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An Age Variant Face Recognition System

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Abstract— As there is day-by-day increase in the use of technology it's been good to make full use of it but there are some problems also in the use of technology. Now-a-days biometric techniques such as finger print scan, iris scan etc are very common in authentication of people. But recognizing the face is the most ultimate thing in recent world. In this paper, there are some problems with the face recognition system. The most basic problem is not matching the 10 year old images with the latest image.

Keywords— Authentication, Face recognition, Principal Component Analysis(PCA), Iterative Closest Point(ICP).

I. INTRODUCTION

Face recognition system[1] is widely used approach for authentication as compare to other biometric techniques because it is the most easy and natural way to identify any person. This system checks the test image from its database (where images are already saved earlier) and if the test image matches with image extracted from database, it can be considered as authorized person. This technique is normally used to identify criminals from police records. The basic steps[2] involves in face recognition is shown below:

Image Pre-processing

This step is done for detection, normalization and removal of noises from background.

Feature Extraction

The normalized image can be inserted as input for next step i.e. feature extraction. In this step, facial features like eyes, nose, lips etc. are separated from the image and proceeds for further step.

Training and Testing

In this step the training and testing process is done. The extracted features are inserted as input here and they get tested and matched with the images in database.

II. LITERATURE SURVEY

To control the unauthorized accessing, recognizing the old images and recognize the criminals sketch etc. there is a need of efficient face recognition system.

Prachi Agarwal and Naveen Prakash et al.[2] gives a modular approach in which face recognition is done with the use of multilevel Haar Wavelet Transform, improved PCA and enhanced back propagation neural network. In this system, the author says on an input image first of all multilevel decomposition using Haar Wavelet Transform is applied then an improved version of PCA is applied for feature extraction. Then, output of this is kept and a copy of this output is going through Back Propagation Neural Network training algorithm. Output of this and test face feature go through Back Propagation Neural Network enhanced testing algorithm. And after that, we get the final result of matching.

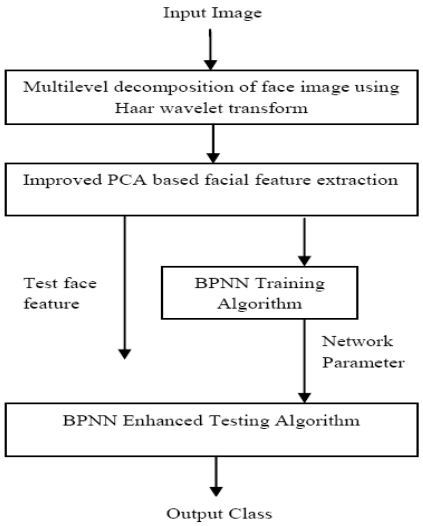

Figure 1 : Face Recognition system by Haar wavelet, Improved PCA and Enhanced BPNN

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Xiaoguang Lu and Anil K. Jain et al.[4] proposed a face recognition system for 2.5D face image to 3D face image using rigid and non-rigid registration. The rigid registration is achieved by Iterative Closest Point. The Thin Plate Spline (TPS) model is applied to estimate the deformation.

Displacement vector field, which is used to represent the non-rigid deformation. For the purpose of face matching, the non-rigid deformations from different sources are identified, which is formulated as a two-class classification problem: intra-subject deformation vs. inter-subject deformation? The deformation classification results are integrated with the matching distances to make the final decision.

Jyoti S. Nayak and Indiramma M et al. [5] proposed a self-PCA based age variant face recognition system. They take area around the eyes as input because this area is considered as more stable part of face as compare to others. The system works on following pattern:

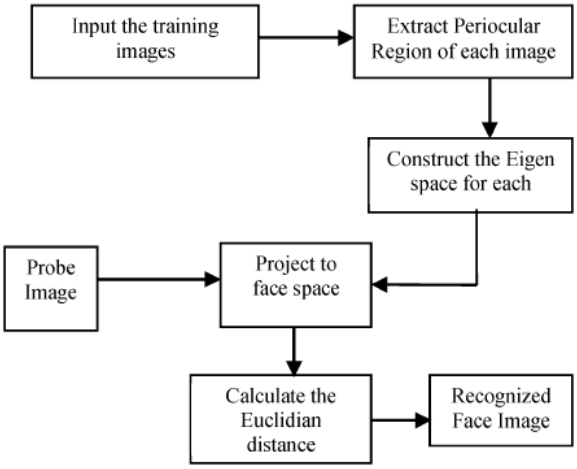

Figure 2 : Age variant Face recognition system using self-PCA

Unsang Park, Yiying Tong and Anil K. Jain et al.[6] proposed a 3D aging modeling technique and shows how it can be used to compensate for the age variations to improve the face recognition performance. The aging modeling technique adapts view-invariant 3D face models to the given 2D face aging database. Age simulation example is shown below:

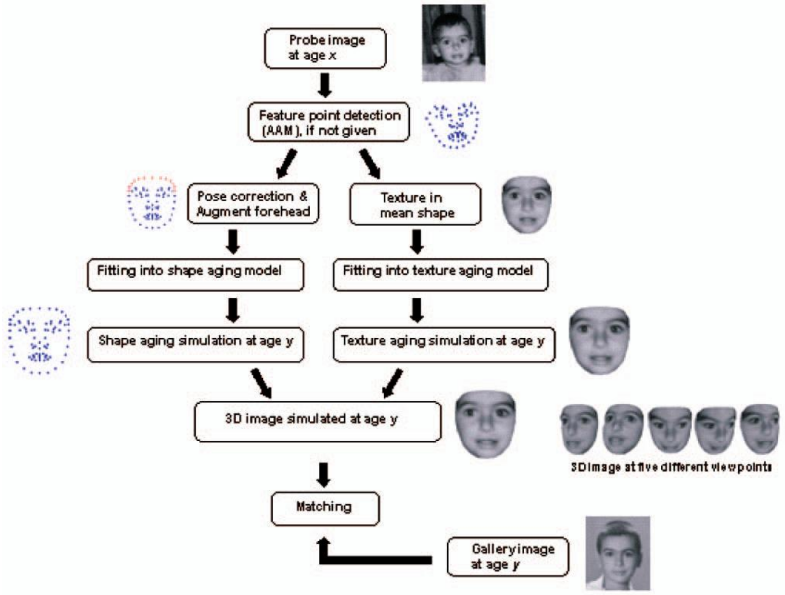

Figure 3 : Age Simulation

Andreas Lanitis and Chris J. Taylor et al.[7] demonstrate that the performance of automatic face recognition system depends on the age difference of subject between the training and test images. They also demonstrate that automatic age simulation techniques can be used for designing face recognition system, robust to ageing variation. The perceived age of the subject in the training and test images is modified before the training and classification procedures, so that ageing variation is eliminated. Experimental results show that the performance of this face recognition system can be improved significantly, when this approach is adopted.

Ioanna-Ourania and George A. Tsihrintzis[13] gives an improved Neural-Network based Face detection and facial expression classification system in which they firstly use face detection algorithm to determine the face in image and then they use facial expression classification module to determine the expression.

R.A. Patil, Vineet Sahula and A. S. Mandal[14] gives a review for automatic recognition of facial expression in image sequences in which they discuss the previous work done to solve the problem.

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Padmaja Vijay Kumar, M.N. Giri Prasad and Padmaja K.V[15] used Local Binary patterns to determine the recognition rate for images which are stored in database. In this, they compressed the images stored in the database at different levels and each level is tested for probe image.

Nisha soni, Mahendra kumar and Garima mathur[16] gives a solution for face recognition by using Self-Organizing Map(SOM) Neural network. This technique is an image based approach, using discrete wavelet transform(DWT), discrete cosine transform(DCT) and sobel edge detection.

III. PROBLEM STATEMENT

After doing literature survey, we are able to understand clearly about what face recognition system is all about. Many authors have their own vision and work related to the same. After reading many theories we have discovered that in face recognition system the most common problem occurs when the images in database are too old for verification.

In real time the problem arises when a person working for an organization for a very long period of time and his latest photograph is not updated in records then the system will not recognize his face.

The same problem arises when any person accidentally or intentionally changes his face and records are not updated according to it.

Another problem arises when any face of almost same size with the authorized person comes in front of scanner in bad light conditions. The system can make mistake to identify him and can give access to the unauthorized person.

IV. PROPOSED APPROACH

For recognition, we are going to use Principal Component Analysis(PCA) and Iterative Closest Point(ICP) for extraction of facial features and match them with already saved faces in our dataset. Principal Component Analysis (PCA) is a statistical dimensionality reduction method [3], produces the optimal linear least-square decomposition of training set. In PCA, the input is training set $t_1, \ldots, t_N$ of N facial images such that the ensemble mean of training set is zero $(\sum_i t_i = 0)$. PCA representation is characterized by set of $N-1$ eigenvectors $(e_1, \ldots, e_{N-1})$ and eigenvalues $(\lambda_1, \ldots, \lambda_{N-1})$.

Iterative Closest Point (ICP) is an algorithm used to minimize the difference between two clouds of points. It is commonly used to reconstruct 2D or 3D surfaces from different scans, to co-register bone model. In ICP algorithm, one point kept fixed and the other point is transformed to best match to the fixed point. The algorithm does the transformation (i.e. translation and rotation) to minimize the distance between two points.

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