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A Robust Algorithm for Face Detection on Unconstrained Background Images using Neural Network

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Abstract

Purpose: The main goal of proposed design is to use a neural network to create a robust solution for face detection on unconstrained backdrop images. In this regards the types of recognition involved in image processing discipline are pattern recognition, Face recognition, object recognition, speech recognition, and analyzing the data, etc. The basic concepts, structure and ideas involved in this recognition are discussed in this section. In the last two decades, object detection and recognition has become the most interesting and challenging research field for the researchers.

Design/Methodology/Approach: Developing a theoretical concept based on model building using the for Face recognition method and analysis. The need for Face recognition and detection arises due to demand for automatic surveillance systems, Human Computer Interface (HCI), etc. A fast processor is required in real-time implementation of implanted image processing applications. For these systems, an accurate and fast real-time implementation of face selecting is essential. Therefore, a novel approach for tracking and determining the face on a live and unmoving image is projected in this paper.

Findings/Result: Based on the developed model, the resultant efficiency of the selected algorithm can be predictable on the basis of Specificity, Accuracy & Sensitivity the result of evaluation is very high. Background, head movement, and neural network or incorrect training are some of the reasons. The efficiency of the selected algorithm can be predictable on the basis of Specificity, Accuracy & Sensitivity. The estimated values are 95.3%, 88.6% & 89.2% correspondingly.

Originality/Value: A novel approach for tracking and determining the

face on a live and unmoving image is projected in this works. This projected process is applied and efficiently tested in the laboratory for different original images with glasses and without glasses taken by camera (specification of camera is Logitech USB, 30fps, 1600 x 1200 pixels). This process is built in a processor named open multimedia applications platform of 1 GHz and by Open CV libraries the proposed algorithm is developed. The rate of success in this selected algorithm is very high as the hardware is very much accurate and works at high speed which is best used for real time. The rate of success on selected algorithms is ninety-eight percent; the two percent unsuccessful rate in results is for some reason like background, head movement & due to neural network/ inappropriate training.

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1. INTRODUCTION:

The first work on this subject started in 1950's in psychology Bruner et al. (1954)1. The research came out with issues like expression, emotion analysis and gestures. The actual research on face recognition started in the 1960's. Woodrow W. Bledsoe along with other researchers did majority of work related to AI-related for different intelligence agencies23 .During 1964-65 Bledsoe continued his work end to end with Helen Chan & Charles Bisson by using computers to identify the face of humans . Later Bledsoe planned and applied a semi-automatic system. Bledsoe discussed a few challenges faced by face recognition systems, after 50 years the problems still continue- variations in illuminations, ageing, head rotation, face expression 4. In 1970, few researchers defined geometric parameters which perform pattern recognition. In 1973, Kenade established an automatic face identification system which was demonstrated on a computer and he observed a 45-75% correct identification rate 56. In 1980's researchers came out with new approaches to improve face recognition systems such as Template matching with "deformable templates" and ANN 7. The year 1990 saw a broad face recognition approach using eigenfaces, ICA, PCA, LDA & their derivatives. Face detection is a process of extracting faces positively from the input image scenes or video stream 89. Feature extraction such as face regions, variations, angles; eye spacing is done in the next step. The last step performs face recognition by comparing it

with an image database10.

The challenges faced by most face recognition system are:

A.Pose Variation: Frontal images would be a condition for a face recognition system but this is an uncontrolled condition. Pose variation is one of the major research issues and this drops the performance of face detection systems. Pose variation depends on the image acquisition system and position which changes spatial coordinates in an acquired image leading to distortion. This variation affects traditional appearance-based face recognition methods like Eigen faces and fisher faces 111213.

B.Face Occlusion: The presence of spectacles, beards or hats may cause problems in face detection. This is another main problem in face detection and identification systems141516.

C.Facial Expression: Facial features vary due to facial gestures and become difficult in identification. Facial expressions represent feelings, tempers and emotions of human beings. The variation in expression results in a change in spatial coordinates but also changes the shape of the face 17.

D.Illumination: Imaging systems and environmental variations affects the image quality. The illumination changes are being discussed in some face detection and identification systems. This variation is caused by different lighting conditions 1819.

E.Clusttering: The above four parameters make changes in original image facial appearances; hence it is necessary to consider the presence of all conditions and backgrounds around a person in acquired images. Avoiding these parameters affects face detection algorithms and reduces performance. Yan, Kriegman and Ahuja divided face recognition techniques into four categories which may overlap, developing another algorithm which may consist of two or more categories 2021.

The four categories are:

i. Knowledge dependent Process: Identify faces based on information about humanoid faces.

ii. Invariant Feature Methods: Methods developed under this category recognize faces based on invariant features.

iii. Template Matching Methods: These methods try to correlate original images with database pattern images.

iv. Appearance Based Methods: This recognizes faces based on a set of training pictures.

F.Knowledge Depending Process: These use some knowledge about faces like ellipse shape

and triangle features. Other set of rules which can be used, face usually has two symmetric eyes and eyes are darker than cheeks222324. It measures the distance between eyes or intensity between eye areas. Knowledge-based methods can reduce the computation cost but they are rotation limited. If rules set are too universal, there could be more false rejections. The solution to overcome this problem is to develop hierarchical knowledge-based techniques. But these methods are limited and unable to find faces in complex images252627.

G.Feature-Invariant Methods: This makes use of features like edge, complexion, texture and shape for face detection. These methods are rotation independent, scale independent and fast. The method which is scale independent, rotation independent can reduce computational cost. Building Face identification systems depends on skin complexion as a feature, the researcher has three major issues as, which complexion space to choose, modelling of skin complexion distribution and way to process skin complexion282930.

In image/vision processing, complexion is used as a powerful tool to identify objects or features such as computer graphics, Colorimetry & video signal communication standards have given many complexion spaces with dissimilar properties [31] [32].

a. RGB: This cloudscape originated from CRT, it is defined as a mixture of Greenish colour, Reddishcolour, and Bluecolour. This complexion space is the veryextensively used information for saving image data. Combining luminance &chrominance with RGB is unfavorable choice for complexion space 33.

b. Normalized RGB: This is obtained from RGB by normalizing, r=R/(R+G+B), g=G/(R+G+B), b=B/(R+G+B). The ‘b’ component has no significance, hence neglected. The remaining two components are called pure complexion, and normalized RGB does not vary due to light source. This property made this complexion space gain popularity among the researchers 3334

c. HSV, HSL- Hue, HSI, Saturation Value (Lightness, Intensity): Dominant complexion like red, purple, yellow is represented as Hue. Complexion brightness is measured using Saturation. Intensity, Lightness and Value are related to luminance 35.

d. TSL- Tint(T), Saturation(S), and Lightness(L): This complexion space is a transformation of normalized RGB, close to hue and saturation. Normalization of TSL within RGB is the advantage of TSL complexion space transform. Normalized values of r and g for TSL space are more effective during skin segmentation approach. This normalization reduces variability of skin complexion sensitivity and improves skin complexion detection rate. TSL complexion

space is more efficient and robust after normalization. No complexion correction algorithms are existing for image acquisition devices. Despite all these efforts, detection of dark skin complexion is an open challenge to researchers 36.

e. YCbCr: This complexion space is nonlinear encoded RGB, mostly used in European television for compressing images without loss of information. It is constructed by weighted sum RGB, Cr, and Cb and complexion is represented as luminance. Cr is luminance difference red and Cb is luminance difference blue components. The luminance separation and components property of chrominance makes this color space beautiful for skin color modeling. In the year 1990, RGB colour space with Bayes SPM achieved a TPR of 80% and FPR of 8.4% Mason made use of three different colour spaces: RGB with Bayes Skin Probability Map (SPM) classifier, YIQ with I-axis threshold classifier & RGB with threshold ratios classifier 37. The TPR of these three methods are 19.8%, 30.2% & 32.3% respectively. In 2000, another researcher used HSV color space with Max. Likelihood estimation which worked on different skin types, an attractive study on skin color spreading under different conditions of lighting was proposed which showed 125 individuals to lie inside a definite color space locus, writers used scatter matrices of non-skin & skin clusters 38. The conclusions drawn were, separating skin and non-skin in RGB space &falling luminance will worsen the separation. In 2005, authors used five color space models with different classifiers, but failed to achieve TPR more than 90%. In 2009, authors used YCgCb + YCgCr with thresholding as classifier, and achieved 92.1% TPR with 6% of FPR. In 2010, YCbCr with 2D Gaussian Model and Bayesian Network (BN) achieved 96% of TPR with 15% of FPR. With the Literature Survey on Face detection using Skin Segmentation, it is concluded that a good classifier must distinguish between skin and non-skin pixels of several persons having different skin hues like white, wheat, black & brown.

To expand the accuracy of the classifier, it is better to take into consideration other features such as motion, shape & size. If skin detection is a pre-processing step in any application, the authors concluded that it yields better results with 1D RGB color space. Other authors concluded that results can be improved using Hybrid color space i.e., combination of different color space such as HSV+YCbCr, HSV+rgb, HSV+TSL+rgb . Meeting real-time application requirements such as computational and storage are extremely important 3940.

Template Matching Methods: Template matching is one of the widest used methods for face identification because they are strong to noise, easy to use & take less time. In this method,

the forward face images are already defined and kept in the system database. An Image processing algorithm is developed where correlation between input and stored image is performed to detect the face. But face detection algorithms suffer from illumination and variation of face feature shapes. One simple method to resolve this problem is to receive the usual face from the face examples & then keep them in the database, then the input picture with high association score is the position of face. This process is known as the filter match process. Filter match process accepts Additive White Gaussian Noise (AWGN), which is not good for image like variation, illumination and expression. AWGN is noise added to images to investigate the performance of the proposed system.To reduce this high variation Appearance based methods have been used by various authors. The association between input image and face template is similar to Normalized Cross Correlation (NCC). But NCC is exaggerated by clutter background and illumination. This problematic situation can be resolved using Sum of Absolute Differences (SAD), but it is mostly cast-off for compression and tracking the object, hence SAD needs optimization. In 2012, authors proposed face detection using Optimized SAD (OSAD) instead of NCC to reduce illumination effect. The results showed that OSAD are unaffected by variation of pose but affected through clutter as objects exist in it.

2. RELATED WORKS:

The initial work was carried out by bruner, J. (1954) had examined the perception of people for Image detection. The literature of hand book of social psychology was useful context in terms of understanding the human psychology 1. One of the methods in facial recognition, panoramic research had solved Bledsoe et al. (1964) which had considered being accurate model2. In Chan et al. (1965) had proposed a new man-machine image identification system and got some of the preliminary results with compromising high accuracy3. Same researcher designed machine recognition by Bledsoe (1965) to get fast abd accurate model for face reorganization 4. Semi-automatic facial recognition for human has been done by Bledsoe (1968) 5. Kanade et al. (1974) explored a new picture for processing system using best model and recognition of human faces with less processing time6.Nixon et al. (1985) experienced about eye lead recognition in applications of digital image processing in international society for optics and photonics lab India 7.Stonham et al.(1986) explained solved the face recognition with large database and verification must be done with WISARD

in aspects of face processing in human 8.In application and characterization of human faces has done by Kirby et al. (1990) 9. The modern development of human factors guidelines and commercial vehicle operations. In Yuille et al. (1992) Feature extraction from faces using deformable templates Lee et al.(1997) 1011.Different types of weariness were investigated by Saito et al. (1992) in a quantitative measurement of eye movements in image detection 12. The efficacy of pupil area identification approach employing two light sources and image difference method was investigated by Ebisawa et al. (1993)13. Calcagnini and colleagues (1994, November). Heart rate variability signal spectral analysis during sleep stages. In Proceedings of the IEEE Engineering in Medicine and Biology Society's 16th Annual International Conference (Vol. 2, pp. 1252-1253) IEEE14. (Biological psychology. Klein et al.) Macmillan 15. Pentland and colleagues (Pentland et al) (1994). Face recognition with view-based and modular eigenspaces16. Vanoli and colleagues (Vanoli et al) (1995). Heart rate variability during different stages of sleep17: a comparison of healthy people and people who have had a heart attack. Wylie and his colleagues (1996). Technical summary of the commercial motor vehicle driver tiredness and alertness research 18.In Pigeon et al. (1997, March).have designed the M2VTS multimodal face192021 .Deng et al. (1997) have the region-based template deformation and masking for eye-feature extraction and description [22][23] [24][25]. In Huang et al. (1998) postheddiscrimination and eye detection using Support Vector Machines (SVM) 262728. Elsenbruch, et al. (1999). Heart rate variability during waking and sleep in healthy males and females 29. Jones et al.(2002)have statistical color models with application to skin detection 30.Meng, et al.((1999) have frontal face localization using linear discriminant 31.In Peters, R. D eulation (1999). Effects of partial and total sleep deprivation on driving performance (No. FHWA-RD-94-046) 32Turner-Fairbank Highway Research Center.Yang et al. (1998, December). Gaussian mixture model for human skin color and its applications in image and video databases**33**3435. Jain et al. (2000). Statistical pattern recognition 3637In Tian, (2000, March). Dual-state parametric eye tracking 38. Feng, et al.(2001). Multi-cues eye detection on gray intensity image 394041. InMartinkaupp et al. (2001). Basis functions of the color signals of skin under different illuminants 42. Ji et al. (2001, July). Real time visual cues extraction for monitoring driver vigilance 4344.Vijayalaxmi et al.. (2020). Image processing-based eye detection methods a theoretical review 45. Vijayalakshmi et al. (2020). Implementation of face and eye detection on DM6437 board using simulink model46. InBiradar, et al. (2018) have hardware

prototyping for video and signal processing applications using dm 6437 texas instrument evaluation board 47.Biradar, et al.(2018) have DM3730 Processor Hardware Debugging on Linux Platform4849.Chaudhry et al. (2017) have face detection and recognition in an unconstrained environment for mobile visual assistive system5050.In Ganapathi, et al.(2020) have unconstrained ear detection using ensemble-based convolutional neural network model 5253.Zhou et al. (2018). have survey of face detection on low-quality images. Sahu et al. (2018) have modeling of attacks in sigma delta adc for hardware security 54.Zhang et al. (2019) have face boxes: A CPU real-time and accurate unconstrained face detector 55.Yang et al. (2017) have faceness-net: Face detection through deep facial part responses 56.Ravidas et al. (2019) have deep learning for pose-invariant face detection in unconstrained environment 57. Lu et al. (2017) have feature extraction and fusion using deep convolutional neural networks for face detection 58.Sawat et al. (2020) have pixel encoding for unconstrained face detection 59.Kneis, et al. (2018) explored face detection for crowd analysis using deep convolutional neural networks 60. Oloyede et al. (2018) discussed Improving face recognition systems using a new image enhancement technique, hybrid features and the convolutional neural network 61.Bekhet, et al.(2022 have gender recognition from unconstrained selfie images: a convolutional neural network approach62. Ranjan, et al. (2019) designed fast and accurate system for face detection, identification, and verification 63. Salman et al. (2020) have automatic fish detection in underwater videos by a deep neural network-based hybrid motion learning system 64. Methods Based on Appearance: These templates are learned from images examples. These procedures depend on statistics and machine learning face characteristics. In 1986 & 1990, face recognition systems were developed efficiently using PCA where the face is represented as a vector coordinate system. These vectors are known as eigenvectors (Kirby,M., and Sirovich,L.,1990). In 1997, few researchers developed a neural network-based face recognition system. The detection system consisted of 2 classes, non-face and face class. The real challenge in neural network-based approaches is training and representing images not containing faces. Support Vector Machines (SVMs) are used to increase the margin between decision and training hyper planes because they are considered as linear classifiers (Pigeon, S., and Vandendrope, L., 1997)[65]. Recognizing human faces under different conditions like 5year old boy, grandma's wedding photo, face occluded, and a person with a beard are trivial but not impossible. So, they are a challenge to computers. The core problem in the recognition stage is feature selection. This feature selection process is

described as methods of removing applicable information from the original image. This data is given as input to the next step with minimum error. While developing a classifier, care should be taken such that the FPR of the classifier should not increase. The TPR and FPR basically depend on training samples, if the training samples are relatively smaller in number when compared to features then a problem called “peaking phenomenon” occurs which can be avoided by considering training samples ten times per class of number of features. As the classifier complexity increases, a large amount of training examples is required. The correctness of the classifier depends on the number of features selected while training the classifier.

2.1 RESEARCH GAPS :

(1) Designing of fast and accurate system for face detection were challenges using existing methods.
(2) The real challenge in neural network-based approaches is training and representing images not containing faces.
(3) Recognizing human faces under different conditions like 5year old boy, grandma’s wedding photo, face occluded, and a person with a beard are trivial but not impossible.
(4) As the classifier complexity increases, a large amount of training examples is required.
(5) The correctness of the classifier depends on the number of features selected while training the classifier.
(6) A CPU real-time and accurate unconstrained face detector is still need be in investigation and design implements.

3. OBJECTIVES AND RESEARCH AGENDA:

The following are the goals of the planned work:
(1)Feeds the seven general face expressions into the neural network that was built to train the identifier.
(2)To demonstrate the suggested method's high efficiency and feasibility in dealing with multi-scale face detection difficulties.
(3) To introduce a technique that employed by different studies like matching the template, Hough Transform and Eigenvectors. HSV for eliminating all unnecessary pixels in the picture

excluding Face & Neural Network categorize the picture as Face / non-Face.

4. PROPOSED ALGORITHM:

The algorithm that was chosen consists of two steps. The first stage is training, and the second stage is detection. The stage is broken into two parts: a neural network and preprocessing processes using a Gabor filter. Otherwise, training involves manual segmentation of the interest region and color model selection of the most essential features. In the initial stage the automatic removal of eyes region by color model and eye candidate's separation is performed by morphological operation.Block diagram of database imageshown in Figure 1 [Author as source]

A. Database:

Some databases are used in both stages such as GATV, VITS, Face expression and Math Works. This stage is performed by different conditions like hair style, various facial expressions, condition of illumination etc. This preformation happens by including up to five hundred gray scale images and five hundred color images of dissimilar size. This work used thousands of images for training purposes and approximately thousand numbers of images for the purpose of testing. Mendeley Desktop, the original reference manager based on the Qt framework that runs on Microsoft Windows, macOS, and Linux is used as source engine to build references.

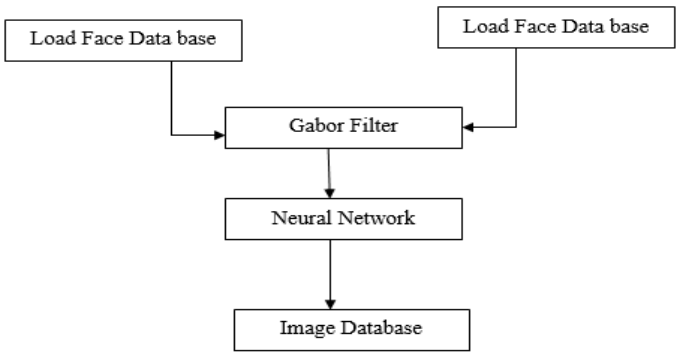

Fig.1: Block Diagram of Database Image

5. TRAINING METHODOLOGY:

For training the neural network a huge number of no face and face images are required in the first step. Approximately two hundred faces are cropped from several pictures and gathered. That image contains different sizes of face, position, orientation, with glass, with occlusion etc. These pictures were used to control every face at the similar scale, same position, same alignment etc. The stages are given below:

1. Reset FF which is a vector and will be the normal position of every feature labeled for entire faces with location of feature in the 1st face.

2. These features synchronize in FF by rotation, translation and scaling. For this step the face location averagely appears at a determined location with a 32 x 20-pixel window. In this stage, 40 face specimens are generated from an image by circulating the image at their center up to hundred scaling in between 90% - 100%, interpreting up to ½ pixel and reflecting for training. Normally, all images can work as a non-eye specimen because the non-eye image space is ample larger than the eye image space. Though, representative collection for non-eye computer sets and information technology is very problematic. Instead of image collection before the training starts, the image can be collected in training period by following manner, taken from [13].

a. By producing fifty random images, make a preliminary group of non-face images. After that apply the above steps in all of these images.

b. Train the neural network for producing the input of 1 (for face image) and 0 (for non-face image).

c. Run the system on the set of images that consist of no face. Gather the sub images in which the network improperly specifies the face (the activation output > 0).

d. For example, select approximately 40 numbers of sub images randomly, put on the previous steps and add all selected faces into the set of training. For the second step, some non-face examples are collected in the time of training as shown in figure 2. It should be reserved in mind that the face which is not very close is the positive example which is shown in figure 3. This example gives a lesson in precisely the boundary between non-face image and face images. Here we used two hundred sets of images for gathering the negative examples as per the above description. For training neural networks, the non-face and face images are used which is shown in the following figure 2 **[source as Author]**..

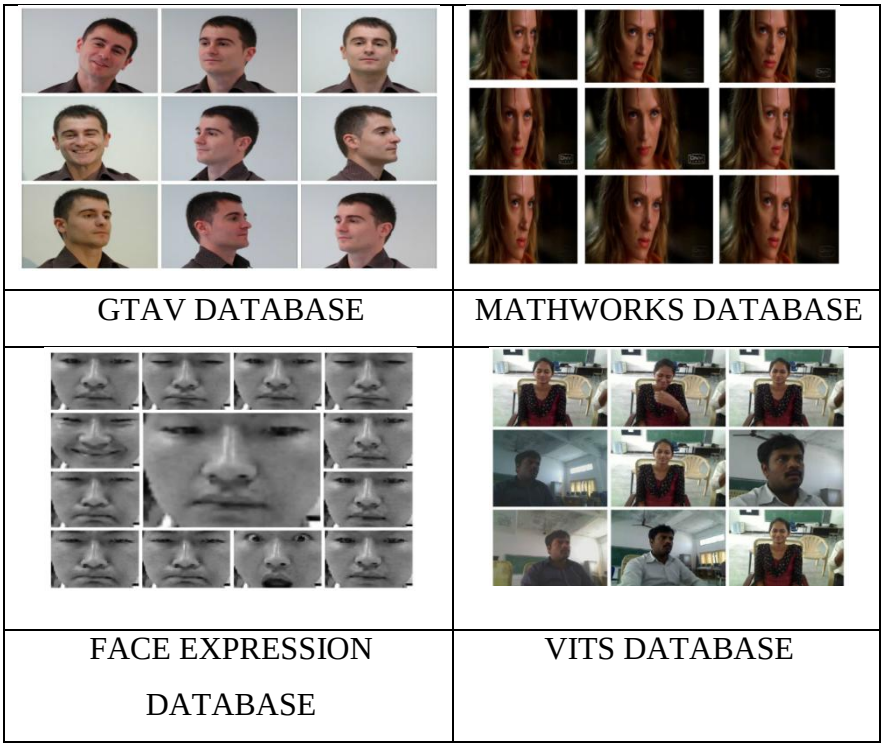

Fig.2: Examples of eye shapes from the test & training sets.

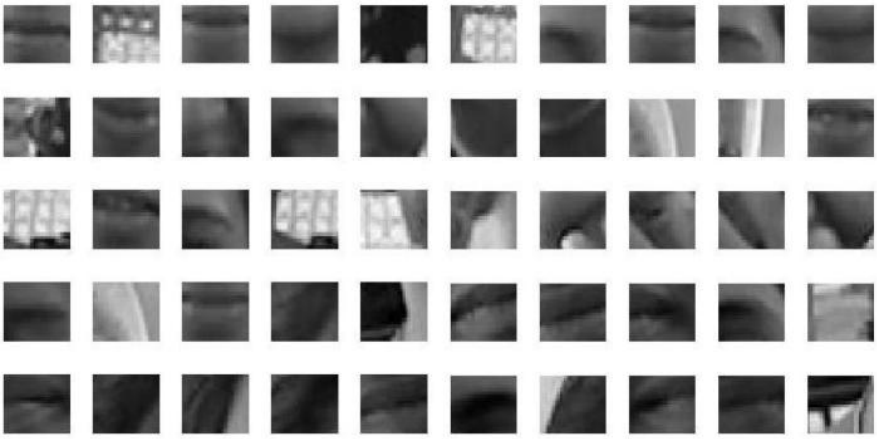

Fig.3: Examples of non-face shapes from the test and training sets.

A. **Gabor filters**:

Daugman gives a proposal on a two-dimensional Gabor function to structure the properties of spatial summation (of accessible field) for modest cells in the graphic cortex. They are largely used in computer vision, image dispensation, psychophysics and neuroscience. Functions visualization of Gabor use Gabor filter for some purposes like removal of texture feature by detection of edge, by simulate complex and simple cell (visual cortex), by simulation of non-

classical open field inhibition / edge suppression & use this for detection of object outline, describe certain effects (visual perception). The image examples are applied in following Gabor function which is two-dimensional:

$$g_{\lambda,\theta,\sigma,\gamma}(x,y)=\exp\left(-\frac{x'+\gamma^2 y'}{2\sigma^2}\right)\cos\left(2\pi\frac{x'}{\lambda}+\varphi\right) \quad (1)$$

$$x' = x\cos\theta + y\sin\theta$$
$$y' = -x\sin\theta + y\cos\theta$$

The definite value parameters of Gabor function are orientation, wavelength, aspect ratio, bandwidth and phase offset. These functions are estimated and showed as image map intensity in the production window. Light grey colors represent positive function value and dark grey color represents negative function value. The output image and input image size are the same. By altering various parameters, the set of training data produced by Gabor Filter Kernel such as orientation, wavelength, angle of rotation etc. which are shown below in the following figure 4**[source as Author]**.

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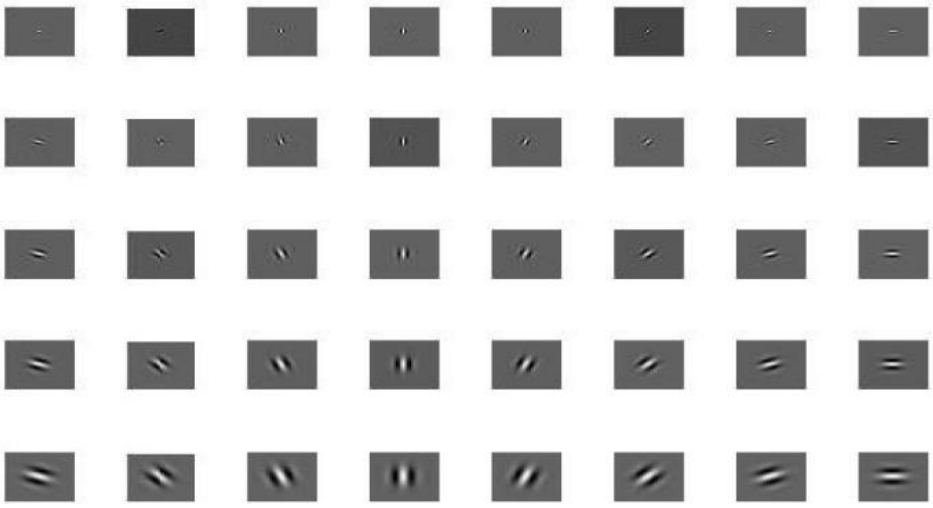

Fig.4: Gabor Filter Kernel by various alignment, angle and wavelength

B**. Neural network:**

The networks will collect 960 actual values in a 960-pixel image as an input (size of image approximately= 32 x 20). Then it is essential to detect the face by replying by an output vector [25]. The output of the vector represents a non-face and face. For correct operation the

network should give 1 if the face is present and otherwise the network should give 0 in [25]. Additionally, the network must be able to manage the non-face image. Practically the network will not detect the faultless image of the eye which is denoted by input vector.

C. **Neural network Architecture:**

To identify the eyes, the neural network required 960 output & input layers to point out the eyes. This network is like a 2-layer log-sigmoid network. The log-sigmoid transfer function had been taken as the range of output is 0 to 1 which is an exact range for study of Boolean standards output [25]. The secret layer has two hundred neurons [25]. These numbers were collected through experience and guesswork. If this network feels distress in education then neurons may be an addition in this layer. These networks are skilled on the basis of 1 as output & 0 like non-eye recognition. Through, the non-eye images may give a network which does not create one and zero perfectly. After making the network skilled, the output will be sent by the modest transfer function shown in figure 5**[source as internet]**.

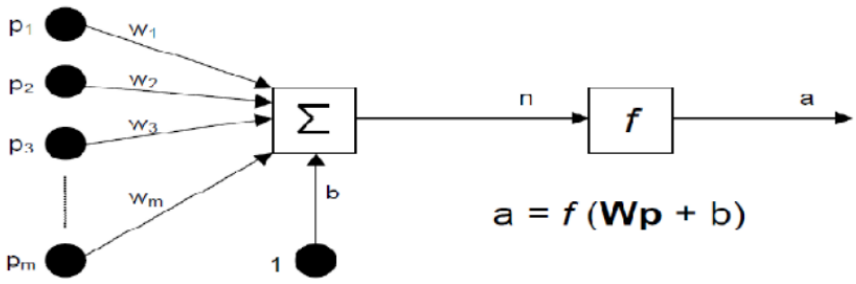

Fig.5: Architecture of Neural Network

6. TESTING METHODOLOGY:

At the time of testing, the neural network reliability is estimated by network testing by a hundred numbers of images (input) of several circumstances. In this work, an algorithm is produced for separating eyes from the images (input) which are given. The selected algorithm is shown in the following figure. By extracting the skin region, the algorithm works with face removal by l transforming color space structure. The face is sensed by removing unnecessary space using color space (HSV) and to remove extra areas Morphological operation is used. The selected algorithm is given below figure 6[source as author].

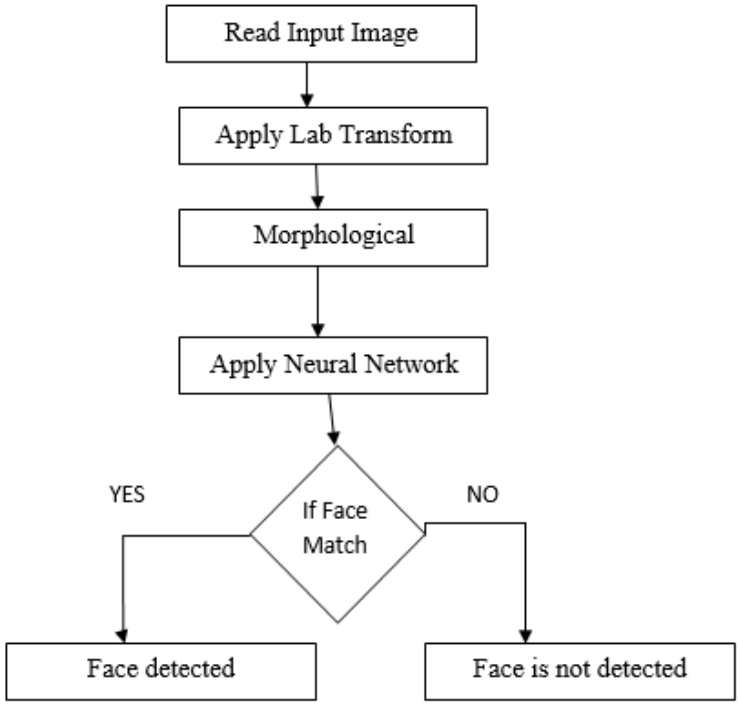

Fig.6: Selected Algorithm

The 1st step is detecting the face separating the human face from the sequence of images. Simple search procedure in video will not assist to select the face in between the additional organizational face components like moustache, beard etc. Those problems become complicated by live images like video, as the available time for searching in every image is limited. An effective face selection feature is human skin color.

Many different color places have been used to pixels stage as skin with RGB, regularized RGB, HSV [18], [24], [20], [19], YIQ, XYZ, &YCbCr [21]. The proposed method in this paper includes skin recognition to remove the background of component tracked through detection of eye.

Skin area removal assist in estimating the estimated location of the eye by removing a huge number of wrong eye candidates. Additional expansion was made on the algorithm which is based on skin color. For color description, RGB color space is an efficient algorithm and it is used in a terrible way. Therefore, every coordinate such as green, red & blue which does not give necessary related data about whether a specific picture has skin or not as that image has luminance effects from image intensity. To improve the color representation, Lab color model

is used. It has three-dimensional color space and in which color alterations are perceived to be similarly large and also have the same distance between them. For face segmentation, a lab color model is applied. In the selected algorithm, the model of lab colour is useful subsequently for applying the color space of HSV and for getting the actual region of the eye. The HSV gives information about colors which is similar to humans thought of color. The descriptions of general pure color given by "Hue", the manner of diluted pure color is described by 'saturation" and the achromatic motion of intensity is provided by 'Value". As defined in the research paper, the 1stconstraints S and H will give cultivated data related to skin.

As stated, [29] the cost of H shall be in between0.01 & 0.1 i.e 0.01 less than H less than 0.1 → skin

It has been noticed that this do not eliminate entire skin from the picture but the minor image portion stay in it. As this is a Morphological operation, it is considered as a benefit. These remaining skin areas can be efficiently eliminated by this Morphological Operation. Lastly, the eyes are separated from the removed face image by HSV structure& Morphological operations which is shown in the following figure. The extracted features of the above algorithm are given in to sorting by the skilled SVM. After the execution step, the consequences are estimated by some measurement like specificity, accuracy and sensitivity. Specificities are denoted, TN stands for true-negative, FP stands for false-positive, FN stands for false-negative and TP stands for true-positive.

7. RESULT &DISCUSSIONS:

The selected algorithm is applied on some databases like GATV, VITS, MATHWORK and FACE EXPRESSION. That algorithm is applied on more than 500 images in the automatic extraction stage on the face region. In figure 6 a successfully detected face image is shown. Also, in figure 7 a detected failed image is shown[source as author]. It has been observed that maximum errors arise due to the face position, especially when the image of face is moving aside, distance of face and eye closer. The maximum efficiency of the selected algorithm is estimated on 500 pictures on which the detected region of eyes flourished. The result of evaluation is very high like sensitivity is 88.7%, specificity is 95.3% & accuracy is 89.3%. Figure 7 shows the picture of the non-face region. It is concluded that the error arise if the region of eyes were dark, similarities with eyebrows and background region & hair.

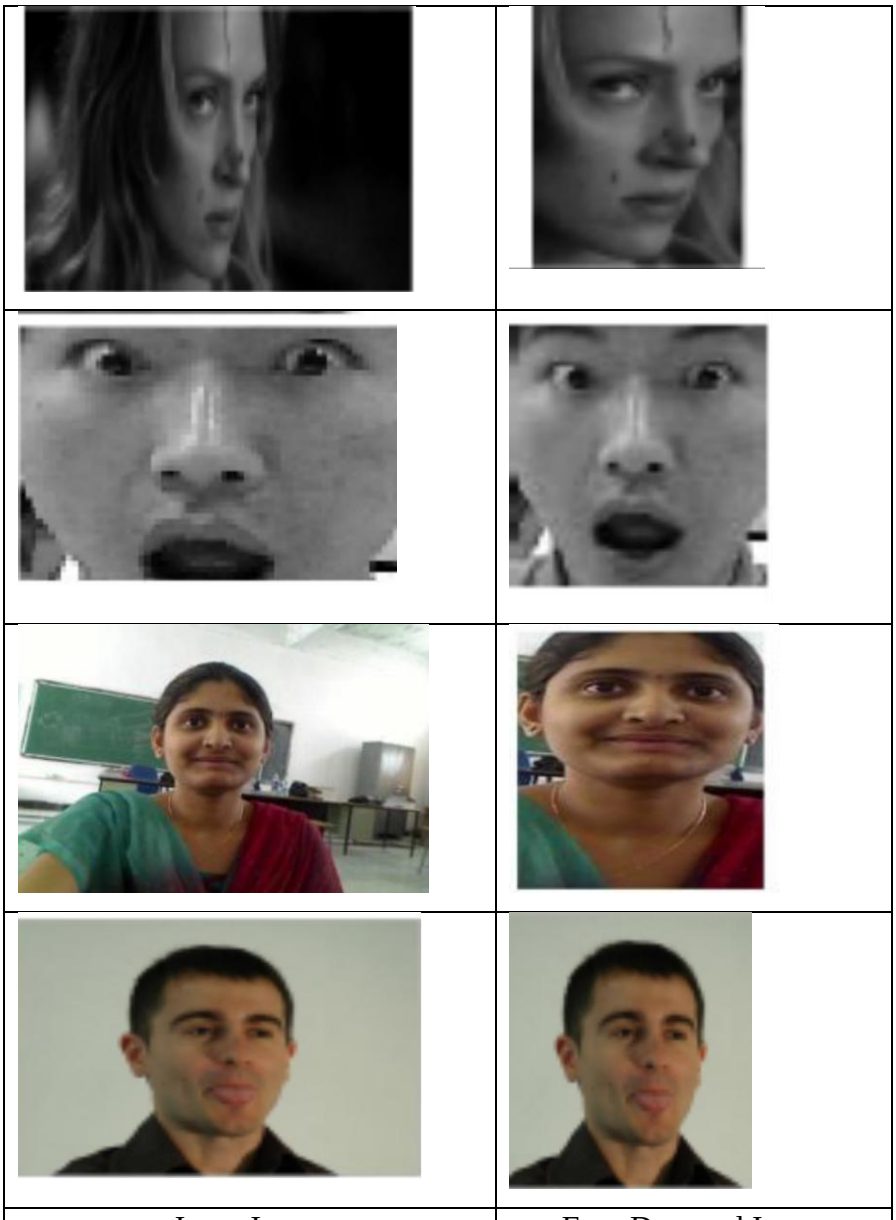

Fig.7 (a): Showing successful detection of Face; **(b):** Failure images

8. CONCLUSIONS:

Face detection nowadays has become a very essential issue for various applications. In this process, the face should be separated after removing unnecessary portions such as skin, background, & other human parts of the selected image. Many techniques are employed by different studies like matching the template, Hough Transform and Eigenvectors. Here a proposal has given some different process which includes Lab color spaces as well as HSV for eliminating all unnecessary pixels in the picture excluding Face & Neural Network categorize the picture as Face / non-Face. These experiments were performed by 100 pictures of various head persons, taken from the available standard databases & VITS database made in the time of the research work. The rate of success on selected algorithms is ninety-eight percent, the two percent unsuccessful rate in results is for some reason like background, head movement & due to neural network/ inappropriate training. The efficiency of the selected algorithm can be predictable on the basis of Specificity, Accuracy & Sensitivity. The estimated values are 95.2%, 88.6% & 89.2% correspondingly. For up gradation, the authors remain the work on the subject.

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