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Face Recognition Ticketing System Using Combination of PCA, PIFS, DCT and Template Matching Correlation

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Abstract— To enhance the performance and accuracy of face recognition, we proposed an advance algorithmic approach by the combination of four recognition techniques. In this approach, multiple algorithms are used. For this purpose we have used PCA, PIFS, DCT and Template Matching using Correlation. Our motto is finding out in which combination of above mentioned techniques give the highest recognition rate. Lastly we proposed a face recognition ticketing system using the best combination of PCA, PIFS, DCT and Template Matching using Correlation. This is used in the proposed automated face recognition biometric system. In this proposed technology is very easy, hazardless and convenient process for the passenger of railway.

Keywords— PCA, PIFS, DCT, Biometric gate, Face recognition

I. INTRODUCTION

Comparing with the other biometric identification technologies such as finger print, iris, retina etc, a personal identification system based on the face patterns is regarded as one of the most promising biometric recognition technologies because of its convenience, fast identification, large user acceptance, prominent recognition accuracy and difficult to counterfeit. This face recognition have numerous commercial applications and security applications. Some example of this applications are photo Id's, passport etc.

II. STUDY OF FACE RECOGNITION APPROACHES

For over two decades face recognition has drawn attention of the research community. With the synergy of efforts from researchers in diverse fields including computer engineering, mathematics and psychophysics, different frameworks have evolved for solving the problem of face recognition. In PCA method the images are projected onto the so called eigenspace that best encodes the variations among known facial classes. In mathematical terms, we wish to find the principal components of the distribution of faces, or the eigenvectors of the covariance matrix of the set of face images, treating an image as a point (or vector) in a very high dimensional space. The eigenvectors are ordered, each one accounting for a different amount of the variation among the face images. Recognition technique[6][7] formulated on Partitioned Iterated Function System (PIFS)[1] makes use of the fact that human face shows region-wise (fractal) self-similarity, which is utilized for encoding the face to generate the PIFS code. Recognition is performed by matching these PIFS codes. DCT is used to extract the features from images. To get the feature vector representing a face, its DCT coefficients are determined and only a subset of the DCT[2] coefficients is retained. This feature vector contains low to mid frequency DCT coefficients, as these are the ones containing highest information. To recognize a particular input query face, the system compares the face's feature vector to the feature vector of the database faces using Euclidean Distance nearest neighbour classifier[8][9]. In this section we will discuss the implementation steps of face recognition systems based on Principal Component Analysis (PCA), Discrete Cosine transform (DCT), Template Matching using Correlation and Partitioned Iterative Function System (PIFS)[3][4].

A. Multi Algorithm Approach

In multi-algorithmic approach, we made the combinations of three and four of the above mentioned algorithms as listed under.

Combinations of three Four combinations are formed as listed under; PCA+DCT+Corr, PCA+DCT+PIFS, PCA+Corr+PIFS, DCT+Corr+PIFS.

Combination of four: PCA+DCT+Corr+PIFS.

B. Results & Discussions

Recognition rate results are obtained at level (top 10-IDs).

Result of face recognition system based on group of four:

The top 10-IDs result for PCA+DCT+PIFS+Corr based system i.e. when all the four individual techniques are combined together is as follows.

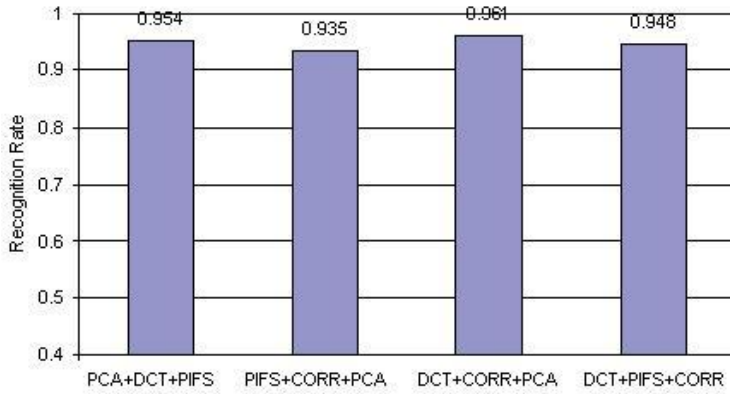

Fig. 1 Results of recognition rate for group of three (four combinations):

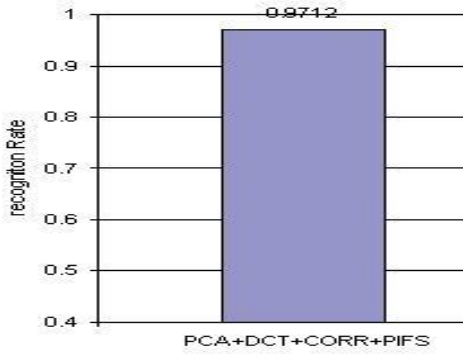

FIG. 2. RESULTS OF(PCA+DCT+CORR+PIFS):

IV. PROPOSED FACE RECOGNITION SYSTEM IN RAILWAY TICKETING PERSPECTIVE

This biometric system is essentially a pattern recognition system that operates by acquiring biometric data from an individual, extracting a feature set from the acquired data, and comparing this feature set against the template set in the database.

The Face Recognition System may easily be applicable to Railway Ticketing System Management in three ways: First, It takes a face image of passenger. Second, it keeps the image as record in an easily manageable database. Lastly, when the passenger comes in front of the exit gate and looks at the front panel of exit gate, it tries to identify and recognizes the face image from the previous database.

A. For the Single Rider

The automated biometric ticketing system is very easy to use. Before entering the station premises, the rider has to pay the fare charges from the starting station to destination station which is all ready given in the fare chart table. The working process of this biometric system is as follow:

Step 1: Insertion of Fare charge: Just the rider has to insert the amount of the fare which is multiple of 5 Rupees coin. Say, the fare is Rupees 15, the rider has to pay 3 no. of % Rupees coin in the definite place of insertion of coin.

After inserting the fare, it calculates the total amount of fare and displays the available distance for move from the starting station.

Step 2: Readiness of the Scanner for finger print: This biometric system is essentially now the touch panel is activated and ready to take the face image of the passenger. The machine asks the rider to wait for a second, if the machine is unable to take the face image of the rider again it will ask to wait for a second.

Step 3: Taking of face image and storing in Database: Let the rider has wait in front of the scanner and the scanner successfully scans the face of the rider. Now the image of the passenger will be send to a central database which keeps the image of all the passengers. The database is connected with all the stations.

All tables and figures will be processed as images. You need to embed the images in the paper itself. Please don't send the images as separate files.

Step 4: Detection of finger print image from the previous Database: After travelling by train from the starting station to destination station, the passenger has to exit from the station premises. To exit the rider or the passenger has to cross the exit gate. At this point the passenger has to wait few seconds and the image will be taken once again. Then the image will be send to the same database for verification.

Step 5: Exact fare calculation and opening of Exit gate: This step is involved in fare calculation of a passenger; if the image of that particular passenger matches with the previous images from the central database, then the fare charges will be calculated according to the travelling kilometer distance by the passenger. If the inserted fare by the passenger does not match with the exact fare of the passenger from the starting station to destination station, then the gate will not open, if the fare matches then it let the passenger to go out.

B. For the Multi Rider

This face recognition biometric system is also very helpful and convenient for the multi rider. For multi rider passenger they do not have to carry the smart card or any receipt for monthly purpose or seasonal ticket.

Step 1: Account recharge along with face image: For the multi rider passenger, they have to recharge their account against their face image. For this purpose the passenger have to pay the exact amount at the monthly or seasonal counter.

Step 2: Enter at the station: After recharge the passenger have to enter the ticket zone area through the entrance gate. At entrance gate the passenger have to wait in front of the face image scanner machine. The scanner will read the face image and identify the image of that passenger from the centralized database which is keep at the time of recharge, if the face image matches then the scanner sends the information about the starting station of the passenger to the centralized database.

Step 3: Travelling Charge calculation: Suppose the passenger have travelled five stations from the starting station to the end station and the fare is rupees x. At the end station passenger has to exit through the exit gate. At exit gate the passenger has to wait for a while and the scanner again take the image and compare with the previous stored images from database.

Step 4: Exit from the Station: If the finger print matches from the stored previous database then the automated system automatically deduct the used fare chare from the account of the passenger and will let the passenger to go or if the face image does not match with the stored database, it will generate an alarm message.

C. System Overview

Hardware Requirement: For this ticketing system two types of gate are required.

For Entry Gate: At entry gate an indicator will be used to insert fare charge. After inserting the fare, it will ask for wait to take face image of the passenger. Face image Scanner will be used to capture the image and extracts the unique features. Lastly it will be send to the SQL Server table.

For Exit Gate: At exit gate an indicator will be used to inform the passenger to wait before the scanner. Face image Scanner will be used to capture the image and extracts the unique features. Lastly it will be send to the SQL Server table to verify the image with stored images.

Required Software: The software architecture consists of: Application Program and Database.

Application program:

The Application Program can be developed with Microsoft C# programming language using Microsoft Visual Studio framework. It provides a user interface for the proposed system. Because this programming language easily runs on both Microsoft operating system and Unix operating system. It can easily communicate with database.

KeyLemon: its closed loop recognition algorithms operate in real time for convenient biometric based system without disturbing the user.

Database

The main component of this proposed ticketing system is its database. For this purpose the SQLServer database can be used. SQLServer can store and maintain a large number of data. It is very fast and easy to operate. The database will record the Passenger Id, Face Image, Inserted Fare Amount, Starting Station and Destination Station in a table.

Working Methodology:

This Proposed ticketing system will work on two basic steps:

1. Capture & Storing of Image.
2. Verification & Fare Chare Calculation.

Capture & Storing (Image and Fare charges): In this step the face image of the passenger will be captured and the features are extracted and stored in the database along with the passenger id, inserted fare charges, stating station information.

Verification & Fare Charge Calculation: After travelling a passenger will ready to exit from the station premises. The objective of this step is to capture the image of the outgoing passenger and check that with the already existing image of passenger. If it matches then check the travel fare with inserted fare and let the passenger to go out.

V. CONCLUSION

The important features of this work are:

1. When we compute the recognition rates the four recognition systems based on four individual techniques namely PCA, DCT, Correlation and PIFS at two levels namely at top 5-IDs and top 10-IDs, we find that the DCT based face recognition systems outperforms the other three face recognition systems as it has higher recognition rates in both cases.

2. In the multi-algorithmic approach, we combine these four individual techniques in a pair of two to obtain six combinations namely PCA+DCT, PCA+Corr, DCT+Corr, DCT+PIFS, PIFS+Corr, and PIFS+PCA. Experimentally, we find that these combinations based systems provide better results than the corresponding individual techniques based system. The obvious reason for this is that the some IDs are returned by first system but not by the 2nd system in the pair and vice versa. When we combine these two techniques, these IDs got combined and the recognition rate in both the cases i.e. for the top5-IDs and for the top10-IDs increases. Out of these six combinations, the PCA+DCT based system has the highest recognition rate in both the cases i.e. for the top5-IDs and for the top10-IDs.

3. In another multi-algorithmic approach, we combine these four individual techniques in a group of three to obtain four combinations namely PCA+DCT+Corr, PCA+DCT+PIFS, PCA+PIFS+Corr, and DCT+PIFS+Corr. Experimentally, we find that these combinations based systems provide better results than the corresponding individual techniques based systems and also perform better than the corresponding combinations of a pair of two in both the cases i.e. for the top5-IDs and for the top10-IDs. The reason for this is that the addition of the third technique improves the efficiency of the corresponding combination of the pair of two techniques. Out of these four combinations, PCA+DCT+Corr have the highest recognition rate in both the cases i.e. for the top5-IDs and for the top10-IDs.

4. Using the four combinations, PCA+DCT+Corr+PIFS have the highest recognition rate which is used for biometric ticketing system for railway.

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