AUTOMATIC ATTENDANCE MANAGEMENT SYSTEM USING FACE RECOGNITION

Ibrokhimov Sanjar, Byung-Gook Lee*
*Dept of Computer Engineering, Dongseo University
e-mail : lbg@dongseo.ac.kr

Abstract

This paper is about the biometric attendance management. The automatic attendance management will replace the manual method, which takes a lot of time-consuming and difficult to maintain. There many biometric processes are being used in these days for the offices and factories but face recognition is the best method. In this paper, we are going to describe attendance without human interference. In this method, the camera is fixed in the entrance and it will capture the image, the faces are detected and then it is recognized with the database and finally, the attendance is market. If the employee is marked as absent the message about employee's absent is sent to the office manager. There are various methods for comparing faces, eigenface is one of them. The face space is defined by the "eigenfaces", which are the eigenvectors of the set of faces. Recognition is performed by projecting a new image into the subspace spanned by the eigenfaces ("face space") and then classifying the face by comparing its position in face space with the positions of known individuals

1. Introduction

Maintenance of employee's attendance is the most difficult task in various places like factories, offices and construction places. Every company has its own method of taking attendance such attendance sheet or biometric methods. But these methods consumes a lot of time. Mostly employee attendance is taken by the help of an attendance sheet given to the manager of the company. This takes long time and work to control attendance system for managers. Calculation of consolidated attendance is another major task which may cause manual errors. In some other cases, the attendance sheet may become lost or stolen by some of the employees. To overcome such troubles we are in need of automated attendance management system.

This system uses the face recognition approach for the attendance of workers without intervention. The approach transforms face images into a small set of characteristic feature images, called eigenfaces", which are the principal components of the initial training set of face images. Recognition is performed by projecting a new image into the subspace spanned by the eigenfaces ("face space") and then classifying the face by comparing its position in face space with the positions of known individuals.[2]

2. SYSTEM OVERVIEW

The system uses the eigenface approach for face recognition. The method analyzes and computes eigenfaces [1] which are faces composed of eigenvectors. The method also compares the eigenfaces to identify the presence of a person(face) and its identity. The method involves the following steps [2].As a first step the system should be initialized with a set of training faces. Next, when a face is detected the eigenface is calculated for that face. Then, the system compares the eigenvectors of the current face and the stored face image and determines whether the face is identified or not. The final step(optional) is that if the unknown face is detected repeatedly the system may learn to recognize it.

A. Process

The worker needs to be in front of a camera at a minimum distance of 60cm.The system will detect the image of the worker according to PCA [3], converts it into a gray scale and stores it in an xml file. When the worker reappears before the camera, faces are recognized by comparing the eigenfaces of current and stored images. Then the names of the detected faces are stored in Database.

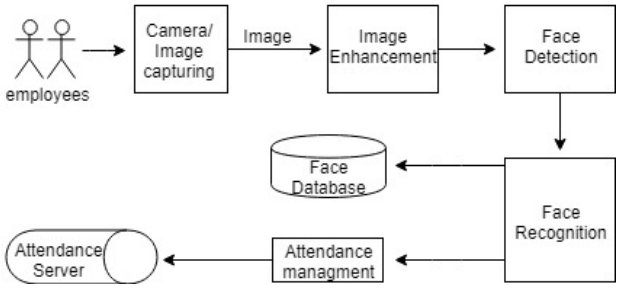

Fig. 1. Overview of the system

B. Eigenface Approach

Eigenfaces is the name given to a set of eigenvectors when they are used in the computer vision problem of human face recognition.[4] The approach of using eigenfaces for recognition was developed by Sirovich and Kirby (1987) and used by Matthew Turk and Alex Pentland in face classification.[5] The eigenvectors are derived from the covariance matrix of the probability distribution over the high-dimensional vector space of face images. The eigenfaces themselves form a basis set of all images used to construct the covariance matrix. This produces dimension reduction by allowing the smaller set of basis images to represent the original training images. Classification can be achieved by comparing how faces are represented by the basis set.

Eigenface approach is used, it transforms faces into a set of characteristics, eigenfaces which is considered as training data. Recognition is done by projecting a new image in the eigenface subspace, in which person is classified by comparing its position in eigenface space with the position of known individuals. Set of eigenvectors are known as eigenvectors if they are used for human face recognition. The covariance matrix of the probability distribution is used for derivation of eigenvectors. To construct the covariance matrix, eigenface form a basic set of all images. To represent the original training images, it produces dimension reduction by allowing the smaller set of basis images Classification can

be achieved by comparing how faces are represented by the basis set.[6]

3. SYSTEM ARCHITECTURE

A. Image Acquisition
Captured Images will be acquired by facial-scan technology from camera that captures images in good quality and big resolution.

B. Pre-processing
First Image is cropped from acquired image. Then cropped images are resized to some pixels for face recognition. These resized images are converted from RGB to Gray level.

C. Database (DB)
In this step, pre-processed pictures can be stored on database for further processing.

D. Template Matching
It compares match templates against enrollment templates. In identifying a single individual from a large database, facial scan is not so effective as iris scan. After large-scale facial-scan identification searches, numbers of matches are returned.

E. Face Recognition
For face recognition, it compares selected facial components from the image and database; it verifies a person in image.

F. Face Database Generation
Original face database consists of images of all employees having 5 images per worker. With change in intensity of light and various facial expressions, the original database images are acquired at various interval of time.

4. COMPUTING THE EIGENFACES

Before generating eigenfaces, face images are normalized to line up the eyes and mouths, then all resampled at the same pixel resolution. Eigenfaces are then extracted out of the image data by means of principal component analysis (PCA) in the following manner: Given *M* face images with the size of $h \times w$, each image is transformed into a vector of size $D(= hw)$ and placed into the set $\{\Gamma_1, \Gamma_2, \cdots, \Gamma_M\}$. The face images should be appropriately scaled and aligned, and the backgrounds (and possibly non-face areas such as hair and neck) should be constant or removed. Each face differs from the average by the vector $\Phi_i = \Gamma_i - \Psi$, where the average face is defined by $\Psi = \frac{1}{M}\sum_{i=1}^{M}\Gamma_i$. The covariance matrix $\mathbf{C} \in \mathrm{R}^{\mathrm{D}\times\mathrm{D}}$ is defined as

$$\mathrm{C} = \frac{1}{M}\sum_{i=1}^{M}\Phi_i\Phi_i = \mathrm{AA}, \qquad (1)$$

where $A = \{\Phi_1, \Phi_2, \cdots, \Phi_M\} \epsilon R^{D\times M}$.

5. ALGORITHM

In this project we used Principal component analysis for data analysis. Principal component analysis (PCA) is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables (entities each of which takes on various numerical values) into a set of values of linearly uncorrelated variables called principal components.[7]

A. Steps
1. Reduction of data into single vector.
2. Calculate mean of the data.
3. Calculate the covariance matrix.
4. Compute the eigenvalues and eigenvectors of the covariance matrix.
5. Forming a feature vector and Choosing component.
6. Acquiring new data coordinates.
7. Approximation.

6. CONCLUSION

The automated company attendance system using human face recognition method works more efficient. Traditional method, which takes a lot of time and hard to maintain can be replaced by the automatic attendance management. Certainly, it is improved for better result particularly by paying attention in feature extraction or recognition process. This improvement may help to company as automated attendance system cannot be faked and stolen by worker which makes this method more secured.

7. ACKNOWLEDGEMENT

This work was supported by Institute for Information and Communications Technology Promotion (IITP) grant funded by the Korea government (MSIT) (No.2018-0-00245, Development of prevention technology against AI dysfunction induced by deception attack)

REFERENCES

[1] M. H. Yang, N. Ahuja, and D. Kriegmao, “Face recognition using kernel eigenfaces,” IEEE International Conference on Image Processing, vol. 1, pp. 10-13, Sept. 2000

[2] M. A. Turk and A. P. Pentland, “Face Recognition Using Eigenfaces,” in Proc. IEEE Conference on Computer Vision and Pattern Recognition, pp. 586–591. 1991.

[3] J. Zhu and Y. L. Yu, “Face Recognition with Eigenfaces,” IEEE International Conference on Industrial Technology, pp. 434 -438, Dec.1994.

[4] L. Sirovich; M. Kirby (1987). "Low-dimensional procedure for the characterization of human faces". Journal of the Optical Society of America A. 4 (3): 519–524. doi:10.1364/JOSAA.4.000519.

[5] M. Kirby; L. Sirovich (1990). "Application of the Karhunen-Loeve procedure for the characterization of human faces". IEEE Transactions on Pattern Analysis and Machine Intelligence. 12 (1): 103–108. doi:10.1109/34.41390.

[6] International Journal on Recent and Innovation Trends in Computing and Communication. Volume 4, Issue 12. “Automatic Attendance Using Face Recognition” by Ms. Pooja Humble

[7]Principal Component Analysis https://en.wikipedia.org/wiki/Principal_component_analysis

[8] B. Yang, J. Yan, Z. Lei, and S. Z. Li, “Aggregate channel eatures for multi-view face detection,” in IEEE International Joint Conference on Biometrics, 2014, pp. 1-8.