An Improvised Methodfor Detecting Face as ROI in Video

Urmila Pilania, Prinima Gupta

Abstract: ***Objective of the paper is to detect human faces in a video. Lenient decision-based face detection structure is developed. Strength of this structurecan be calculated for a variety of poses, complex backgrounds, face expressions, existence or nonexistence of structural components, orientation of image, condition of imageand blur noises. In particular paper will focus on acolor-based skin model for finding face inside a video which is a unique Region of Interest (ROI).This ROI is calculated, with Improvised Voila Jones Algorithm using Adaboost Cascades. The algorithm is capable of detecting range of unlike faces along with difficulty associated to different illumination conditions, different facial expressions, Image conditions and complex background details. The proposed algorithm detects faces with minimum calculation time while maintaining high detection precision.Then the unique ROI is used for embedding secret information to improve security, robustness, flexibility and imperceptibility of stego file.***

Keywords: Region of Interest(ROI), Voila Jones, Video Steganography, Robust, Imperceptivity, Haar Transform, Adaboost, Cascades and Integral image.

I. INTRODUCTION

With the growth of communication network, video processing hasdeveloped more and more significantly. In video processing skin detection plays significant role among large range of skin tone.Detecting human skin tone have many real life applications [6] like investigation, motion exploration and tracing, video observation, face and movement recognition, human computer interface, image and video indexing and retrieval, image editing and steganography [14].The aim of skin tone finding is to check whether a particular video frame, an image, a section or a pixel detect human skin [7]. Simplest used human skin finding methods [9] is to describe a static conclusion boundary for dissimilar color modules. Human face is likely to detect, if it contain data regarding skin tone, position, shape and texture to recognize the regions.

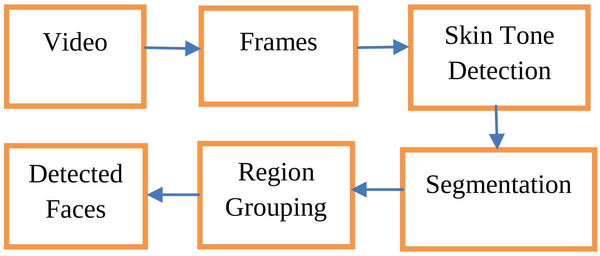

Fig.1 Processing steps for face detection

Different color models are used to characterize images like [18] RGB, HSV, YCbCr, Grayscale &LAB color spaces. In real time video processing detections of skin tone is very difficult because of movements of manyentities in static or dynamiccontextual [2]. Skin tone detection is aninspiring problem that had been broadly studied from many years, however no reasonableresult had been suggested so long. Already presentmethods are constructedbased on various color spaces models to detect the skin tone.Some of the problem [5] faced by human skin detection are low accuracy, luminance-invariant color space and large training data. The challenges [12]relatedto face findingare as follow:

- Pose: Face in images may vary because of comparative poses. Some of the facial features like eyesand nose mightconverted moderately or wholly obstructed [3].
- Existence or nonexistence of structural mechanisms: Presence of some facial structures like beards, whiskers and eyeglasses. Because of presence of these componentsthere are chances of inconsistencycontaining shape, colour& size [8].
- Facial appearance: Person's faceexpressions straightly affectlook of face.
- Image positioning: Images of face vary rightatdiverserevolutionsabout camera's optical axis.
- Imaging settings: When images aredesigned, featureslike lighting, distribution, intensity, sensorand lenses affect look of a face.
- Lighting conditions: Look of the face varies with lighting conditions [9].
- Different skin tone: Skin tone vary from person to person that affect appearance of image.

II. RELATED WORK

In RGB model Skin pixel standards for r plane varies from 0.36 to 0.456 and$g$ plan varies from 0.28 to 0.363. In [14] HSVcolor model pixel is categorized as skin pixel if value of H varies from 0 to 50 and value of S varies from 0.20 to 0.68.

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$HSV$and$YCbCr$ color model in combination [15] are used with groupingseries of $Cb \leq 125$ or $Cb \geq 160$; $Cr \leq 100$ or $Cr \geq 135$; 26 $<Hue<$ 220. Skin color method issubtletowardbrightnessdifference& fails in case background covers skin color like entities [9]. Other difficultsystemspracticesseriousnessstructures to find face constructedbased on geometry and qualitydesign. LPA and LBP systemsare also used forremoving textural structures with LDA dimensionality decrease and SVM [12]. Face can also be detected with edge maps & skin shade thresholding. PCA [11] extract face images and changes them into small subset of feature face images and these are called as Eigen values of faces. A Multi-level ellipse sensoralongsidesupport vector device verifier is planned in [17] for detecting human face.The above method doesn'tappropriatelyaimed at small faces, low-quality pictures andno directly oriented looks. 3D face findingconstructedbased on 3D point dissemination model is projected in [18]. Thesystemdoesn'trequire somepreviousinformation of face orientation. It demand large training set for improvedprecisionlaterlesserquantity of training examplesdropaccurateapprovalpercentage. Abin et al. in [19] suggestedmany face detection system that practices skin color, edge &shape evidence. $YCbCr$ color space model was castoff for skin pixel finding along with Viola-Jones technique to proveparticular detection.Viola and Jones [16] projected real-time AdaBoost algorithm aimed atdetection of rectangular facestructures. Viola Jones face detector [20] is joinedthrough color penetrationinformation fordecreasingquantity of wrong positives. LCH model L represent Lightness values, C represent Chroma values and H give chemical composition of hemoglobin and melanin. To represent skin portions of human beings more accurately LCH colour model is converted to LAB color space model. Values of L, A and B is calculated as:

LValues = CHL(:,3);

AValues = CValues .* cosd(HValues * pi/180);

BValues = CValues .* sind(HValues * pi/180);

For converting RGB to YCbCrcolor model and then to grayscale we need to take following steps in MATLAB:

YCbCr = rgb2ycbcr(imageRGB);

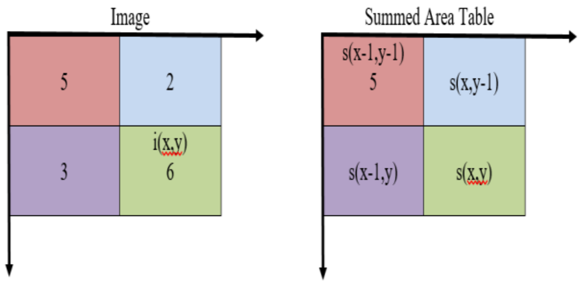
Grayscale=YCbCr2gray(imageycbcr);

III. PROPOSED WORK FOR DETECTING FACE AS ROI IN VIDEO

The existing methods do not work well with a varied range of poses, complex backgrounds, facial expressions, Existence or nonexistence of physical components, Image positioning, Imaging settings and blur noises. Sotoimprove results along with all these conditions we are using Voila Jones algorithm on video to detect skin tone. Once skin tone is detected then faces can be located inside these skin tones. These detected faces are the unique ROI. Unique ROI [1][6] is then used to secret hiding data. Hiding data in faces is more secure than hiding in any other part of video frames because human face has most of information in low frequency range thus high frequency range can be used for hiding information. So for the attacker finding secret information inside faces is very difficult.

Voila Jones is analogs to image detection in which image of person is match bit by bit [12]. It isrobust and operates in real time and it focus on four points one after another to detect face inside image. These points are Haar feature, Integral image, Adaboost and Cascading [13]. Following set of steps need to perform for calculating ROI in the form of face in video cover file using Improved Voila Jones Adaboost Cascades method:

a). Haar Feature: Some common properties like eye section are darker than upper chicks and Nose Bridge are brighter than eyes etc are carried by every human face. These features can be used for edge detection [20]. In edges detection kernel are used and based on these kernel we find



whether there is a face or not.

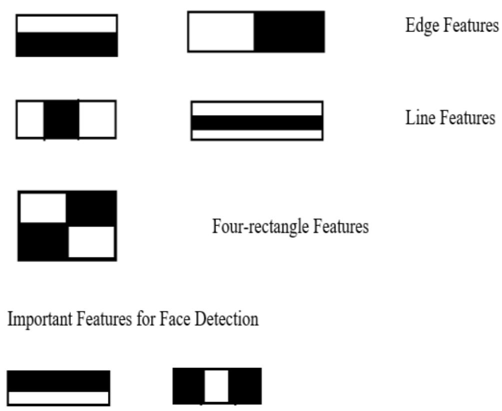


Fig.2Haar feature [13]

b). Integral image: It is sum of values to left of it plus value above it. In an image sum of any region is calculated by:

Fig.3 Integral Image [10]

I(X', Y')= S(A)+S(D)-S(B)-S(C)

Δ= Dark- White=1/n $\sum_{Dar}^{n}$

Δ: for ideal Haar feature is 1 and for real images 0.56

c). Adaboost: In an image all features are not relevant so we reduce those features that are not relevant with the help of adaboost. Adaboost is a m/c learning systemthat help us in finding the best features from existing features. For evaluating in a window whether it is face or not all the features are arranged in a linear weighted combination [3].

Collection of these features are known as classifier. A linear combination of all weak and strong classifier gives us strong classifier. For creation of strong classifier it attemptsseveral weak classifiers over a number of rounds. Then it select best weak classifier [2] in each round and compute the best strong classifier.

$$F(x) = \sum_{i}^{n} \alpha f_i(x)$$

d). Cascade: If a face is detected then there must be two eyes, one nose and one month. When 10 feature are passed through a 24*24 size window if a match is found then this process is continual many time otherwise we stop by proving that no face is found [5].

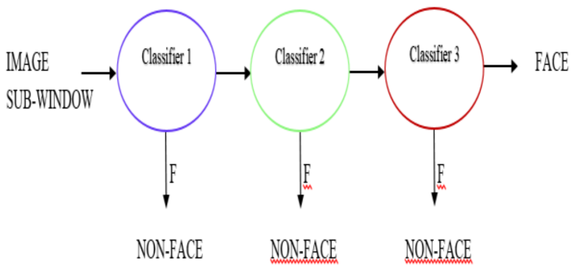


Fig.4 Cascade [20]

IV. EXPERIMENTAL RESULTS AND ANALYSIS

This Face detection algorithm is evidentlywell-known from earliermethodsby itscapability to find faces veryquickly. Working on 256 * 256 pixel frames, faces are found at 18 frames/sec on original 750 MHz Intel Pentium V. In other face findingschemes, supportingfacts, like framevariances in video arrangements, or pixel color may vary in color images, are used to accomplish high frames per second. This proposedschemeattains high frame per secondfunctioning with data present in a RGB color image. Alldifferentbases of info can be combined with proposed scheme to accomplish higher frame per second. To detect skin portion data was taken from actual human individual and produced scatter plot of human skin color in LAB color space. Thisrepresent color as 3mathematical values, L^* represent lightness and a^* and b^* represent green–red & blue–yellow color constituents. LAB remainedplanned to be perceptually constantthroughhuman color visualization, means that equal amount of numerical change in these values matches to about same amount of visually perceived modification. The LAB color model is a 3 axis color system with absolute and exact color. It is independent of device meansthrough **LAB color space** we canconnectdissimilar colors across diverse devices. With the help of spectrophotometer object color is calculated in LAB color model. After implementation it was found that white and black skin color has very low chroma or saturation values. Popular skin color changesmayrecognized to alterations in Lightness Values represents vertical position and Chroma values represents radial distance. The hue value of skin is determined by chemical composition of hemoglobin and melanin. LCH color space is converted to the LAB space in fig (5). Here the skin portions form shape of the scatterplot or banana-shaped gamut.In fig (6)same scatterplots for the skin portions are represented in 3- dimensions.

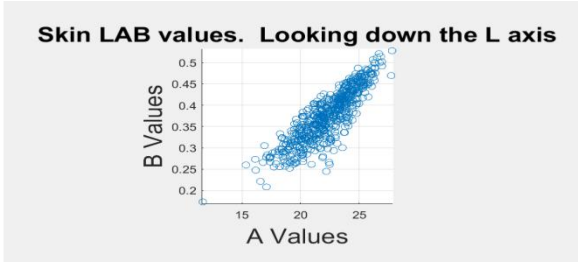


Fig.5 Detected skin portions

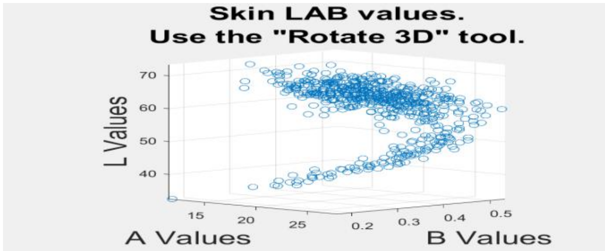


Fig.6 Detected skin portions in 3D

After detection of skin portions, these skin portions in the form of skin map are used to find the faces insidethe video. Video is played inside MATLAB in fig (7)and human face is detected in rectangular frames. Frames with images in RGB are converted to YCbCr color model in fig (8).

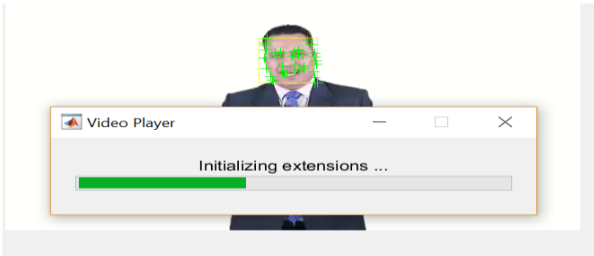


Fig.7 Detected face in video

Fig.8Detected face in YCbCr color

To represent colorful images R-G-B planes along with Bitmap images are used.From the existing research it was found that human eyes have different sensitivity and intensity for color. That why transformationfrom RGB to YCbCr model is done.

Cb component produce strong values image have sky (blue), when image color is green then Cb and Cr produceweak values, & in case of reddish color Cr is strong. Then in fig (9) YCbCr color model is converted to Grayscale images. As Grayscale images measure the intensity of light at each pixel according to a particular weighted combination of frequencies. Fig (10) and (11) represent detected face in the form of location map of image and block wise location map of image.

Fig.9 Detected face in grayscale

Fig.10 Location map of image

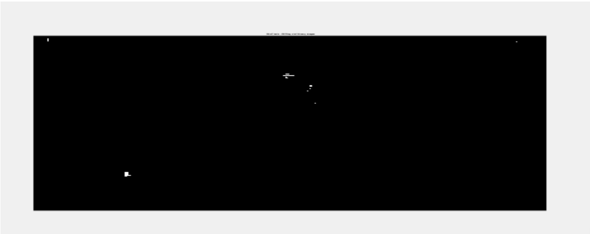


Fig.11 Block-wise Location map of image

V. CONCLUSION

With improved Voila Jones algorithm face inside video is detected with minimum computation time althoughretaining high detection accuracy. By experimental results it is found that 94.20% face is detected by the proposed algorithm. This improvisedalgorithm is almost 10 times faster than the existing approach. It work well with a variety of poses, complex backgrounds, face expressions, Existence or nonexistence of structural components, Image Positioning, Imaging settings and blur noises. This algorithm also works well with different color-based skin models. Here purpose of finding human faces is to hiding secret information because human face has most of information in low frequency range thus high frequency range can be used for hiding information.

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