

# THE INTERNATIONAL JOURNAL OF SCIENCE & TECHNOLEDGE

## A Novel Approach of Face Recognition Using PCA and K Mean Clustering

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### **Abstract:**

*Face recognition is emerging as one of the popular field in the biometric research. It is used in various surveillance systems for the security purpose as it doesn't need object comparison. The main advantage of using face recognition system is its uniqueness and acceptance over other biometric systems. Though this system is considered to be accurate but the detection of face is a difficult process as face detection is having the high degree of variability. The main problem with these types of systems is the accuracy and the speed of detection of the face. Various techniques have been proposed earlier for detection of the face but still the results obtained were not efficient.*

*So in this proposed method the face detection and the signature verification are combined for increasing the security of the system. After the extraction of the feature using K mean feature extraction has been applied. From the results obtained it is concluded that this proposed approach is efficient than the traditional method of face recognition. The efficiency and the accuracy of the proposed system is more.*

**Keywords:** *Principal Component analysis, face recognition, K mean feature extraction*

### **1. Introduction**

A biometric system is a computer System which performs the Biometric Recognition Algorithms for biometric Technique. Sensing, Feature Extraction and Matching Modules are the main components of a biometric System. A biometric sensor senses the biometric parameter such as fingerprints sensors and digital camera gives the output in the Digital form. The irrelevant information is discarded from the acquired samples by using the feature of extraction, the remaining extracted and discriminatory information is normally used for Matching Process. During the process of Matching, A Query is generated by the biometric Sample that is matched with the reference information stored in the database and generates the identity associated with the Query.

Biometrics is mechanized strategies for perceiving a man in view of a physiological or behavioral trademark. The past of biometrics incorporates the distinguishing proof of individuals by particular body elements, marks or some unique features that distinguish them from other individuals like height, skin color or texture, retina, voice etc. [4]. The present components are face acknowledgment, fingerprints, penmanship, hand geometry, iris, vein, voice and retinal output. Biometric procedure is presently turning into the establishment of a wide exhibit of exceedingly secure ID and individual confirmation. The need to increase the level of security rapture and exchange trick builds, the requirement for well secure recognizable proof and individual confirmation innovations is getting to be obvious [3]. Late world occasions had led to an expansion enthusiasm for security that will incite biometrics into larger part utilize. Territories of future use contain Internet exchanges, accessing systems, telephone exchanges and tourist industry [7]. There have diverse sorts of biometrics: Some are old or others are most recent innovation. Biometric systems use fingerprint, facial features, eye retina, voice, signatures, hand geometry [4] as the matching features for distinguishing individuals and the advancements in the field are still taking place [7].

Face recognition is one of the applications of biometrics that differentiates an individual from others [5]. By analyzing and comparing two images and then extracting and matching the features of both the images, face recognition can be done and this application of biometrics is used widely and primarily for security reasons [4].

Face identification and acknowledgment are assuming an essential part in our present society, because of their utilization for an extensive variety of uses, for example, observation, banking and mixed media gear as cameras and computer game consoles [6] which are only some of the examples from its wide applications. Face recognition is a particular instance of article class discovery, whose principle undertaking is to discover the position and size of items in a picture having a place with a given class. Face recognition calculations were firstly engaged in the location of frontal human appearances, yet these days they endeavor to be more suitable to tackle face multi-view identification: in-plane revolution and out-of-plane turn [7]. Be that as it may, face recognition is still an exceptionally troublesome test because of the high variability in size, shape, shading and composition of human appearances. By and

large, confront discovery calculations execute face location as a parallel example order assignment. That implies, that given an information picture, it is separated in pieces and every square is changed into an element. Highlights from class face and non face are utilized to prepare a specific classifier. At that point another info picture is given, the classifier will have the capacity to choose if the specimen is a face or not [7].

Face recognition can also be used to detect faces in image or videos and it can be used for recognizing criminals too [7]. Many techniques are used for face recognition like PCA i.e. Principal Component Analysis, LDA, SVM i.e. Support Vector Machine, LBP i.e. Linear Binary Patterns, ICA, Gabor wavelet etc. [2]. The prime need of the face recognition technique is reliability and accuracy [3] and that is what has been improved in each new developed technique.

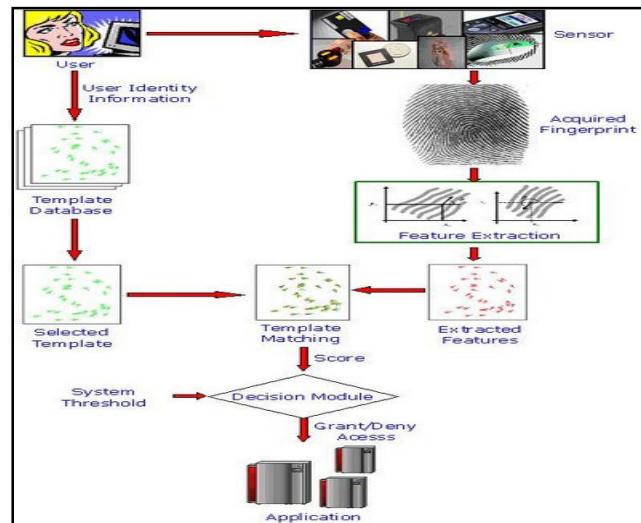


Figure 1: Process of identifying authenticity

## 2. Techniques

Various techniques have been used till date for extracting the features from an image for face recognition. Some of the techniques have been described below:

- i. **Linear Discriminant Analysis:** LDA finds most of its applications in appearance based methods. It is considered to be an efficient and qualitative algorithm for selection of features in the applications it is being employed. The demerit of LDA is that it is inefficient in extracting features [8].
- ii. **Independent Component Analysis:** ICA is a strategy for finding hidden variables or segments from multivariate (multidimensional) measurable information. Its main usage is to actualize face acknowledgment framework utilizing ICA for facial pictures having face introductions and diverse light conditions, which will give better results as contrasted and existing frameworks. The advantage of using ICA method for face recognition is that it not only considers non Gaussian components but also takes into account statistically independent components [2].
- iii. **Local Binary Pattern:** LBP technique was developed with the prime purpose of texture description [6]. It is invariant to monotonic dark scale changes which are fundamental for surface depiction and investigation for the reason of computational effortlessness handling of picture continuously is conceivable. With LBP it's conceivable to clarify the composition and model of an electronic computerized picture. This is finished by isolating a photo into a few little areas from which the components are extracted. These components contain paired examples that portray the natural surroundings of pixels in the local region. The elements that are framed from the areas are connected into a solitary element histogram, which depicts to shapes a representation of the picture. Pictures will then be thought about by measuring the similitude (separation) between their histograms. Concurring various studies face acknowledgment using the LBP technique gives positive results, both with respect to speed and segregation execution. Because of the way the surface and model of pictures is portrayed, the strategy is clearly entirely hearty against face pictures with various outward appearances, changed helping conditions, maturing of persons and picture pivot. LBP elements were proposed initially for composition investigation, and as of late have now been acquainted with speak to faces in facial pictures examination. The most pivotal properties of LBP elements are their resistance against light changes and its simple computation [14].
- iv. **Compound Local Binary Pattern:** An augmentation of the first LBP administrator that allots a 2P-bit code to the middle pixel taking into account the dark estimations of a nearby neighborhood containing P neighbor pixels. Not at all like the LBP that utilizes one piece for every neighbor pixel, to express just the indication of the contrast between the middle and the relating neighbor pixel dark values, the CLBP strategy utilizes two bits for every neighbor keeping in mind the end goal to speak to the sign and additionally the size data of the distinction between the inside and the neighbor dim qualities. Here, the principal bit speaks about the difference between the value of middle bit and the value of its neighbor pixel. The CLBP sets this bit to 1 if the contrast between the middle and the comparing neighbor is more than the edge  $M_{avg}$  Otherwise, it is set to 0.  $M_{avg}$  is considered as reference value [16].

### 3. Problem Formulation

Face is our primary focus of attention in social intercourses. It plays an important role in providing human identity. Face recognition is a section of pattern recognition in which human visual perception is saved in computer. This approach is much popular in many of the fields the main and the important one is recognition or can say as the security or authentication purpose. Many researchers are working on this field from many of the years, many algorithms and techniques are developed to update the traditional systems the common these days are PCA, LDA, and Gabor etc. But these approaches individually are not that much efficient in some of the cases, so the combination of the algorithms are done as an example if PCA approach is used it will provide better results for small datasets. So to overcome these disadvantages the continuous research is processed to get better results. There is one issue too if the algorithms are getting advanced the fake parties are also able to make the algorithm crack able. So there is need to develop an algorithm which will work as advanced and modified approach to make classification that much complex that will not be easy to crack up to an extent, so a study gives a proposed work for classification or security

### 4. Proposed System

Face recognition is an important aspect in identification of an individual. Growing use of biometrics has increased the research work done in the field of face recognition. Face recognition is a section of pattern recognition in which human visual perception is saved in computer. This approach is much popular in many of the fields the main and the important one is recognition or can say as the security or authentication purpose. Lot of work is done in this field to improve the conventional techniques employed. The disadvantage of the conventional techniques was that it used only PCA that worked with small data sets but proved to be inefficient when it comes to working on large data sets. This disadvantage is to overcome in the proposed work by combining the techniques of PCA and K-mean clustering. PCA will give significant results for small data-sets and K-mean clustering approach is efficient for large data sets. This combined technique works better for task of face recognition on both small as well as large data sets and hence is an efficient technique for face recognition.

#### 4.1. Objectives

1. To Study traditional approaches of FACE recognition named as PCA
2. To Extend the Face recognition with combined PCA and K mean Clustering
3. To design the updated hybrid face recognition system
4. To perform the accuracy of proposed system

### 5. Methodology

In this paper, proposed technique uses PCA and K mean clustering for the evaluation and extraction of the features. Methodology for the proposed technique is given below:

#### 5.1. Training of Dataset

1. In the training of dataset, firstly read face dataset for the evaluation purpose.
2. Now apply enhancement on the extracted feature so that it can be clearly verified.
3. Apply PCA feature extraction technique on the dataset for extraction of features.
4. Now again apply K mean feature extraction on the acquired featured from PCA.
5. Lastly create feature matrix on which further matching will be performed.

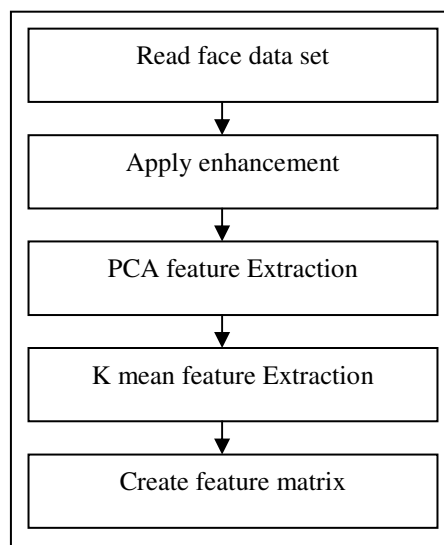


Figure 2: Block diagram of training of dataset

### 5.2. Testing of Dataset

1. Now perform testing of dataset which is extract during training.
2. Firstly, read test dataset that need to be tested.
3. Now apply enhancement technique on the dataset read by previous stage. Enhancement helps in identifying the images visibly.
4. Application of PCA performed on the test dataset to extract features from the dataset.
5. K mean feature extraction applies on the test dataset.
6. Lastly perform matching of test dataset with the dataset to check the performance of the proposed technique.
7. At last performance parameter calculates which shows the accuracy of the proposed technique in comparison with existing technique.

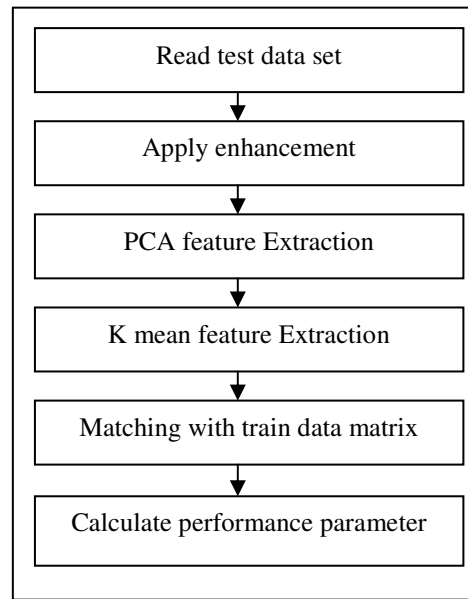


Figure 3: Block diagram of testing of dataset.

## 6. Results and Discussions

In this section results are evaluated by performing proposed technique on the dataset and then testing has been performed on the dataset to evaluate the performance of the proposed technique. For the training and testing of the dataset two techniques have been used named as PCA and K mean clustering. Hybridization of these two techniques outperforms as compared to existing technique.

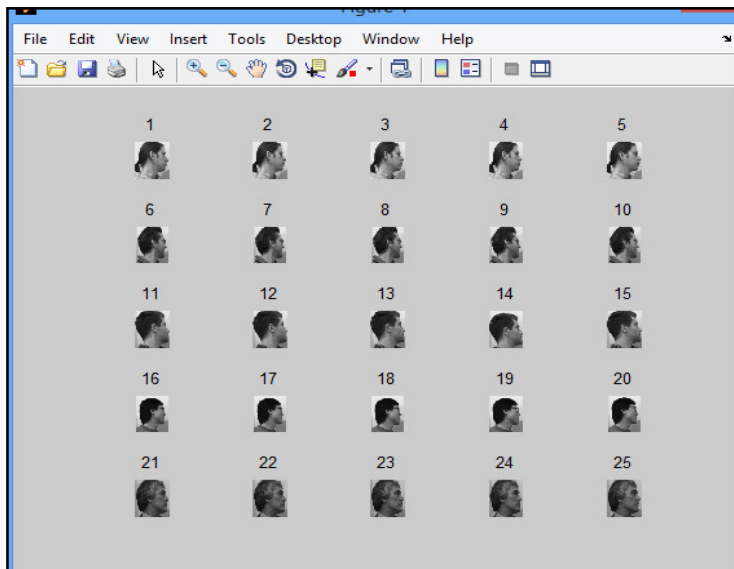


Figure 4: Shows dataset of images i.e. face images for training

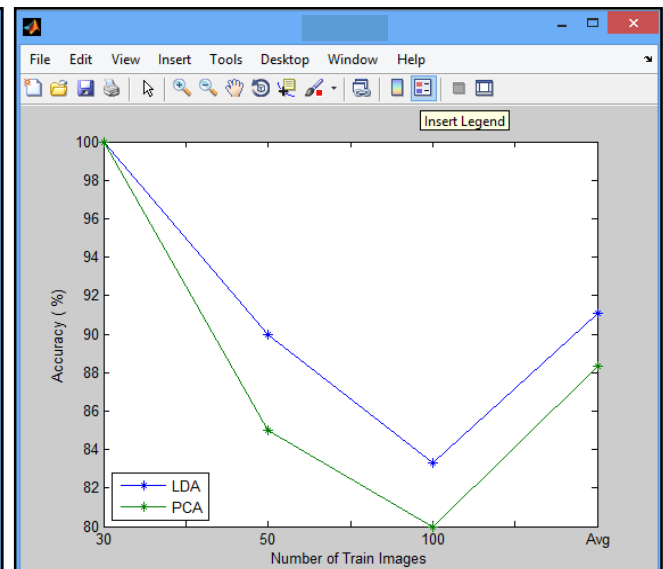


Figure 5: Comparison of accuracy between LDA and PCA

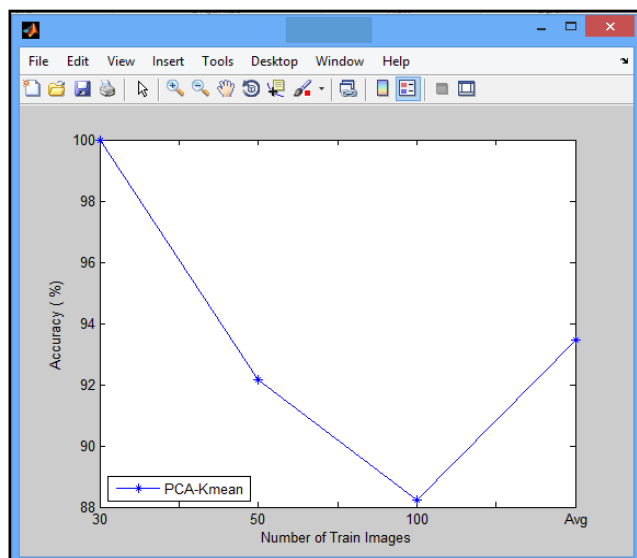


Figure 6: Accuracy of proposed technique i.e. PCA and K-mean clustering

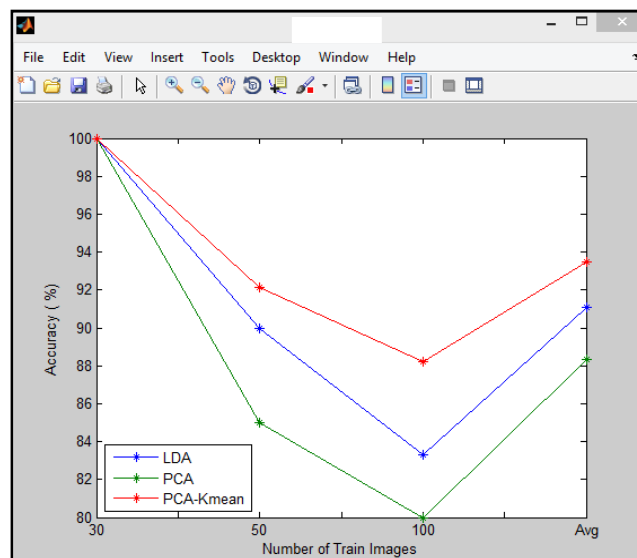


Figure 7: Shows accuracy of proposed technique in comparison with existing ones

## 7. Conclusion and Future Scope

The feature extraction and the classification of the image plays important role in the identification. In this a new method is proposed in which the system is trained and the testing is done. In this the feature are extracted by using the PCA and then by using K mean the system is trained and test. On the basis of the performance of the system which is measured by varying the number of faces of each subject in the training and test faces. A comparison is performed between proposed and the traditional approach. From the results obtained it is concluded that this proposed method is better than the traditional method of the face recognition as this system is more accurate.

In future this technique can be enhanced further by using some other classifier that can increase the accuracy of the system. By using some other classifier, the feature extraction process can be further enhanced. Better the extracted features more accurate will be the system and thus the efficiency of the system increases. Also the security of the system can be increased so that the identification is done is secured.

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