from CRT(or similar) display applications, when it was convient to describe colour as a combination of three coloured rays(red, green and blue). It is one of the most widly used colourspaces for processing and storing of digital image data.
Skin colour is the most important feature of face and is unique because of its colour components. Skin colour pixels can be easily detected using standard colour histogram which is normalized for every future change in the intensity of luminance of division.And thusRGB vector is transformed into a vector[r,g] colour standard provides a fast means of detecting the skin.After review and analysis of different levels of the RGB colour space ,it was found that the following rule worked well in reviewing some necessary pixcels .

$0.836G-14 < B < 0.836G+44$

And

$0.79G-67 < B < 0.78G+42$
Implies the skin texture[3]
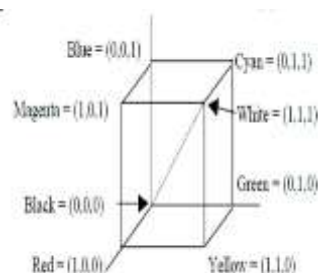
YCbCr Colour space

YCbCr space model comes in the family of television transmission colour space along with the YUC and YIQ and is designed for space analogue PAL and NTSC.

YCbCr colour model has been developed to allow the transmission of colour information on televisions keeping in mind that the existing television in black and white still displays image in shades of gray, has the characteristics of luminance and isolate colour information. It is used in various application such compression.

HSI, HSV, HSL- Hue saturation intensity(Value, Lightness)

Hue saturation colour spaces were introduced when there was a need for the user to specify colour properties numerically. Hue defines the dominant colour(such as Red, Green, Purple and Yellow) of an area, saturation measures the colourfulness of an area in proportion to the brightness. The "intensity", "Lightness" or"Value" is related to colour luminance.

IV. RELATED WORK

Face detection and tracking has been the topics of an extensive research for the several past decades a multilevel ellipse detector along with a support vector machine verifier is proposed to presizely detect human faces and eyes. This method can be used for face detection however it is not situable for small faces, low quality images or non frontly oriented faces. Faces smaller than 10% of the image height increase the processing time and reduce the face detection rate significantly. A beam proposed a real time multiple face detection and tracking algorithm that uses edge skin colour and shape information. However the false detection rate is extreamly high(27.6%) on the Compaq skin database. The AM-CC face detection algorithm based on Adaboost is proposed in an has 10% higher detection rate than the traditional Adaboost algorithm.[6]

Guassian model is used extracting the skin colour in CbCr colour space and with means of likehood ratio method a binary mask is created. Another type of work has been done which based on skin colour segementation and feature extraction. Viola and jones have proposed a robust real time face detation framework, which is built using the Adaboost classifier.In another method regions of face are detected by detecting the eye regions. After this eye pairs are obtained by finding and verifying probable eye regions. The distance between the eyes is used to find a possible face candidate. Next, the face is divided into different regions and facial features are extracted from the corresponding regions. When both eyes are closed then system fails. It is because of the fact that the entire system depends on the extracted eye centres. Thus presence of glasses causes errors in the system. Also performance reduce in extreme lighting conditions .

A boosting algorithm which accent on skin colour information which uses method on skin colour likelihood. A Stochastic model is adopted to compute the similarity between a skin region and a skin color. Both Haar like features and lbp are utilized to build a cascaded classifier. This is implemented based on skin color emphasis to localize the face region from the color image. It shows good tolerance to face pose variations and complex background.

V. PROPOSED METHOD

The proposed face detection algorithm will implement using MATLAB.
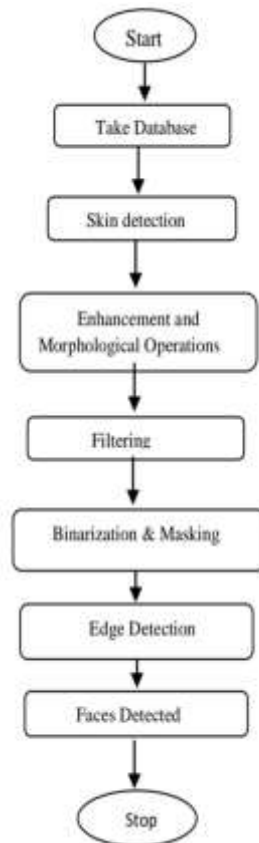The Various steps are used in this process shown in fig is explained as follows:

Fig 3: General block diagram of proposed method.

A.   *Database*

The database include various colored images which are collecting from websites having different poses, blockages, illumination conditions or select an image from gallery.

B.   Skin colour detection

Skin colour varies from person to person belonging to different ethnic groups and from persons across different regions. Firstly

Segment the colour image into skin and non-skin regions[8]. for this purpose three colour spaces are used like RGB, HSV, YCrCb. The RGB colour model defines in terms of the addition of primary colours, whereas, HSV model describes the parameters like brightness, colour vibrancy. HSV is the cylindrical representation of RGB colour model. In YCbCr the colour range is restricted in the colour Tv images because information compression is required .HSV stands for hue, saturation and value.

C.   Enhancement and morphological operations.

Image enhancement is carried out by the two methods based on the weber's law notion. The first method employs information from image background analysis by blocks,while second transformation uses opening and closing operation [5].In this image processing is done with the help of MATLAB .The quality and shape of histogram is enhanced. In this spatial or frequency domain filters are used. Now the enhanced image is subjected to the morphological operations like we can use erosion, dilation, open, and closed operators. A collection of techniques for digital image based on the relative ordering of pixels value not on their numerical values.

D. Filtering

filtering name itself indicates that to filter or to allow for selective highlighting of particular information. There are various types of filtering used in image processing like sharpening filters ,low pass ,high pass and smoothing filter. smoothing filters are used to highlight fine detail in an image.

E. Binarization

A binary image is a digital image that has only two possible values for each pixel. two colors are used for a binary image are black and white .image binarization helps us to classify all the pixels above the value considered as white and all other black. for selecting threshold for each image area adaptive binarization is used.

F. Edge detection

There are different types of edge detection techniques like Roberts cross operator,pre itts operator, sobel operator and canny edge operator. Edge detection refers to the process of finding and locating discontinuities in image.

OUTPUT SCREEN
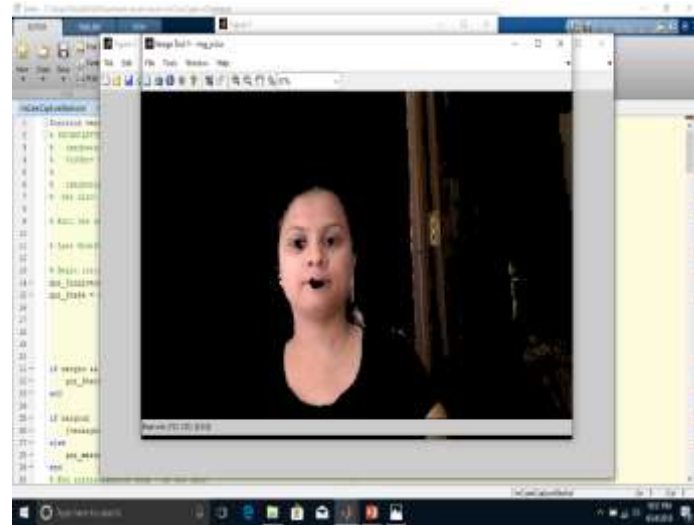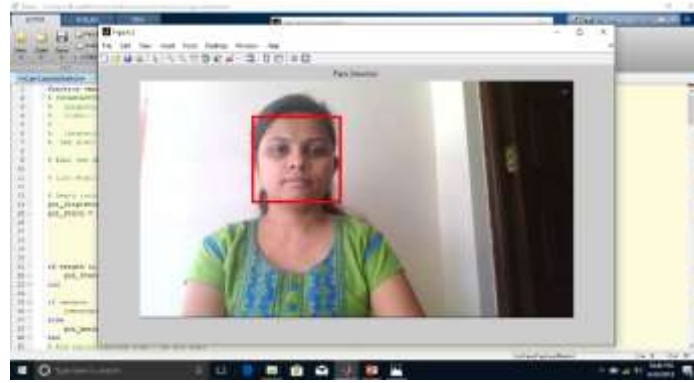
VI. CONCLUSION

This paper explains various techniques of face detection and skin detection at various conditions such as face expressions, position and various lighting conditions. Also explain the operation performed for face detection in future, a new algorithm can be developed using exiting techniques of detection.

VII. REFERENCES

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