



## A Robust Technique of Face Recognition

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**Abstract-** Biometrics are automated methods of recognizing a person based on a physiological or behavioral characteristic. Among the features measured are: face, fingerprints, hand geometry, handwriting, iris etc. Biometrics is becoming the foundation of an extensive array of highly secure identification and personal verification solutions. As the required level of security rises, the need for highly secure identification and personal verification is also growing. In this paper, we propose an algorithm for robust face recognition.

**Keywords:** Face detection, face recognition, PCA, ANN, back propagation, face vector, gray code.

### I. INTRODUCTION

The process of recognizing a face in an image has two phases:

- **Face detection** – detecting the pixels in the image which represent the face. There are several algorithms for performing this task. (fig 1)
- **Face recognition** – the actual task of recognizing the face by analyzing the part of the image identified during the face detection phase. (fig 2)

Facial recognition system store video or photographs and try to find recognizable facial characteristics and match them against known facial templates to identify individuals. Most current facial recognition system processes the 2D camera image, although recent products have emerged that try to map the face in 3D using multiple camera angles. Face recognition has the greatest advantage of not requiring any sort of contact, so there are no hygienic concerns. The biometric samples here are typically taken as 2D images of the frontal section of the face, using one or more digital cameras. Typical technical approaches to achieve this recognition include geometrical, eigenfaces, template and graph matching, neural networks and Hidden Markov Models, or a combination of these. Although there are significant advantages to this technology, mainly due to the extrovert characteristics of face images and the user acceptability, the recognition accuracy has shown to be rather inaccurate in practice. The inaccuracy can be explained by a high sensitivity to environmental conditions such as lighting and image background, and also due to changes in the appearance of a face with regards to hairstyle, beard and glasses for example. This paper proposes a system that will try to overcome such problems. Despite the rather poor recognition accuracy, face recognition appears to be among the most interesting biometrics for user authentication in ID document scenarios, simply because of the simple image acquisition and the intuitive concept of comparing face images to images included in the document. Consequently, standards for the layout of facial images, as well as digital storage formats are currently developed.

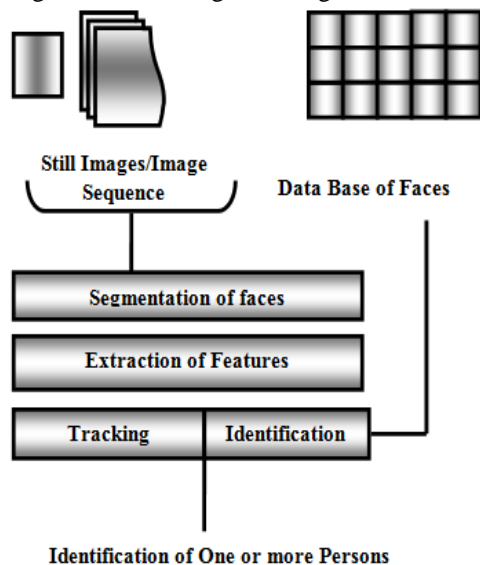


Fig. 1 Process of Detection.

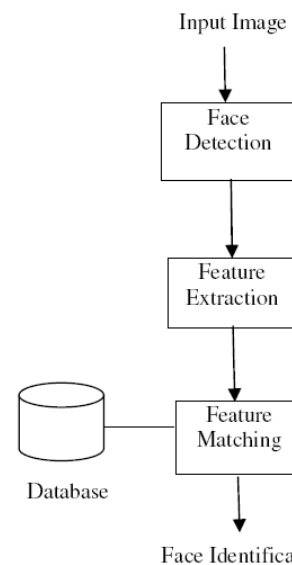


Fig. 2 Process of Face Recognition

## **II. LITERATURE SURVEY**

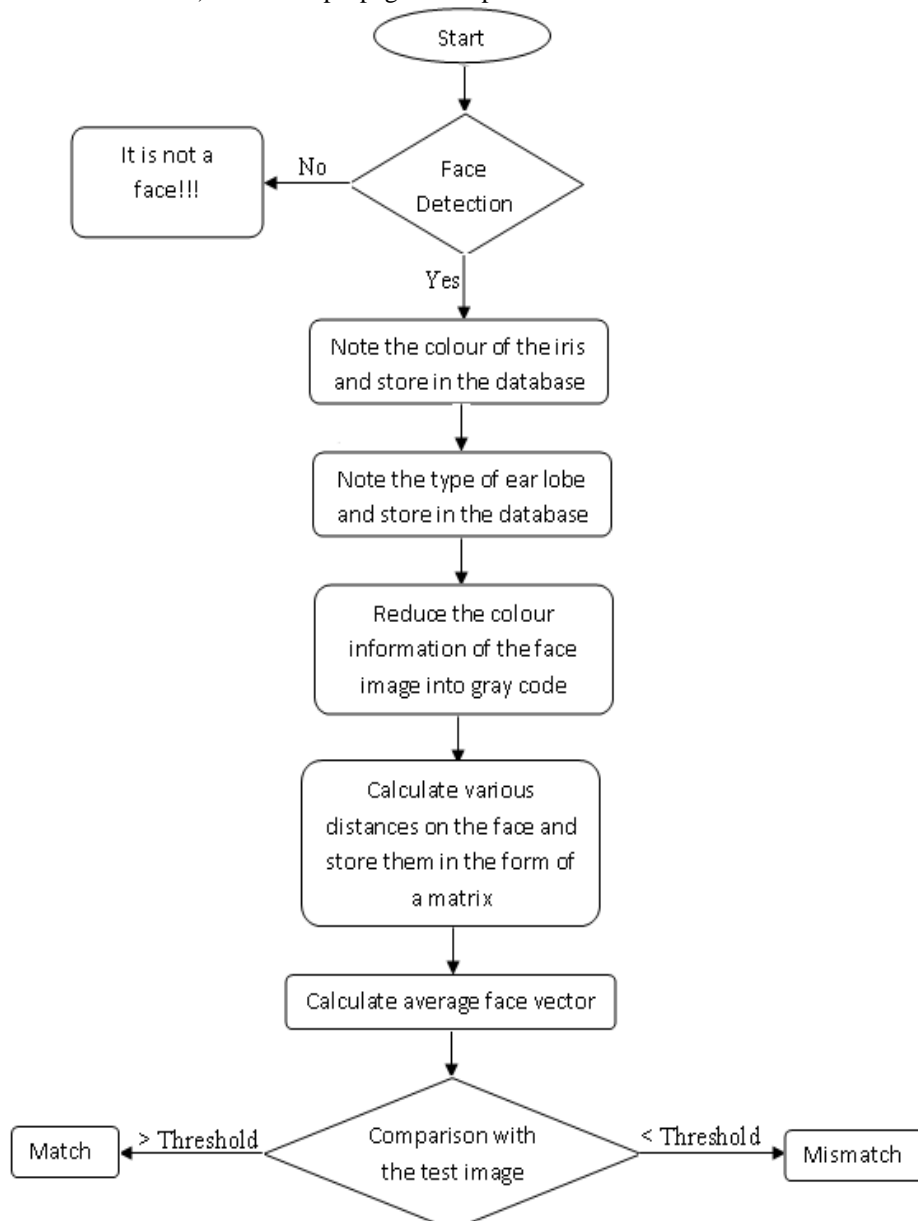
- Manisha Nirania and Mr. Krishan Kumar performed a work, "Efficient Face Recognition Technique using PCA in Neural Network". In this paper, face recognition system's steps and techniques have been proposed which can be used to detect the faces based on features mapping and implemented using MATLAB tool.
- Renu Bhatia performed a work, "Biometrics and Face Recognition Techniques ". In this paper, different biometrics techniques such as Iris scan, retina scan and face recognition techniques are discussed.
- Suhas S.Satonkar, Vaibhav M.Pathak, Dr. Prakash B. Khanale performed a work, "Face Recognition Using Principal Component Analysis and Artificial Neural Network of Facial Images Datasets in Soft Computing ". The paper present a face recognition using Principal Component Analysis and Two-Layer Feed Forward Neural Network techniques used to recognition frontal and poses variation images. The dimension of face image is reduced by the Principal Component Analysis and gives feature vector of images. The training and recognition is done by the Two- Layer Feed-Forward Neural Network. The study highlights the performance of neural network.
- Amritpal Kaur, Sarabjit Singh and Taqdir performed a work, "Face Recognition Using PCA (Principal Component Analysis) and LDA (Linear Discriminant Analysis) Techniques ". In this paper, a survey on the PCA and LDA was conducted and comparison of both was carried out on the basis of their merits and demerits. It was analysed how PCA and LDA work on images and compared both techniques and found that PCA is better than LDA. LDA can give the effective results combining with PCA.
- Jageshvar K. Keche, Vikas K. Yeotikar, Manish T. Wanjari and Dr. Mahendra P. Dhore performed a work, "Human Face Recognition Based on PCA Method using MATLAB". In this paper, the authors have introduced a Principal Component Analysis method for face recognition. Experimental results using PCA show the face recognition with the help of MATLAB software.
- Manal Abdullah, Majda Wazzan and Sahar Bo-saeed performed a work, "Optimizing Face Recognition Using PCA ". This paper conducts a study to optimize the time complexity of PCA (eigenfaces) that does not affects the recognition performance. The authors minimize the participated eigenvectors which consequently decreases the computational time.
- Bruce A. Draper, Kyungim Baek, Marian Stewart Bartlett and J. Ross Beveridge performed a work, "Recognizing faces with PCA and ICA". This paper compares principal component analysis (PCA) and independent component analysis (ICA) in the context of a baseline face recognition system, a comparison motivated by contradictory claims in the literature. This paper shows how the relative performance of PCA and ICA depends on the task statement, the ICA architecture, the ICA algorithm and (for PCA) the subspace distance metric. It then explores the space of PCA/ICA comparisons by systematically testing two ICA algorithms and two ICA architectures against PCA with four different distance measures on two tasks (facial identity and facial expression).
- Vikram Solunke, Pratik Kudle, Abhijit Bhise, Adil Naik, Prof. J. R. Prasad performed a work, "A Comparison between Feature Extraction Techniques for Face Recognition". This paper reviews the Principal Component Analysis (PCA) algorithm and Linear Discriminant Analysis (LDA) algorithm which are popularly used for feature extraction in Face Recognition System. This paper demonstrates the comparison of PCA and LDA algorithm, and also it highlights a 3D Face Recognition algorithm as a improvement over other feature extraction algorithm.
- Manisha M. Kasar, Debnath Bhattacharyya and Tai-hoon Kim performed a work, "Face Recognition Using Neural Network: A Review ". This paper reviews the detection studies and systems which are based on different ANN approaches and algorithms. The strengths and limitations of these literature studies and systems are included in this paper, and also the performance analysis of different ANN approach and algorithm is analyzed.
- Sanjeev Kumar and Harpreet Kaur performed a work, "Face Recognition Techniques: Classification and Comparisons". This paper reviews the different methods for face recognition, their advantages and disadvantages.
- Chetna Singh, Sarvesh Singh and Prashant Baheti performed a work, "Human Face Recognition and Face Detection using Skin Colour Model ". In this paper, face recognition techniques have been discussed and algorithms have been developed for them. In face recognition the algorithm used is PCA (principal component analysis) using eigen faces. This algorithm gives different rates of accuracy under different conditions as experimentally observed. In face detection, an algorithm has been developed that can detect human faces from an image. Skin colour has been taken as a tool for detection.

## **III. PROBLEMS**

- Background (deemphasize the outside of the face, e.g., by multiplying the input image by a 2D Gaussian window centered on the face)
- Lighting conditions (performance degrades with light changes)
- Scale and orientation

#### IV. PROPOSED ALGORITHM

1. **Face Detection:-** First, try to identify different parts of a face (like mouth, nose etc.) so as to ensure that the given image represents a face only. In case some of the body parts are covered with something (like sunglasses), ignore them and look for uncovered parts. This will help us reduce the unnecessary pixel values.
2. Select only the face part out of the complete image and leave all other details to avoid complexity. Find out the colour of the iris and store it in the database of the person.
3. Also see the earlobe- whether it is fixed or hanging. Store this information also in the database of the person.
4. To avoid illumination problem and make-up problem, reduce the colour information of the face into gray scale.
5. Having detected that the given image is of a face, calculate the following distances:-
  - (i) Left most point of the left eye to its right most point.
  - (ii) Left most point of the right eye to its right most point.
  - (iii) Left most point of the left eye to the left most point of the right eye.
  - (iv) Right most point of the left eye to the right most point of the right eye.
  - (v) Width of the nose.
  - (vi) Width of the mouth.
  - (vii) Left most point of the nose to the left most point of the mouth.
  - (viii) Right most point of the nose to the right most point of the mouth.
6. Store all these distances in the form of a matrix.
7. Compute the average face vector.
8. Whenever a face is to be detected, compare it with the stored data of various face images.
9. Select a minimum threshold value for the match or mismatch of a given test image.
10. For information storage and learning process, this technique (based on PCA) can be combined with the ANN (Artificial Neural Network) with back propagation capabilities.



## V. CONCLUSION

Face recognition might be a very easy task for human beings, but it is extremely difficult to make a machine detect and recognize human faces. This has been an area of interest and a challenge also for the researchers, and though huge progress has been made, encouraging results have been obtained and current face recognition systems have reached a certain degree of maturity when operating under constrained conditions; however, they are far from achieving the ideal of being able to perform adequately in all the various situations that are commonly encountered by applications utilizing these techniques in practical life. The ultimate goal of researchers in this area is to enable computers to emulate the human vision system. The proposed system will provide a robust technique for detecting and recognizing human faces. Here we have used PCA alongwith some other facial characteristics that help us to recognize human faces.

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