

## BIOMETRIC IDENTIFICATION ALGORITHMS IN FACE RECOGNITION AND THEIR ANALYSIS

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**Abstract.** Biometric identification systems are widely used to increase security. Due to its wide user acceptance, accuracy, security and relatively low cost, facial image recognition is the leading method. Although facial image recognition systems have reached a certain level of maturity, some challenging tasks still require more research. The reason for this is to increase information security and improve people's living conditions in the age of globalization. In this master's dissertation, we studied the basics of facial image recognition, mathematical methods of biometric facial recognition, and the algorithm of many methods related to facial biometric recognition. For example: linear discriminant analysis, support vector machine, hybrid approach, face detection with CNN (Cable News Network).

**Key words:** CNN, facial image recognition systems, 2DPCA, PCA, F-2DPCA, ICA, stream of frames.

### ***2DPCA (two-dimensional PCA) algorithm***

As we look at the PCA technique, we can see that it is very useful in the field of image recognition and it contains many linear discrimination methods, but there are some weakened points in the traditional PCA. A new PCA was developed to get better performance than the traditional one. Increasing data scatter is not enough to discriminate between clusters, so we present approaches based on new PCA that consider data labeling and enhances the performance of recognition systems. These approaches were proved experimentally and were better than traditional PCA and almost the same complexity. In face recognition, the 2DPCA has been used in large

areas, but it has high sensitivity to outliers, so a novel robust 2DPCA with F-norm minimization (F-2DPCA) is proposed to avoid the problem of usual 2DPCA. In face recognition applications, two-dimensional principal component analysis (2DPCA) has been widely applied. 2DPCA is different from PCA, as it takes a 2D matrix rather than simply one vector. From the 2D image matrices, the image covariance matrix is constructed. This makes the image covariance matrix size much smaller. 2DPCA evaluates the matrix more accurately and efficiently than PCA.

The F-2DPCA is robust and rotational invariant, because distance is measured in F-norm while summation over various data points used 1-norm. As shown Figure 1. when the number of training data increases the accuracy in-creases accordingly.

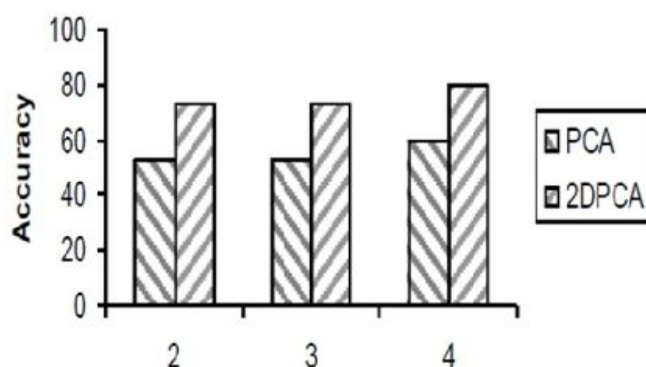


Figure 1. Accuracy of Recognition based on Number of training sample.

### Independent Component Analysis (ICA)

Independent Component Analysis (ICA) is mostly the same as PCA, except in the distribution of the components. In PCA the distribution is designed to be Gaussian, but in ICA it is designed to be non-Gaussian. ICA depends on minimization of higher order and second order in the input data (Matrix dimensions), trying to find the basis along the data for face recognition task, there are two architecture that are provided by of ICA.

- Architecture I statistically independent basis images;
- Architecture II factorial code representation.

ICA is the general model from which PCA is extracted. With respect to ICA, for both linear transformation and linear combination, ICA identifies the independent variables. Because ICA works on higher order statistics, it can provide better data representation than PCA.

ICA searches for directions where noticeable concentrations of data are watched when the source models are sparse in face detection. So, the ICA can be regarded as a type of cluster analysis when using sparse sources of face recognition.

### *Algorithm: Face determination and Recognition Using Independent Component Analysis (ICA)*

As shown in Figure 2.

- Input a video stream (stream of frames).
- Get all frames from the input video sequence and regard the first video frame as key frame;
- In the key frame, apply the suitable searching algorithm on the face region using basic face features as mouth and eyes for face determination;
- Then apply the ICA and by combining independent pixels in linear combinations for definite face recognition;
- Draw the rectangular box for the detected face in the frame;
- Repeat the Step from 3 to 5 till the end of the input video sequence, which

results in the detection and recognition of human face in the video sequence frame.

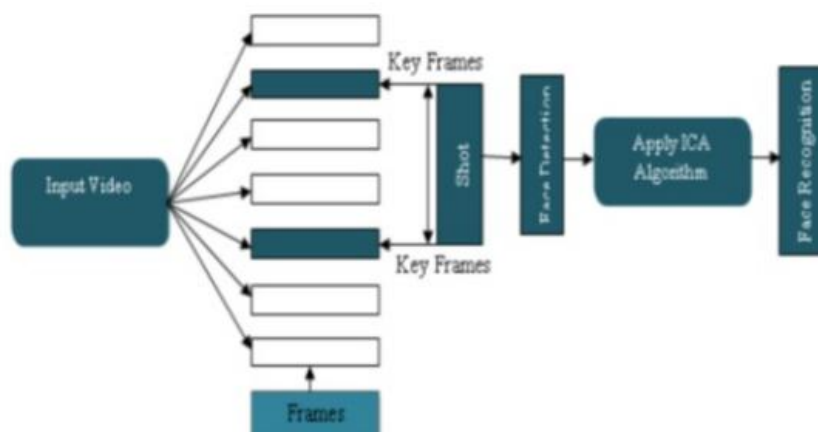


Figure  
Diagram  
Proposed

2. Block  
for the  
Face

Recognition Method.

## CONCLUSION

Face recognition is one of the most important issues which become interesting area for researchers. It is a challenging in the field of computer vision. Because of many algorithms used in different fields the face recognition has received great attention. This paper provided an up-to-date review of human face recognition algorithms. The algorithms Principal Component Analysis (PCA) is the most successful techniques in face recognition systems as a statistical method for dimensionality reduction, but there is a problem related to accuracy and classification time. LDA is widely used to find linear combinations of features while modeling the differences between classes, and recently multi-class LDA algorithms which can manage more than two classes are more used. DCT has a strong energy compaction property, this statistical method is used to transform images, compacting the variations, allowing an effective dimensionality reduction.

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