A Review on Biometric Recognition Systems using Ear and Face

Ankit Gandhi
Student
NBN Sinhgad School of Engineering, Pune, India

Abhishek Kate
Student
NBN Sinhgad School of Engineering, Pune, India

Nikit Khopade
Student
NBN Sinhgad School of Engineering, Pune, India

Lokesh Naik
Student
NBN Sinhgad School of Engineering, Pune, India

Prof. Mrs. Swati Shirke
Professor
NBN Sinhgad School of Engineering, Pune, India

Abstract

We use various applications in day to day life. But we can never know if any of those applications is stealing data from our desktop. So it is important to know about such activity and take action on this. This causes harm to desktop as well as user. This may turn out to be data loss or private data theft. Biometric authentication using Ear and Face image is new research area. Many unique features of human are explored but not many are used. This project focuses on one such area, that is authentication using ear and face image. While sign up, user will provide user name, password, email id. Also user will register his ear and face image using High Definition camera. In this application, user will be authenticated, using user name, password and ear image captured from camera. In 1st step of log in user will be authenticated based on user name and password. User will capture his ear image and this image will be saved in drive. In 2nd step of user will provide his ear image using High Definition camera, and authentication will be done by matching real time ear image with ear image stored while sign-up, same steps will be performed for face recognition.

Keywords: Data Loss, Biometric Authentication

I. INTRODUCTION

The need for secure and automatic authentication is ever growing. Most of the used biometric systems for authentication is fingerprint and face. But Ear biometric is a novel technique that can be used for authentication. Since ear shape does not change with facial expressions, and most of the times its shape does not change with age[1].

Many people have proposed systems that have ear biometric. Some have concluded that since we match the real time image of ear with the image stored in database, the system may take a lot of time to compare and may become inefficient. This is because the database may have superfluous amounts of stored images, and sequentially comparing the real time image with all of them will be an inefficient process, and the performance of the system will deteriorate. Same is applicable for face recognition.

To overcome this, some systems use hierarchical categorization of images stored in database. This would overcome the problem of performance deterioration caused by comparing the image in hand with all other images in database for recognition i.e doing sequential search.. In this review paper, study of two systems(ear and face recognition) are discussed and their flaws are tried to overcome. Firstly, ear recognition system was proposed by Sayan Maity, *Member, IEEE,* and Mohamed Abdel-Mottaleb, *Fellow,* IEEE [1]. And the secondly face recognition system was proposed by Vitomir ˇ Struc, Janez Kriˇzaj, Simon Dobriˇsek, Faculty of Electrical Engineering, University of Ljubljana, Trˇzaˇska cesta 25, SI-1000 Ljubljana, Slovenia[2]. P S Hanwate and U L Kulkarni proposed a system that uses SIFT algorithm and Edge detection for Content Based Image Retrieval [7].

II. OBJECTIVES

The main goal behind designing a multi-modal biometric system is to create a reliable security system for authentication of people. This way if one of ear or face of a person underwent transformation, still the person can authenticate himself/herself using other.

III. RELATED STUDY

As mentioned earlier the two different system studied are based on ear recognition and face recognition. To understand both the system there is a need to have some knowledge about each of them. Some information is given below.

A. Knowledge about Ear recognition:

The earlier research on ear biometrics used only 2D ear images. But recently, researchers are using 3D or using both 3D and 2D images simultaneously[1]. In [3], Chen and Bhanu proposed a two-step iterative closest point (ICP) based approach to match 3D ear images.

B. Knowledge about Face recognition:

Face recognition is not a novel field, it has already been commercialized and many systems have been using it for years now. This is also a very good way of authenticating, but since face of a person changes with time and age, this can become a little inefficient in long run. To overcome this, the system must take new reference images from people after a certain period of time.

IV. PROPOSED SYSTEM IMPLEMENTATIONS

A. Ear Recognition Based Implementation

Sayan Maity and Mohamed Abdel-Motalleb proposed a system in which 3D features of ear are used[1]. In this firstly an image of a side of face is taken. Then, only the ear part of the image is segmented i.e. selected and cut-out. This is one of the most challenging task of this system, to do segmentation without human intervention[1]. Among various problems of segmentation, on of it is occlusion. Which can occur because of hairs on ear, ear rings etc.

They use Landmark localization technique[5],[6] or tree structured graph[4] for segmentation. After this pre-processing is done. And the 3D features of the ear are measures. And Because of this, it is possible to store ear images in hierarchical structure in database rather than sequential structure. By storing them in hierarchical structure the time of comparison and result generation is reduced exponentially. What the system does, based on the 3D i.e. depth features of the ear image, it categorizes the image accordingly, for example, all the triangular shaped ear's images are categorized in one. This way, when a real time image is captured, and it is found out that it is the ear in image is triangular in shape, then it needs to be compared only to images that are characterised under triangular shape category. Thus the time complexity is reduced.

B. Face Recognition Based Implementation

Vitomir Struc, Janez Kriˇzaj, Simon Dobriˇsek proposed a framework system for facial recognition[2]. Facial recognition is difficult task, this is because the captured images of faces sometimes are partially occluded, non-frontal, and of low resolution. In this they try to address this problem by presenting a novel framework for face recognition that combines diverse features sets (Gabor features, local binary patterns, local phase quantization features and pixel intensities), probabilistic linear discriminant analysis (PLDA) and data fusion based on linear logistic regression[2]. In this a matching score is generated by comparing the captured image and the images stored in database. The PLDA algorithm is applied independently to four sets of same images stored in database[2]. Then these results are combined to give out a single matching score for the pair.

V. EXPERIMENTATION AND RESULTS

The experimentation results of Ear recognition system proposed by Sayan Maity and Mohamed Abdel-Motalleb[1] are:

The experimentation results of Face recognition system proposed by Vitomir Struc, Janez Kriˇzaj, Simon Dobriˇsek are[2]:

VI. PROPOSED SYSTEM BASED ON COMPARISONS

From the study we found that under some situations both the systems are not up to the mark. In 3D ear image based recognition system, the computations required to measure depth featured of ear are complex and may take a lot of time if executed on low power systems. Also a major drawback is if the person's ear shape undergoes transformation, for ex. Because of some accident, the person will not be able to authenticate himself through the system unless his other ear image is updated, which could be done only through system administrator. This can be inconvenient sometimes.

And in the system , based on face recognition, since a human's facial features can change with time i.e. wrinkles are formed, if a person becomes fat or becomes slim, that too is reflected in face. In the long run this not efficient. This system requires taking reference images from people after certain period of time. Also if a person's face is changed for some reason, he/she cannot authenticate him/herself. This can be inconvenient.

According to a study, on comparing both the systems, the outcomes were not satisfactory in some conditions therefore a new Hybrid system is suggested by combining both the systems into one. Instead of using 3D features of ear in ear based recognition system, we can use the patter inside the pinna of ear and the shape of the ear for comparison, since it is does not require quite complex operations, this way the system can be used on low power systems.. And face recognition also can be added to the same system. So even if a person cant authenticate himself/herself through one feature, he/she can authenticate through another feature, eliminating the inconveniency would have caused had there been only one recognition system.

VII. ARCHITECTURAL FLOW

Following Figure shows the architectural flow of hybrid System

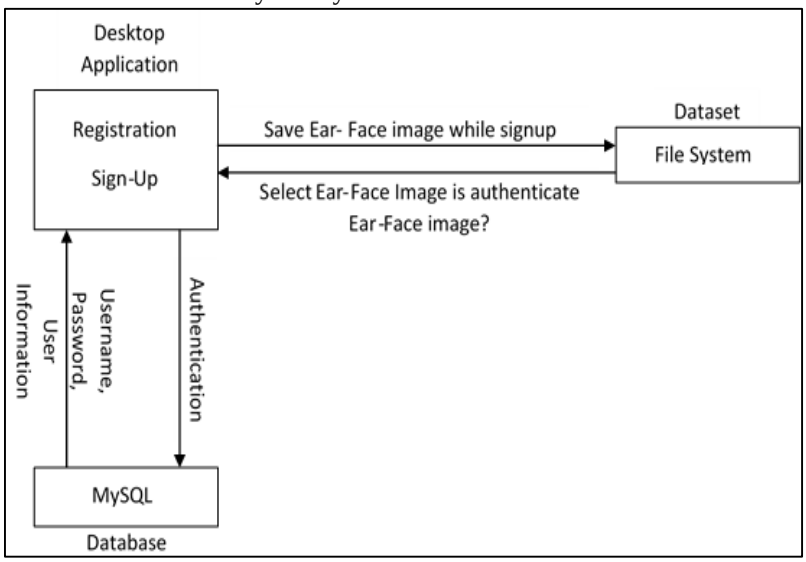

Fig. 4: Architectural Flow of biometric ear and face recognition system

VIII. CONCLUSION

From the study of the biometric recognition system using ear and face we conclude that both the systems gave desired outcomes to some extent. An optimum recognition system can be created by using the suggested hybrid system.

IX. FUTURE SCOPE

From the development point of view, improvements to the existing system can be made by adding features like, the logs of system can be sent to the system administrator. Also if a system fails to identify a certain person for more than certain number of time, an immediate message is sent to the administrator warning him of a potential security breach.

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