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Assisting Blind Using Facial Recognition and Voice Assistance

Abhishek Singh[1], Anish Raj[2], Apoorva Chaudhary[3], Yashil Handa[4]
Student[1],[2], Assistant professor[3,4]
Amity University, Haryana, India
Abhisheksinghbandral2@gmail.com[1], rajanish4@gmail.com[2], apoorvadhaka07@gmail.com[3], yashil.handa@gmail.com[4]

Abstract: The paper aims at developing a system that would be able to recognize the face and hence play the recorded voice of the recognized face (e.g. Playing name of the person recognized) using speaker/headset and voice module. The paper shows the usage of an electronic gadget in which a software is programmed, the usage of such kinds of product have increased many folds in the past decade because of the advancement in electronic technology as well as in the field of software development. We have used PCA technology with implementation of eigenfacesto recognize faces of different individuals. MATLAB was predominantly used to apply this algorithm. A voice module connected to Arduino uno plays the recorded voice of the identified individual. This could be of further importance for users who are blind, so that they are informed of the person at their door.

Keywords- *Biometrics, Eigenfaces, Feature extraction, Neural networks, Principal component analysis, Euclidean distance, Database*

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1. Introduction:

Humans typically use faces to acknowledge people and advancements in computing capability over the past few decades now alter similar recognitions mechanically. Early face recognition algorithms used easy geometric models, but the recognition process has now matured into a science of sophisticated mathematical representations and matching processes. Significant improvements and technological advancements in the past decade has brought face recognition technology into the spotlight. Face recognition can be used for both verification and identification (open-set and closed-set).[17]

Biometrics is a popular field of bio - engineering which has taken strides in advancements; it is the auto- mated strategy of identifying a person based on a physiological or behavioral characteristic. There are currently immense number of biometric systems such as signature, finger prints, voice, iris, retina, hand geometry, ear geometry, and face. Within such systems, facial recognition systems apparently seem to be one of the most universal, efficient, and accessible.

Biometric face recognition, otherwise known as Automatic Face Recognition (AFR), is a particularly attractive biometric approach, since it focuses on the same identifier that humans use primarily to distinguish one person from another: their "faces". One of its main goals is the understanding of the complex human visual system and the knowledge of how humans represent faces in order to discriminate different identities with high accuracy.[10],[11]

Now a days, due to rising security concerns and hectic life one needs to monitor the person entering in its home, offices, protect its important belongings or to safeguard itself from the day to day increasing crime thus making the project a much-needed development in today's world.

The face recognition problem can be divided into two main stages: face verification (or authentication), and face identification (or recognition).

The detection stage is the first step in identifying an individual's face; it consists of identifying and searching a face in an image. [12]

The recognition stage constitutes the second stage; it includes feature extraction, where necessary info for discrimination is saved, and also the matching, wherever the recognition result's given with the help of a face information. Primary face recognition ways are projected within the following paragraphs. In the immense literature on the subject there are completely different classifications of the present techniques. The subsequent is one amongst the potential high-level classification:

- Holistic Methods: the full face image is employed in the form of raw input to the recognition system. E.g. the famous PCA-based technique put forth bySirovich and Kirby, succeeded by Turk and Pentland.

- Native Feature-based Methods: Local features are extracted, like eyes, nose and mouth. Their locations and local statistics (appearance) are the input to the

identification stage. An example of this methodology is Elastic Bunch Graph Matching (EBGM).[18]

Although progress in face recognition has been encouraging, the task has additionally proven to be a tough endeavor.

1.1 FACE DETECTION APPROACHES:

Some of the most important face detection ways are mentioned here.

1.1.1 Knowledge dependent methods are developed on the foundations derived from the developer's information of human faces. Drawback during this approach resides in translating human data into well needed rules.

Knowledge-dependent techniques used are facial features, template Matching and skin colour are accustomed to find eyes, mouth, nose or alternative facial features discover the faces. Skin colour or facial features are accustomed to notice eyes, nose, mouth and different facial features to discover the face. Color of the skin is dissimilar to different colours and it is distinctive. Its characteristics don't alter with relation to creating variation. Face has distinctive features to differentiate from alternative objects and so, a pattern may be generated to visualize and discover faces. Facial features are essential data for individual faces and standardized pictures are often generated in sequences.[1]

1.1.2 Featured-based methods: Invariant features of faces are used for collecting data regarding texture, skin color. However features from such algorithmic rule may be severely corrupted owing to illumination, noise and occlusion.[7]

1.1.3 Template matching: Input image is compared with predefined face model. However the performance here suffers attributable to variations in scale, pose and shape.

1.1.4 Image-Based strategies used training ways to create decision between face and non-face pictures. These strategies used multiple pictures of face and non-face and trained to enhance the accurateness of the system. Eigen Face, Neural Networks and SVM are completely different strategies that are used face detection.[9]

1.1.5 Appearance-based method: In model matching methods, the templates are predefined by specialists. Whereas, the templates in appearance dependent methods are learned from examples in pictures. Applied mathematics analysis and machine learning techniques are often accustomed to notice the relevant characteristics of face and non-face pictures.[1]

1.2 FACE IDENTIFICATION:

Face identification is performed at the subordinate-level. Here, in this same level, a new face is set to find differences and similarities with face models stored in a database and later classified to a known person's ID if a corresponding result is found. The performance of face identification is affected by several factors: scale, pose, illumination, facial expression, and disguise.

The scale of a face can be handled by a rescaling process. In eigenface approach, the scaling factor can be determined by multiple trials. The idea is to use multiscale eigenfaces, in which a test face image is compared with eigenfaces at a number of scales. In such a situation, the picture will appear to be close to the face space of only the most similar scaled eigen-faces. Equivalently, we can scale the test image to multiple sizes and use the scaling factor that results in the smallest distance to face space.[15]

Different poses often result from tilting of the head or change in the viewpoint. Various recognition mathematical algorithms showcase different sensitivities to degrees of variation in pose.

To identify faces in different illuminance conditions is a challenging problem for face recognition. A particular individual, characteristic of almost similar facial expression, and viewed from the same point of view, could appear to be drastically different as the lighting condition alter. In recent years, two approaches, the fisher face space approach and the illumination subspace approach, have been proposed to handle different lighting conditions. The fisher face method projects face images onto a three-dimensional linear subspace based on Fisher's Linear Discriminant in an effort to maximize between-class scatter while minimize within-class scatter. The illumination subspace method constructs an illumination cone of a face from a set of images taken under unknown lighting conditions. This latter approach is reported to perform significantly better especially for extreme illumination.[5],[8]

Different from the effect of scale, pose, and illumination, facial expression can greatly change the geometry of a face. Attempts have been made in computer graphics to model the facial expressions from a muscular point of view.Disguise is another problem encountered by face recognition in practice.[6]

2. Methodology:

Face recognition system generally recognizes the faces form single source, either from still images or recoded videos.[16] In this work, we can recognize the face image from multiple

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1327 – 1331

sources like still images, webcams and recorded videos. Face detection unit can detect single face as well as multiple faces detect face from different sources. Face recognition module matches up the face contender with face images which are stored in the database and recognize the face contender.

We have incorporated PCA with eigenface algorithm in this system. It is one of the easiest techniques available.

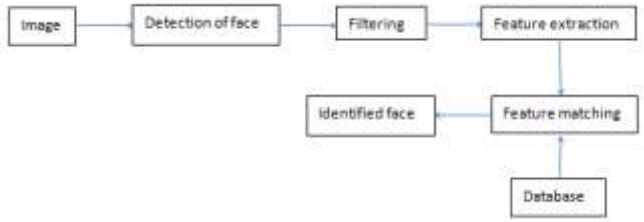

Fig: Face Recognition Flow Chart

Eigenfaces in facial recognition:

Eigenfaces are a set of eigenvectors that are employed in the computer vision applications of facial recognition techniques.[2] The strategy of using eigenfaces for identification of faces was developed by Sirovich and Kirby (1987) and used by Matthew Turk and Alex Pentland in face classification. The eigenvectors are obtained from a covariance matrix pertaining to a joint probability distribution over a high-dimensional vector space of facial pictures. The eigenfaces themselves form a basis set of all images used to construct the covariance matrix. Itresults in reduction of dimension by giving permission to the smaller set of basis images to showcase the original training pictures. Classification can be achieved by comparing how faces are represented by the basis set.[4]

Facial recognition was the source of motivation behind the creation of eigenfaces. Thus, eigenfaces have several pros over other techniques available in the market, e.g. the system's speed and efficiency. As eigenface is primarily a dimension reduction method, a system can represent many subjects with a relatively small set of data. As a recognition system of faces, it doesn't vary to large reductions in image sizing, but it starts to fail drastically when the variations between the viewed images and the probed images is large.[14]

To recognise faces, gallery images, those seen by the system, are saved as collections of weights describing the contribution each eigenface has to that image. Whenever a new facial image is provided to the recognition system for classification, its own weights are calculated by projecting the picture onto the collection of data ofeigenfaces. This provides a set of weights describing the probe face. These weights are then classified against all weights in the gallery set to find the closest match. A nearest neighbour method is a simple approach for finding the Euclidean distance between two vectors, where the minimum can be classified as the closest subject.[3],[13]

3. Components:

3.1 Software:

1. MATLAB
2. Arduino IDE
3. Audacity
4. WT588D Software

3.2 Hardware:

1. Personal computer with web cam
2. Arduino uno board
3. WT588D voice module
4. Speaker/headset
5. LED

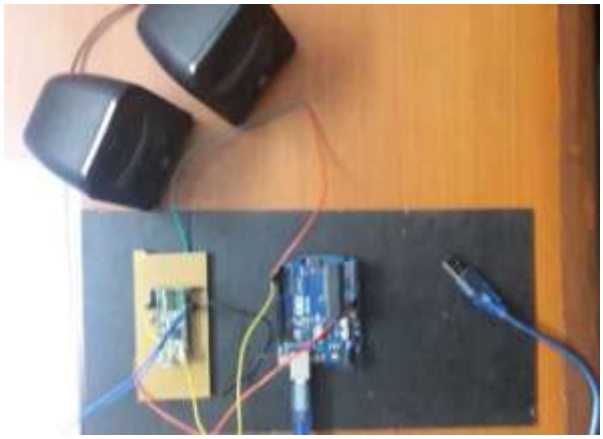

Fig. Hardware components

3.3 Block diagram:

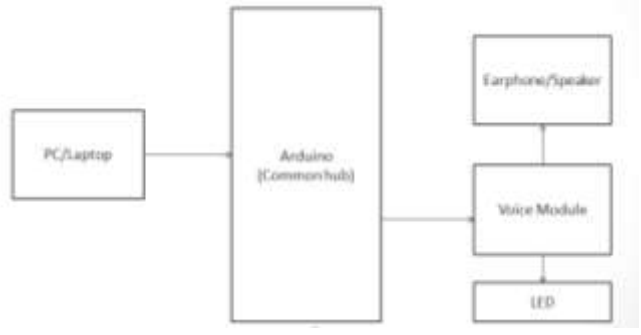

Fig. Block diagram of the system incorporated

The PC-Arduino interface is established using MATLAB. MATLAB gives the command for playing a particular voice message to Arduino, in turn the Arduino has been coded to execute the voice module to play a particular voice playback when triggered by face recognised by MATLAB. The voice messages are added to the voice module by connecting it to a PC and using audacity and WT588D software.

3.4 Procedure:

Firstly a set of face images are added in the database. Secondly the database is trained with the feeded images.When a face is recognised by webcam, MATLAB shows the nearest face match.Then MATLAB sends command to Arduino to execute its program for voice playbackArduino sends the command to the voice module to play the voice file corresponding to the face recognised.

4. Results:

Fig. Face recognition

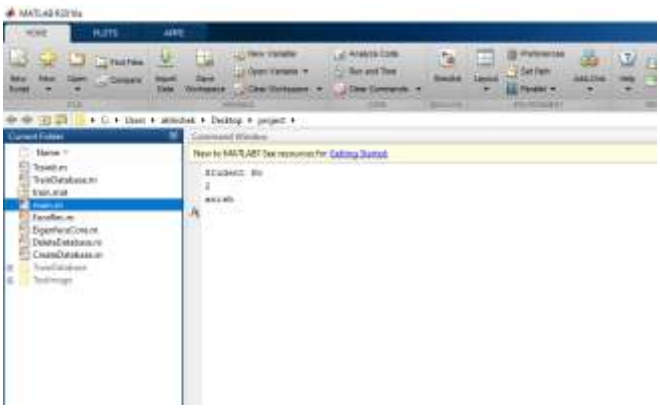

Fig. Result in command window(MATLAB)

The MATLAB program was trained with faces of 5 different individuals. It yielded results with 70 percent efficiency. As the number of individuals increased the efficiency went down and hence the voice feedback also became inconsistent.

5. Conclusion:

Eigenface algorithm is obsolete, but is speedy and easy to execute and learn. Since the efficiency went down with increasing number of individual face images in the training database, it can be inferred that PCA with eigenfaces alone cannot be used for wider commercial purposes. More practical study is required to combine different approaches to obtain high efficiency with higher database range.

References:

[1] Bhensle, A. & Raja, R. (2017). An Efficient Face Recognition using PCA and Euclidean Distance Classification. International Journal of Computer Science and Mobile Computing.[Online].3 (6). pp. 407-410. Available from: http://www.ijcsmc.com. [Accessed: 5 February 2017].

[2] L. Sirovich; M. Kirby (1987)."Low-dimensional procedure for the characterization of human faces". Journal of the Optical Society of America A.

[3] M. Turk; A. Pentland (1991). "Face recognition using eigenfaces" (PDF). Proc. IEEE Conference on Computer Vision and Pattern Recognition.

[4] 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.

[5] Belhumeur, P., Hespanha, J. &Kriegman, D. (1997). Eigenfaces vs. Fisherfaces: recognition using class specific linear projection. IEEE Transactions on Pattern Analysis and Machine Intelligence.

[6] Chellappa, R., Wilson, C. &Sirohey, S. (1995). Human and machine recognition of faces: a survey. Proceedings of the IEEE.[Online].83 (5). pp. 705-741

[7] Emam, S. (2017). Face Detection and Face Recognition with Real-time Training from a Camera. [Online]. 2017. Shervinemami.info. Available from: http://www.shervinemami.info/faceRecognition.html. [Accessed: 13 April 2017].Georghiades,

[8] A., Kriegman, D. &Belhurneur, P. (n.d.). Illumination cones for recognition under variable lighting: faces. Proceedings.1998 IEEE Computer Society Conference on Computer Vision and Pattern Recognition (Cat.No.98CB36231).

[9] He, Y., Zhao, L. & Zou, C. (2006). Face recognition using common faces method. Pattern Recognition.39 (11). pp. 2218-2222.

[10] Introna, L. &Nissenbaum, H. (2017). Facial Recognition Technology: A Survey of Policy and Implementation Issues. 1st Ed. [Online]. New York: The Center for Catastrophe Preparedness & Response.

[11] Jafri, R. &Arabnia, H. (2009). A Survey of Face Recognition Techniques.Journal of Information Processing Systems.[Online].5 (2). pp. 41-68.

[12] jordon, M. (2017). Face Recognition - Introduction. [Online]. 2017.

[13] Luo, M. &Panitchob, Y. (2017). Eigenfaces for Face Recognition.[Online].Min Luo, Department of Biomedical Engineering and YuwapatPanitchob, Department of Electrical & Computer Engineering.

[14] Paul, L. &Sumam, A. (2017). Face Recognition Using Principal Component Analysis Method. International Journal of Advanced Research in Computer Engineering & Technology (IJARCET).Volume 1 (Issue 9). p. 135

[15] Singh, A. & Kumar, S. (2017). Face Recognition Using PCA and Eigen Face Approach. Rourkela: Department of Computer Science and Engineering National Institute of Technology Rourkela

[16] Singh, M. (2017). A Project Report on Automatic Facial Expression Recognition using MATLAB. [Online].Lonere: Department of Electronics and Telecommunication Engineering Dr. BabasahebAmbedkar Technological University.

[17] Subudhi, K. & Mishra, R. (2017). HUMAN FACE DETECTION AND RECOGNITION. Rourkela: Department of Electronics and Communication Engineering National Institute of Technology, Rourkela.

[18] Tarhini, A. (2017). Face Recognition: An Introduction. [Online]. 2017. Ali Tarhini. Available from: https://alitarhini.wordpress.com/2010/12/05/face-recognition-an-introduction/.