ENHANCING THE RECOGNITION RATE AND REDUCE THE COMPUTATION COMPLEXITY IN IMAGE PROCESSING – A RESEARCH

Kamal Dhanda*

Shalu Goel*

Abstract:

Face recognition is an active and important research from past many years. This process includes face tracking, expression finding and many more. In the beginning it was not possible to detect the face with the local structure. But now with the modern methods like LPP, it is now possible to preserve locality also. In a database having hundreds of images it is quite difficult to detect a face with less amount of time or having a high recognition rate with high accuracy. The main problem of face recognition is high dimension space which is to be reduced by dimension reduction technique. This low dimension subspace can be achieved by using dimension reduction techniques like Principal component analysis, Linear Discriminates analysis and Locality Preserving Projection (LPP). So the aim of this paper is to first reduce the dimension of all the images present in the database and then search the required image from the given database.

***Keywords*:** Eigen Value, Laplacian Faces, a Priori Laplacian, Linear Projective Projection, Face Biometric.

* Department of Computer Science & Engineering, BRCM college of Engineering and Technology, Bahal

1. Introduction

Images containing faces are essential to intelligent vision-based human computer interaction, and research efforts in face processing include face recognition, face tracking, pose estimation, and expression recognition. The rapidly expanding research in face processing is based on the premise that information about a user's identity, state, and intent can be extracted from images and that computers can then react accordingly. Face registration for whole database is a challenging task because of variability in scale, location, orientation (up-right, rotated), and pose. Face recognition has applications mainly in the fields of biometrics, access control, law enforcement, and security and surveillance systems. The first step of human face identification is to extract the relevant features from facial images. Research in this field primarily intends to generate sufficiently reasonable familiarities of human faces so that another human can correctly identify the face. The question naturally arises as to how well facial features can be quantized. If such a quantization if possible then a computer should be capable of recognizing a face given a set of features. Investigations by numerous researchers over the past several years have indicated that certain facial characteristics are used by human beings to identify faces.

2. Objective

The objective of a robust face recognition system is to account the given features below and to improve the existing algorithms in terms of time and accuracy:

Scale invariance: The same face can be presented to the system at different scales as shown in Fig 1. As this distance gets closer, the face image gets bigger. So at the time of recognition the algorithm should be invariant to the scale.

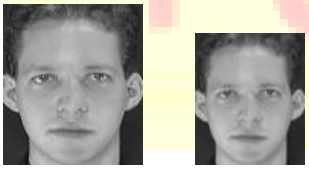


Figure 1 Faces at different scales

Shift invariance: The same face can be presented to the system at different perspectives and orientations as shown in Fig 2. For instance, face images of the same person could be taken from frontal and profile views. The system must incorporate this shift invariance property for proper results.

Figure 2 Frontal and profile view of same person

Illumination invariance: Face images of the same person can be taken under different illumination conditions such as, the position and the strength of the light source can be modified like the ones shown in Fig 3.

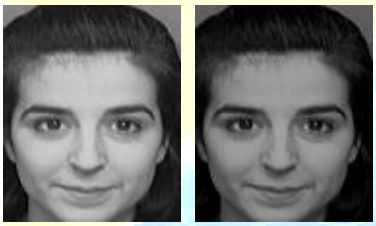


Figure 3 Variation in illumination

3. Problem Formulation

Due to the dynamic nature of face images, a face recognition system encounters various problems during the recognition process:

1. The problem is mainly a classification problem. Training the face recognition system with images from the known individuals and classifying the newly coming test images into one of the classes is the main aspect of the face recognition systems. The topic seems to be easy for a human, where limited memory can be a main problem; whereas the problems in machine recognition are manifold.
2. No method is used to improve similarity measures till now. So, by improving this factor the efficiency to recognize a face will improve.
3. Already existed algorithms will be modified to yield better results in terms of time and accuracy.
4. The main problem of face recognition is its high dimension space which is to be reduced by any dimension reduction techniques. The pattern recognition approach then tries to match the face features which are extracted from all the images present in the database. So there are two major problems one is feature extraction and then pattern recognition.

Before this image registration of all the faces is required to enhance the recognition rate of whole system.

So these all motivates to search for new method to solve all these problems and then integrate them to make fully functional system with high accuracy.

4. Methodology/Planning of work:

The performances of three statistical face recognition techniques were given below. A holistic Principal Component Analysis (PCA) based method and the Linear Discriminates Analysis (LDA) are used to reduce the dimension and after that nearest neighbour approach. Third one is the linear projective projection (LPP). LPP is designed for preserving local structure. LPP's are linear projective maps that arise by solving a variational problem that optimally preserves the neighbourhood structure of the data set. Finally these algorithms will be modified to yield better results in terms of time and accuracy. And furthermore new algorithms will be developed which will be more efficient than previous discussed algorithms. These will be discussed with the equations in detail which includes *a priori* Laplacian concept and more.

Finally the subject will be concluded and the comparison of simulation results will be discussed. The results will be compared with respect to the standard PCA and LDA on the image database.

Locality Preserving Projections (LPP) finds an embedding that preserves local information, and obtains a face subspace that best detects the essential face manifold structure. In the priori laplacian approach the Laplacian is used but prior knowledge of each face to its class will proposed to be used, which removes the Nearest Neighbour search from the Laplacian and provides the more accurate result.

5. Steps of Technique

- Step 1: Apply the PCA to all images in database so as to reduce the dimension from N2 to lower dimension M (M<<N2).
- Step 2: Then apply scattering class concept.
- Step 2: Create a Binary Graph in which value will be '1' for Class members and '0' for others.
- Step 3: In Class Member approach pre knowledge is used to create the graph i.e. it is already known to which class person belongs so this actually will reduce the

computational complexity & time between class and within class matrices and enhance the results.

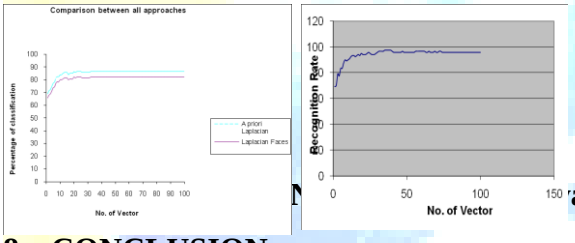
- Step 4: Transpose whole Database into lower k dimension subspace.

6. TESTING

Whenever a new face comes:

- Step 1: Transpose it with same W vector
- Step 2: Apply Nearest Neighbor Pattern classification approach to retrieve the class of the person from the database.

7. RESULTS



N anced Priori

8. CONCLUSION

Algorithm	% of classification
Laplacian	86.7
Advanced Priori	97.5

The various ways of dimension reduction methods like Linear Preserving Projections, a Priori Laplacian and Principal Component Discriminates Analysis are introduced here in this paper and then try to detect the nonlinear structure in manner of linear subspace learning. These all methods are used here for face analysis and are a part of feature reduction and projection. In reference to Laplacian faces this concept which uses labeled samples, a different and effective similarity measure works very well on the database for the purpose of recognition of identity of a person. The accuracy rate also increases due the effect of class concept. Also the computational complexity is reduced due to no more searches for k nearest neighbor for each sample. This comparison shows that PCDA is best in terms of recognition rate among all the discussed techniques. The results can be taken on P4 2.2Ghz, Microsoft Windows XP Professional with MATLAB 7.1 as the platform.

9. References

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