Face Detection and Skin Detection Using RGB Ratio

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Abstract :
In today's digital world the major controversy is substantiate and identification. In substantiate and identification the eloquent role is face detection . In real time application face detection and skin detection becoming a challenging task. In this paper RGB color model is used for skin detection .Basically, to remove the non-skin pixels from an image this color model is used. In face detection ,the two regions are namely "face region " and "non -face region". This accession to detect the face is based on color tone utility particularly clarify for skin area detection within the image frame. This paper proposes the use of morphological filter, color model for face detection and skin detection.

Index Terms **–Image processing , Face detection , color space , skin color, Skin detection**

I. INTRODUCTION

Face detection means that a system having power to find that there is a human face present in an image or video. It is one of the great technology in image processing. when we are communicating with people, we normally look at his face; the person's face expression plays vital role at the time of communication. In many applications the face detection step is very much important such as face recognition, video surveillance and large scale retrieval system[2]. Images of faces vary greatly rest on pose, facial expression and occlusion .

In this paper face detection system is proposed and perform using a skin region or color analysis method within the image in accordance with YCbCr color, where each and every pixel is categorizing either skin or non-skin. From any background of image the system will detect the face. This system is implemented by using image processing. The important characteristics of human face is 'color' .Using skin –color as a characteristics for tracing a face has a number of advantages. color processing is speedier than processing other facial characteristics. Face detection techniques can be divided into various categories specifically feature- based approaches, template matching – based approaches and skin color model- based approaches. Numerous methods have been implemented to determine each variation. Out of all these categories template- matching methods [4] are used for face detection by comparison of an input image to a grade face pattern. For feature detection of eyes, ears, mouth, nose, the feature invariant approaches are used. Appearance –based methods are used for face detection with edge detection [7] and neural networks [6]. Number of algorithms are used for face detection i,e. neural network , support vector machine[8].Various literatures have studied that is used to separate the skin region from non –skin[1][4].

Skin color has proved to be useful and robust cue for face detection ,localization and tracking. Skin detection plays an important role in a wide range of image processing applications ranging from face detection , gesture analysis, image based retrieval system. A method for detecting human faces in color images is explained that it separates skin part from non –skin part and then locate faces within skin regions .In this color image is firstly converted to a gray scale image that gray scale values or pixel shows that the skin .An acquired gray scale image subdivided into skin and non- skin regions. In this paper , a specific study of face detection algorithms based on "skin color" has been made . Mainly three color spaces are used for face detection and skin detection are RGB ,YCbCr and HSI .

II. LITERATURE REVIEW:

- A beam proposed a real time multiple face detection and tracking algorithm that uses edge skin color and shape information however the false detection rate is extremely high (27.6%) on the compaq skin database.
- Segmentation algorithm for multiple face detection in color images with skin tone regions using color spaces and edge detection techniques .This algorithm ingeneously combines different color space models specifically HIS, YCbCr along with canny ,prewitt edge detection techniques .In this segmentation stage is critical for face detection.[3]
- A boosting algorithm which accent on skin color information which uses method on skin color likelihood. A stochastic model is adopted to compute the similarity between skin region and a skin color .both harr like features an 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.
- Ghazali Osman ,Muhammad suzuri Hitam & mohd Nasir Ismail, " Enhancedskin color classifier using RGB ratio model . In this paper newly proposed model performs all the other models in terms of detection rate RGB Model is used to reduce FP detection .
- Xing ywang ,Heng wang , " Robust Real time face detection & modified census transform . In this paper the combination of an illumination invariant approach to face detection with skin color detection & false positive suppression for improving speed & accuracy of system.

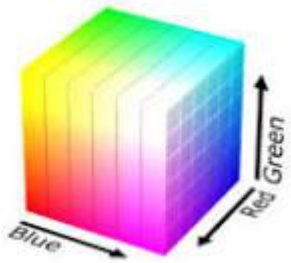
III. **COLOR MODELS :**

The focus of color model is to make smooth specification of color in a definite level. Color image is a digital image which includes information about colors for each pixel.Basically there are two types of color models Additive color model and Substractive color models . Mainly RGB color model is used which is additive color model.

. Each color model is oriented towards either specific hardware (RGB, CMY,YIQ),or image processing applications(HSI). RGB is a color space originated from CRT (or similar) display applications[1], when it was convenient to describe color as a combination of three colored rays(red, green and blue).It is one of the most widely used color spaces for processing and storing of digital image.

- RGB color space:-

The RGB color model is an additive color model in which red ,green ,blue light are added together .RGB is mainly based on Cartesian coordinate system . This color space includes three basic colors red, blue, and green. These colors spectral components are additively combined to result a new color. Its model is often represented by 3D cube with red, green and blue at three corners of three adjacent axes, Figure 1[7]. The black color is found at the origin where r=0, g=0, and b=0, whereas the white color found at the opposite corner of the black color of the cube. In this cube the grey color keeps track of the diagonal line which starts in black corner and ends in white corner. In the (24-bit) color graphics system whose (8 bits) for each color channel, the green color equals (0, 255, 0) Despite the fact that RGB pattern represents the design of computer graphics system in a simple way[4,8].



- YCbCr color space:

This color model is ideal for hardware implementation. Human practice interpretation is described in terms of Hue Saturation and Intensity (Brightness). HSI model separates the intensity component of the color information-bearing and is an ideal tool for development processing algorithm based on the image description of the colors that are natural and intuitive to human health. This color space was found to satisfy the increasing demands for digital algorithms that handl video information, so it became a very widely used pattern in the digital video, Figure 2.

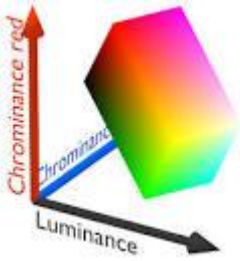


Fig.2. YCbCr Color Space

YCbCr belongs to television transmission color spaces family, which includes other color spaces like YIQ and YUV. It is considreda digital color space, whereas YIQ and YUVare considered analog spaces used in PAL and NTSC systems. These color spaces detach the Red, Green, and Blue into chrominance, and luminance information, and they are effectively used by compression applications, yet the specification of colors is some what unintuitive [10].

- HSV color space:-

Since hue, saturation and value are three properties used to describe color, it seems logical that there be a corresponding color model, HSV.When using the HSV color space, you don't need to know what percentage of blue or green is requiredto produce a color. You simply adjust the hue to get the color you wish. To change a deep red to pink, adjust the saturation. To make it darker or lighter, alter the value [11]. Many applications use the HSV color model.Machine vision uses HSV color space in identifyingthe color of different objects. Image processingapplications such as histogram operations, intensity transformations and convolutions operate onlyon an intensity image. These operations are performed with much ease on an image in the HSV color space.For the HSV being modeled with cylindrical coordinates,Figure 3[8]. The hue (H) is representedas the angle 0, varying from 0o to 360o. Saturation(S) corresponds to the radius, varying from 0 to 1 .

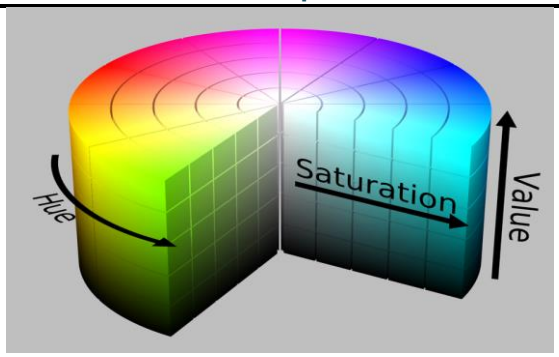


Fig.3 HSV color space

IV. Face Detection:

Face detection is the essential stage. The efficiency recognition is heavily dependent on the accuracy of face detection technique being used. In this work, face detection based on skin color and pixel based model, Face detection stage includes many steps and in each step several algorithms have been used to detect accurate face.

The objective of face detection is to find out whether or not there are any faces in the image and, if present, return the location and the extent of each face [1].

SEVERAL FACE DETECTION TECHNIQUES:-

Yang et al. [2] gives face detection approaches into four major categories: Knowledge-based, Feature invariant, Template matching and Appearance-based approaches. Knowledge-based approaches [3] [4] [5] depend on a set of rules, based on human knowledge, to detect faces. For example, a face often includes two eyes, a nose and a mouth within certain distances and positions relative to each other.

A. Feature Base Face Detection :-

Anima Majumder, L. Behera and Venkatesh K Subramanian et. al. presented different approach for fully automatic detection of facial features. The new techniques may use the basic concepts of facial geometry. They proposed to locate the mouth position, nose position and eyes position. The estimation of detection region for features like eye, nose and mouth enhanced the detection accuracy significantly. Hear we can use the H-plane of the HSV color space to propose for detecting eye pupil from the eye detected region.

B. Geometric Based Face Detection:-

Padma Polash Paul and Marina Gavrilova et. al. presented a PCA based modeling of geometric structure of the face for automatic face detection. The method improves the face detection rate and limits the search space. Skin Color Modeling (SCM) is one of the best face detection techniques for image and video. However, feature selection is very important for even better template matching performance in terms of detection rate and time. This paper presents an efficient feature extraction and selection method based on geometric structure of the facial image boundary and interior. To model the geometric structure of face, Principle Component Analysis (PCA) and

canny edge detection are used. Fusion of PCA based geometric modeling and SCM method provides higher face detection accuracy and improves time complexity. Both models provide filtering of image in term of pixel values to get the face location that are very fast and efficient for large image databases. Proposed system uses skin color model to reduce the search space. Orientation invariant threshold based on geometric model and improves system further. For reliable template matching, feature extraction and selection based on novel combination of geometric filter with SCM filter is introduced. Proposed system is composed of two major components: first, skin regions are segmented using skin color model. In the second part, segmented regions are filtered using geometric model of face. They can focus on four color spaces which are normally used in the image processing field: RGB: Colors are precise in terms of the three main colors: red (R), green (G), and blue (B). HSV: Colors can be represnted individually in the terms of hue (H), saturation (S), and intensity value (V). They are the three attributes that are apparent about color. The conversion between HSV and RGB is nonlinear.

C.High-Level Language based Face Detection:-

P Daesik Jang, Gregor Miller, Sid Fels, and Steve Oldridge et. al. give a new methods for a user oriented language model for face detection. Hear many open sources or commercial libraries to solve the trouble of face detection. There are still hard to use because they need explicit knowledge on details of algorithmic techniques. They projected a high-level language model for face detection with which users may develop systems easily. Important conditions are mainly considered to classify the big trouble of face detection. The conditions recognized here are then represented as expressions in terms of a language model so that developers may use them to express various problems. Once the conditions have developed by users, the proposed associated interpreter interprets the conditions to find and classify the best algorithms to solve the represented problem with corresponding conditions. The purpose of this technique is to come up with a high level language model for face detection with which users will expand systems easily and even without specific knowledge of face detection theories and algorithms. By doing this, the problem of selecting algorithms and deciding complicated parameters for algorithms are isolated from development of face-detection applications. Developers just need to define the problem and express it with the language model suggested and an interpreter will

select algorithms appropriate for the associated sub-space of the problem. They first consider the important conditions to classify the huge problem of face detection. The conditions identified here are then expressed in terms of a language model so that developers have been used them to express various requirements of a given problem. Once the conditions are expressed by developers, the interpreter plays an important role to interpret the conditions to find and organize the optimal algorithms to solve the represented problem. The model is a part of the Open Vision Language (OpenVL), a vision language that allows programmers to describe their vision problem in terms of what it is they want to do, instead of how they want it done. A proof-of-concept is implemented and some example problems are tested and analysed. They present two different detection problems to validate and demonstrate the ease of use of our proof-of concept language model proposed in this paper. Three different face detection algorithms have been implemented for the selection of proper algorithms in this paper: AdaBoost based algorithm, Neural Network based algorithm, and Color based algorithm.

The first case is to detect an upright, frontal and large face for face identification. Face detection is often used as a preprocessing for identifying persons by providing the exact future improvement, the technique need more face detection algorithms will be analyzed and added for more practical and better usability of the language model. Some intelligent approaches for selecting algorithms are necessary to be considered for more optimal selection process .

D. Haar Like Feature Based Face Detection:-

T Ning Jiang, Wenxin Yu, Shaopeng Tang, Satoshi Goto et. al. proposed to improve the performance on Haar feature based cascade detector. First, we define a new feature for cascade detector. That feature was called Separate Haar Feature. Second, they defined a new decision algorithm in cascade detection to develop the detection rate. There are following three key conditions. The first is “Separate Haar Feature”, which adds a don’t-care area between the rectangles of Haar Feature. The second is the algorithm for selecting the best width for this don’tcare area. Finally, proposed a new decision algorithm which makes the decision by not only a stage result in cascade detection process to develop the detection rate.In this cascade algorithm, when an image was rejected by any stage, it is not calculated in the left stages. This cascade algorithm can discard the background images rapidly, but once a wrong detection occurs in one stage, this wrong detection will occurs in the detection. Then we proposed to use the results of the front stages to extend the current stage threshold. This cascade algorithm is good for discarding the background images rapidly, but it also discards the face images when a wrong detection occurs in any stage. They want to use more information to do the decision. They proposed to save the value distance between stage value and threshold of the front stages which is detected and accepted in and using this message together with the threshold and value in the current stage to do the

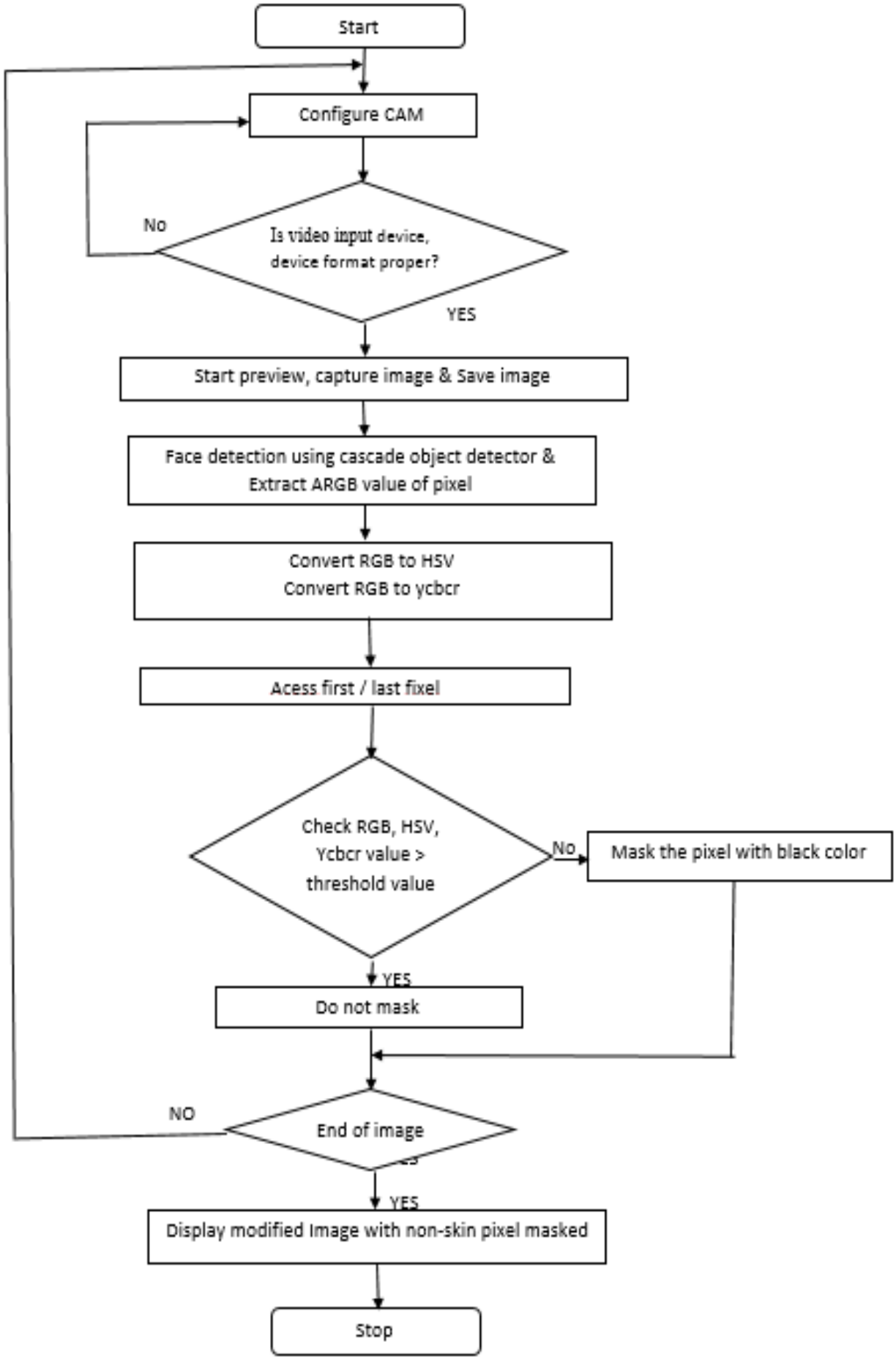
V. Skin Detection:-

In this section a new algorithm which represents a combination of the three algorithms have been depicted, which depend on RGB, YCbCr, and HSV, respectively. It has been explained that those three algorithms function splendidly under only one condition, which the image must contain only one face. Implementation of these algorithm consists of two main steps; in the first step the skin region will be classified in the color space and the rsulted image of applying the skin color statistics will be subjected to binarization by applying suitable threshold, in the second step combining the detected regions that obtained from all the three mentioned color spaces.

- **Determine Skin Area**

Determine skin area is done by classifying the pixels for each color space resulting from color transformation step separately into skin as white color pixel and non-skin as black color pixel.

Flowchart of face detection and skin detection Algorithm as shown below.



RESULTS AND DISCUSSION

Our face detection method is implemented with MATLAB 2016 a. Dig. 3(a) shows main window showing complete GUI structure for project . 3(b) shows output of Face detection . 3(c) shows the mulitiple face detection. Fig. 3(d)shows the otput of skin detection.

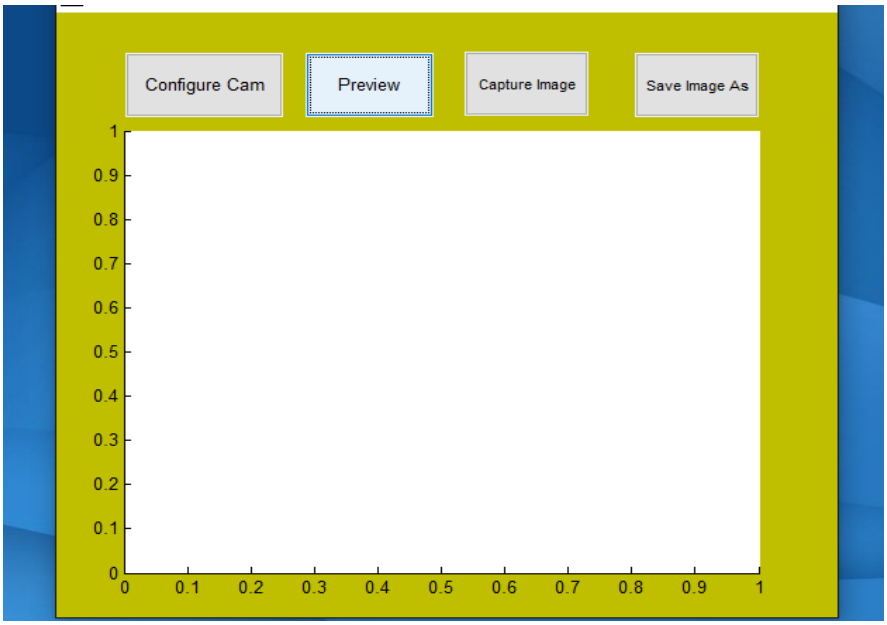


Fig. Main window showing complete GUI structure for project

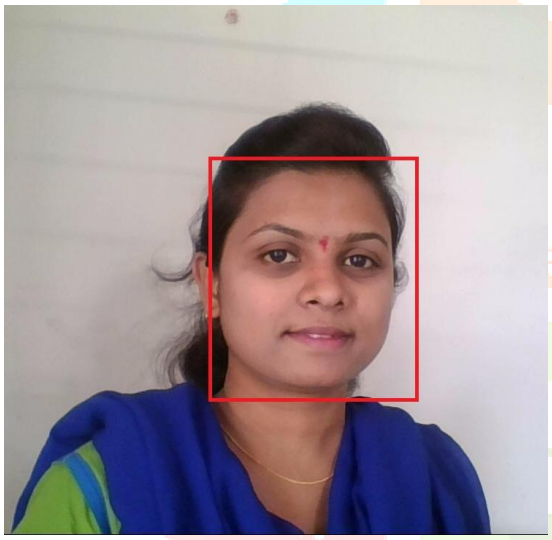


Fig. Output (Face Detection)

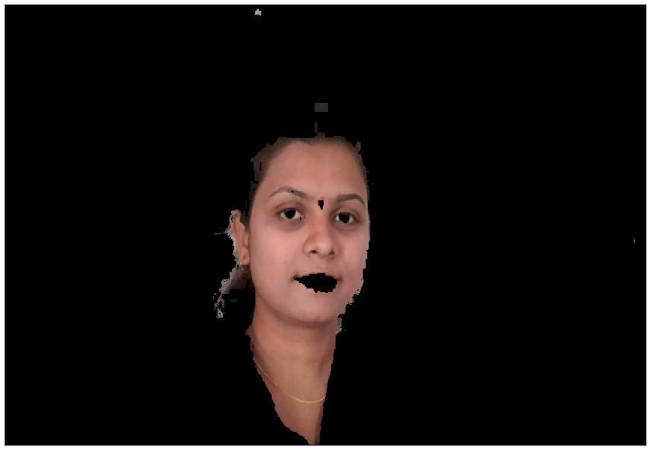


Fig:- Skin Detection

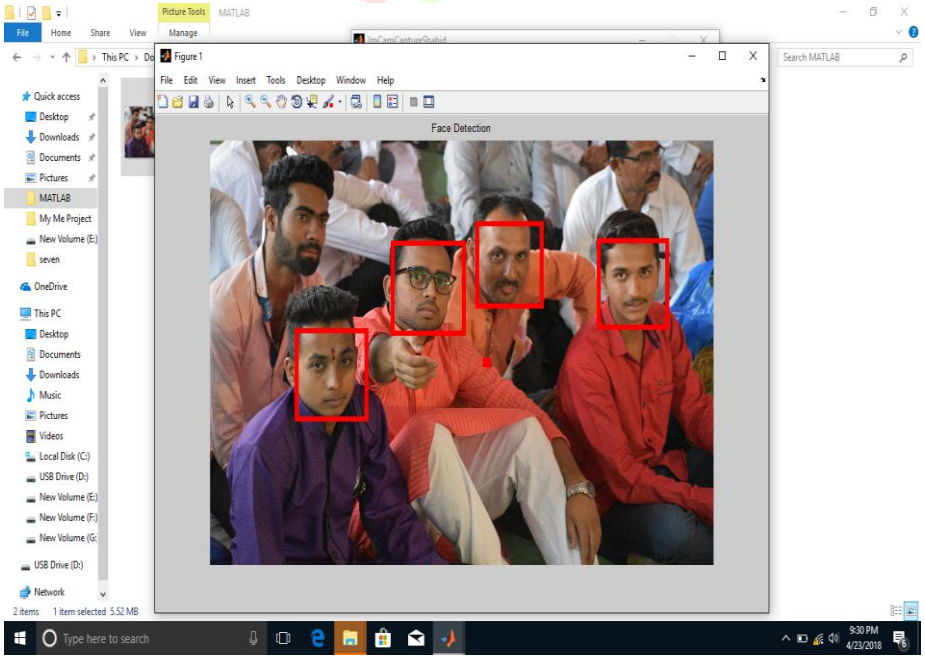


Fig. Output (Face Detection for multiple faces)

V. CONCLUSION:

In this paper, we have implemented face detection algorithm using skin color for that we have used RGB ratio model.

ACKNOWLEDGMENT

Our sincere thanks to the management of MGICOET shegaon and reviewers for constant support.

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