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# Side-View Facial Recognition: Major Issue in Face Recognition

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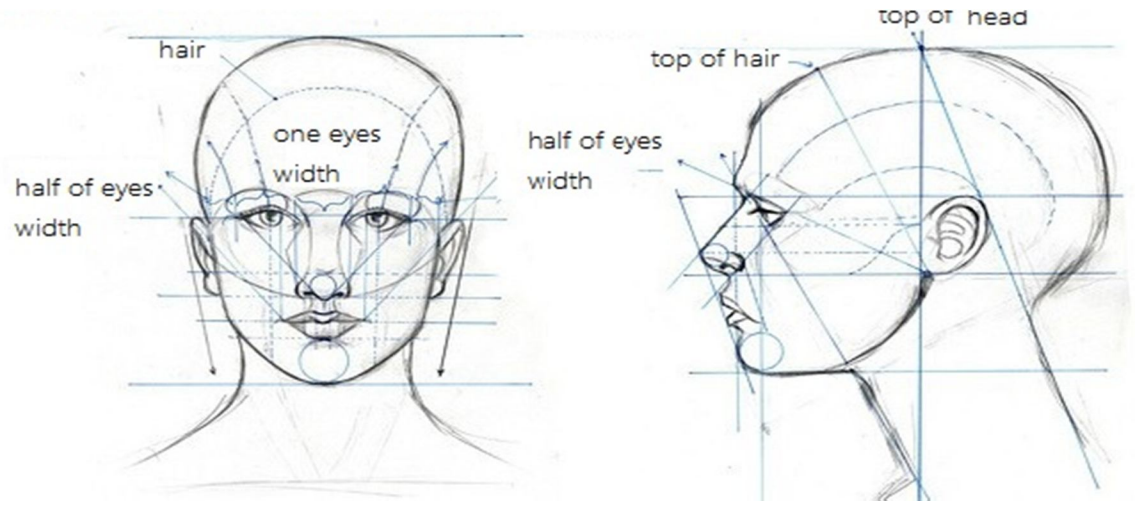
***Abstract:*** ***A facial recognition system is used to identify or verify a person from an image or video frames from any video source. It can be done by comparing the various facial features that are selected from the images in facial database. It is also used in security and vigilance systems and can also be utilized to other biometrics such as fingerprint or eyes recognition system***
***In this paper we focus on issues and solutions for SIDE_VIEW facial recognition system. We also favor facial recognition system by giving its effectiveness and weaknesses. This paper will definitely enhance the scope of facial recognition system in India.***
***Keywords: Facial Recognition, Sideview facial recognition, side-view, Artificial Intelligence Machine Learning, Image Processing***




## I. INTRODUCTION

The concept of Automated Facial Recognition system was introduced by Woody Bledsoe, Helen Chan Wolf and Charles Bisson
In 1964, Woody, Chan Wolf & Charles, worked on recognition of human faces using computer.
But their concept and working were not allowed to get publicity because their working was funded by an un-named Intelligence agency. So only little documentation were published.
Problem occurs in facial recognition is only by the following factors:

*A.* Variability in head Rotation
*B.* Tilted Head
*C.* Lightening Intensity or luminance
*D.* Angle of face
*E.* Facial Expression
*F.* Ageing etc. that are mentioned by Bledsoe (1966a).

When an unprocessed set of images or can be said as Optical Data, that is passed in the method of Correlation, is certain to fail in such cases where the changes in above mentioned feature is high.
Particularly, the correlation may very low between two images of same person with two different rotations of head.

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While image Processing for Facial Recognition, coordinate sets of various features are calculated in photographs
To use it further by computer for Recognition. Using various tools (RAND TABLET's or GRAFACON), operator calculates the coordinates of the facial features such as location of eyes, ears, noes and also the detailed view such as the center of the pupil and the distance from center to iris, inside & outside corners of eyes, a list of various distances such as pupil to pupil, width of eyes, and width of mouth.
By measuring these distances, operator can process around forty photographs in an hour and using this analysis, a large dataset is created that is further used during recognition phase. In this phase, the set of distance of the input image was compared with each of the preset photographs database. The closest similar records are returned.
This methodology is an extra-simplification that generally fails because it's possible that any of two pictures can be matched in head rotation, lean, tilt, and distance from the camera(scale).
Hence each distance set that is created earlier, is normalized to view the face in front orientation.
Around 1997, a software was created by Christoph von der Malzberg and the students of University of Bochum, Germany and outperformed collaboration with the University of Maryland & MIT. United States Army Research Laboratory have funded this Bochum System.
Also, when it comes to the side wise face recognition, the recognition is still very tough task to recreate the 3D Geometry of the head. Side face include various contradicting features such as luminance, inclination, scale etc. Many of the time while creating the dataset for Side wise faces, two or more than two faces have same value of luminance in grayscale proportion, which creates a confusion in identifying the real one that is feeded as an input image.

## II. FACIAL RECOGNITION

Every face has various distinguishable features and landmarks, the different crests and troughs that are considered as facial features. FaceIt defines these characteristics as nodal points. Every human face has approximately 80 nodal points. Some of these measured by various software's are:

*A.* Distance between eye
*B.* Nose Width
*C.* Depth of eye sockets
*D.* Shape of cheek-bones
*E.* Length of the jaw line

These nodal points are measured by creating a numerical code, that are named as **face print** and these face prints represents the faces in dataset.
Earlier, the facial recognition software was based on a 2-dimensional image to compare or identify another 2-dimensional image from the database. To be more effective and accurate, the image captured, must be of a face, looking directly at the camera, with little luminance or variance of light or facial expression from the image in the database which creates a few problem. Most of the time, images were not taken in a controlled environment. Even the smallest changes in light or orientation could reduce the accuracy of the system, so they couldn't be matched to any of the face in database, which leads to a high rate of failure of the system.
Facial recognition is basically a biometric software that creates the mapping of an individual's facial features mathematically and stores the data as faceprint. The system uses various deep learning algorithms to compare a live captured or digital image to the stored face print in dataset to verify an individual's identity.
High-quality cameras in smartphones have made facial recognition an enriched option for authentication as well as identification. The mobile phone software's, which are designed and enhanced with 3-D modeling to avoid being fooled by photos or masks, captures and compares around 30,000 variables.

## III. SIDE_VIEW FACIAL RECOGNITION

Side face Recognition is definitely a tough task in todays world especially when we talk about real time scenarios. It's a challenging task to recognize a face in unconditional environment such as expressions, face variations and occlusion and also high luminance. Many applications including Vigilance system, smart homes, or any application that deals with identification of people from videos use face recognition as primary biometrics.
Faces from frontal view, are not so complicated as compared to side-view face recognition.

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Area for implementing the face recognition techniques are like home safety applications. Due to busy schedule, parents, overlooked risks or external threats, many people suffer from accidents and injuries that happens in home. It is possible to prevent such accidents by enhancing the situational awareness, and face recognition is the methods that can be used for this purpose.
In this, we follow the similar structure and classify the available techniques into two categories: feature-based techniques and image-based techniques. In feature-based techniques, pose-variation is managed on the basis of feature, where may be the selected features to pose variations or for registration the features are transformed accordingly. In image-based techniques, the images are warped or synthesized using 2D or 3D-equipped systems to synchronize with variant poses.

Fig 1

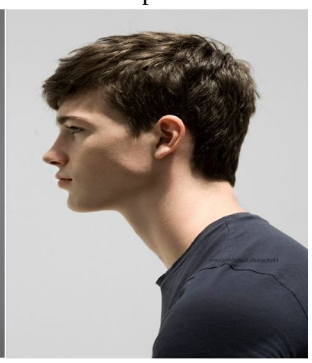
Fig 2

When the dataset of the face is created for the Side-view facial recognition, it is a complicated task because when we talk about frontal facial view, it only includes to capture the semantic features or attributes that are required to detect a Human face such as eyes, nose, ears etc.
The calculations and numerical approaches seem not much complicated because it needs to calculate the stuffs such as Eye-to-eye distance, eye-to-nose cross-section angle, eye-to-lips or eye-to-chin etc.
But when it comes to Side-view, there is nothing like that much simple to calculate, on the basis of which we can train the neural networks.

## IV. RESOLVING PROBLEM OF SIDE-VIEW FACIAL RECOGNITION

Side-View Facial recognition methods can be categorized into two major ways:

*A. Appearance-Based Methods*
*B. Synthesis Face Creation Method*

Here, In Appearance based methods, Pixel elements are used to extract the edge value of a face picture.
Whereas Synthesis face creation methods focuses on face creation from multiple sights and angles and further that developed face from both the above methods, is used to match during Facial recognition.

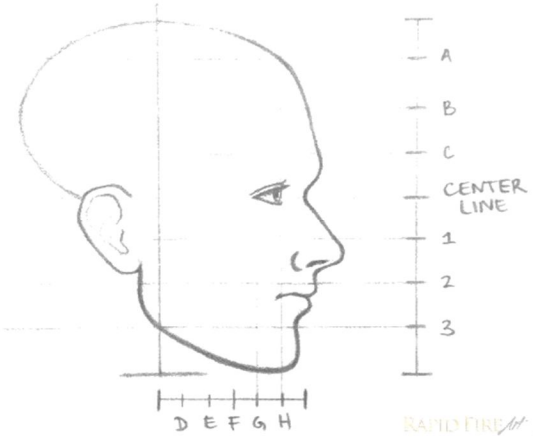

Fig 3

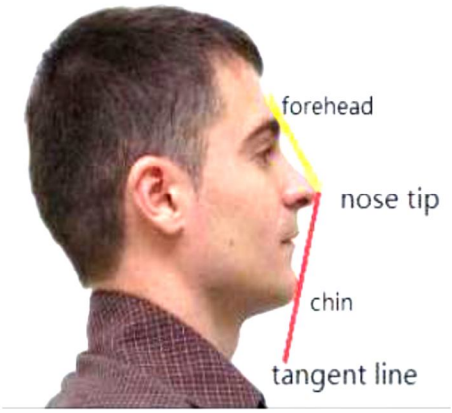

Fig 4

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## V. DISCRETE WAVELET TRANSFORM (DWT)

This facial verification method uses random forest that means it needs a large number of Side face dataset to enhance the accuracy of the system. A large dataset leads to more subsets based on the facial features which results very helpful in correct decision making.

Procedure starts by detecting the edges, that is done by calculating the Threshold Value of the complete subset of the data and finally majority value in-between the dataset images, is considered for result.

Once face is detected, fac alignment is done with the help of Geometric Transformation because the orientation angle of the images may vary. (Fig 3 & 4)

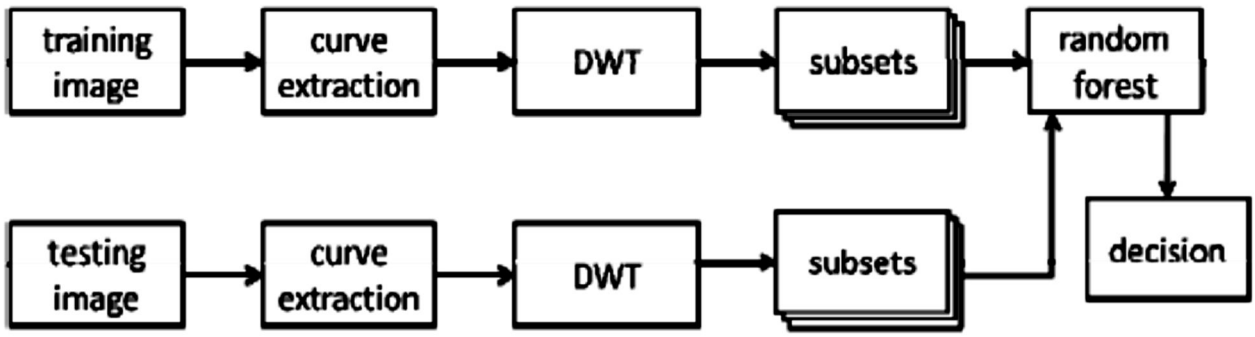


Fig 5

## VI. SIDE-VIEW FACIAL RECOGNITION USING LBP AND FACE FEATURE WARPING

Simply, in LBP and Warping, the images are bounded by the manually labeled landmarks which leads to preprocessing for removal of surroundings or background and warped to a shape free textured picture.

Procreates Analysis is used in LBP to identify the transformation parameters among the dataset images. Now LBP aligns all the parametric values that are extracted in the training set for CNN and average value or landmark is considered.

To have a fix sized image, LBP sets a rectangular boundary and all the facial features are inbound to it.

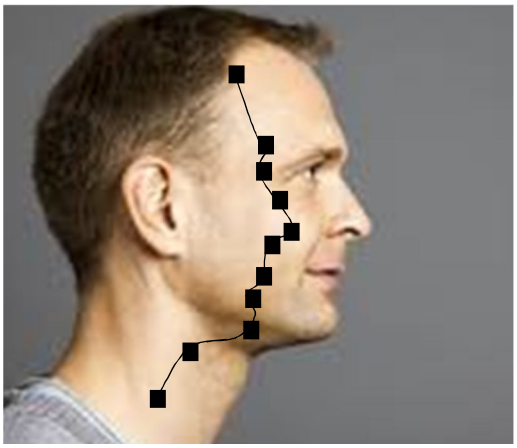

Fig 6 (Manually Labeled Landmarks)

Local spatial structure description is given by LBP, because it is a feature description method.

LBP is invariant in illuminance changes and have simple computation that's why it is very popular method in facial recognition.

LBP divide the images into sub regions that are counted as 75, and compute the LBP histograms for each region. Further, concatenate these histograms to attain the feature vector of the image. For classification, LBP use nearest neighbor method using Chi square distance measurement.

When the warping is done, all the images in the dataset have their unique boundary lines which helps in its classification when an input is given to it. This method will definitely reduce the complexity of Side-view facial recognition.

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Fig 7 (Manually landmarked picture 2)

## VII. SIDE FACE FEATURE EXTRACTION USING LBP:

LBP method uses a face feature extraction technique for side view facial recognition. The system is attempting for automatically analyze then recognize facial portion.

In previous method, face features are extracted manually but here LBP applied techniques on these images like Original LBP, Extended LBP and Principal Component Analysis. PCA minimizes the features required to represent in each image which reduces the computational complexity of the system.

This methodology is very important to automate the facial recognition system.

Fig 8 (Barack Obama eigen-vectors)

PCA is introduces here to use Eigen face method which optimized the size of the dataset in size with minimal reference image for recognition purpose. These data are stored in form of feature vector that to be match with target input image.

PCA on Eigen face is advisable only when dataset size is too large. In Fig 8, it's Barack Obama's eigen-vectors. This approach is generally not advisable for strict identification application. Mainly this approach is use to detect and recognize the faces from even harsh crowd.

When an image data set is (in RBG format) is used, then it occupies 24bits of memory when it is converted into the form of matrix. If the dataset is small then its calculation will be done easily nut if the dataset is large, then image Processing will take a lot of time. Hence to optimize the system and reduce the time complexity of the system, less memory consumption should be made. To reduce memory utilization, the image set must be converted into Grayscale format. Eigen-vector is the form of Grayscale image. Grayscale occupies 8-bits in memory and then it ranges from (0-255) pixels illuminance value. When Gray scaled image is converted into matrix for training on Convolution Neural Network (CNN).

## VIII. CONCLUSION

Various methods are explained above, concludes only thing that the dataset must be accurate, resized and fitted So that it can be easily distinguished for side-view facial recognition

Threshold value of the picture along with the tangential points must be calculated accurately to train the dataset properly and low error ratio and accuracy and validation ratio must be maximum clear images along with particular application of algorithms and methods must be done to resolve the conflicts in Side-view facial recognition.

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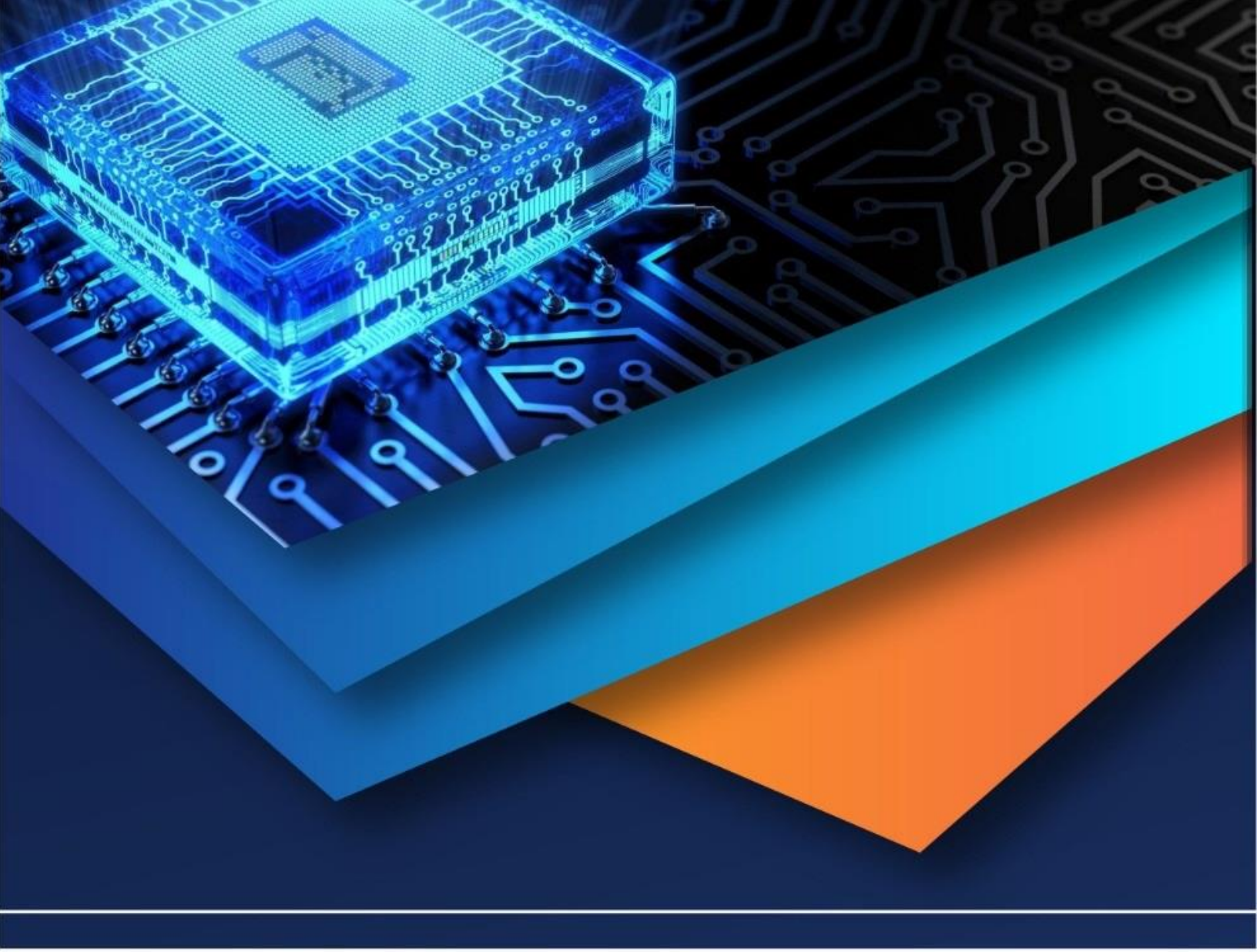

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