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A Survey on 2-Dimensional Ear Biometric Recognition in Pattern Recognition System

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Abstract: **on various services systems of biometric have been employed, by this easily increase the security of whole system. At the present time, mostly used biometric are fingerprint and face. Developing technology has announced prospective biometric like as vein, hand geometry, lips, palm print, lips and teeth. Conversely, special device required by different biometrics for capturing purpose. Additional cost also added for system implementation. Ear is most popular biometric from many years and having a abundant potential for person identification. Newly, by using normal camera human ear easily captured and it can be mined from surviving profile image. Overall, by using simple camera ear of human is captured, then for identification of ear mostly ear recognition system. Various different methods have been projected to establish system for ear identification. Therefore, in this paper concise, appraised, reviewed and censoriously conversed numerous latest improvements in ear recognition, to catch out the investigation.**

I. INTRODUCTION

In Today's life Biometric Authentication [1] is necessary in various fields like Financial, Commercial, Noncommercial, government, E-commerce [2,3]. Main objective of this is security. The autonomy of ear for recognition [4]. It is another aspect of Biometric Authentication. Biometric is divided into 2 parts [5]:

1. Behavioral Biometric - It includes 2 type of information. First-Cards, Badges, Keys but these can be lost by people. Second is Password, Personal Identification Number (PIN), Knowledge these are forgotten by the people and it can't be easily captured by and camera or any device form far distance [6].

2. Physical Biometric – It contain such as fingerprint, ear, face, iris, retina, etc. It can be easily captured and these give the exact matching and correct information. For last decade ear is attractive biometric. Ear is most commonly used Biometric in Military. Ear has a several parts that are mainly used for matching purpose as shown in figure1.

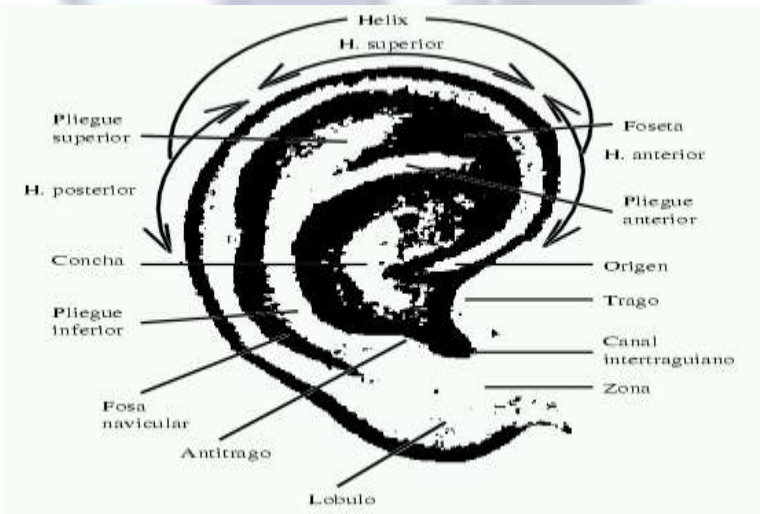

Figure 1: Ear image with parts name

When using ear as for biometric authentication contains several advantages [7-9] such as:

- It can be easily captured from long distance [7].
- It has a unique property that it remains uniformed lifetime after four years of birth [8, 9].
- In our day to day life most important factor that affects is 'time consumption'. Here we are using capturing and scanning technique is very efficient in favor of less Time consumption. As area under observation for ear is lesser in comparison to Face.
- Ear has very complex structure so various feature points extracted for matching.
- Shape of Ear not changed when facial expression generated like smiling, laughing, shouting. It remains intact whenever facial gesture change[15].
- For an individual, a pair of ear is different in contrast both the ear of a single individual are different .its natural factor that ears vary from person to person. Different person have different ear and single person have a different ear like right and left year is different.
- One more crucial thing to be always kept in mind is 'Economic factor'. Ear biometric recognition support as it is cheaper rather than fingerprint, DNA, iris recognition because these thing demands more precise instruments and technical devices. so we can say less cost required for the ear recognition[10].

A biometric system generally consider in 2 parts, one is enrollment process and another is verification and identification process [11] .feature extraction is main step in this because result affected by this step. Different factor affecting accuracy of ear recognition is sometime solved by using masking [10].generally ear images are manually cropped [8, 13-14] to eradicate some segmentation and cropping problem [12].

II. EAR RECOGNITION PROCESS

This process is followed in various steps such as:

1. Image Acquisition: Images can be taken by using different quality camera and make the whole database also with considering environment conditions like light, darkness, and brightness. Image should not either dark/bright or noisy and sharp. For the quality improvement of image specific method are required.

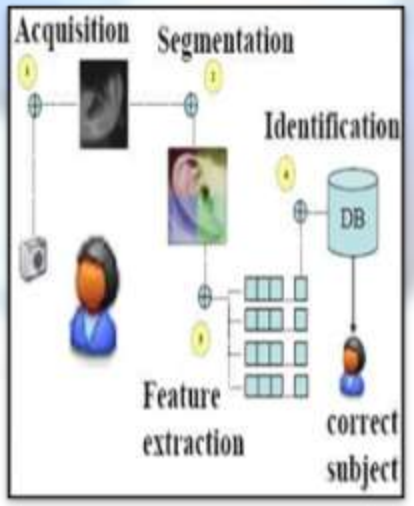

Figure 2: Ear recognition steps

2. Image Preprocessing: After selecting images we need to prepare database of same size images so manually or automatically crop the ear image from the side face image. After that colored images converted into gray scale images. Here we have done with edge detection and binarization and crop and resize.
3. Feature extraction: It is extremely important step is while dealing with problems. So we need to extract the flexible and robust feature to tackle such problems.
4. Classification & identification: After the feature selection and extraction the result of process are sent to the classifier. Result of classifier helps to compare accuracy rate, testing and training time and classification time of new feature extraction technique. After classification matching process followed that after decision taken.

Ear can be distinguish from background clutter and identify when partly occluded by ear-ring, hair, hat or other things .some different type of problems shown in figure 3:

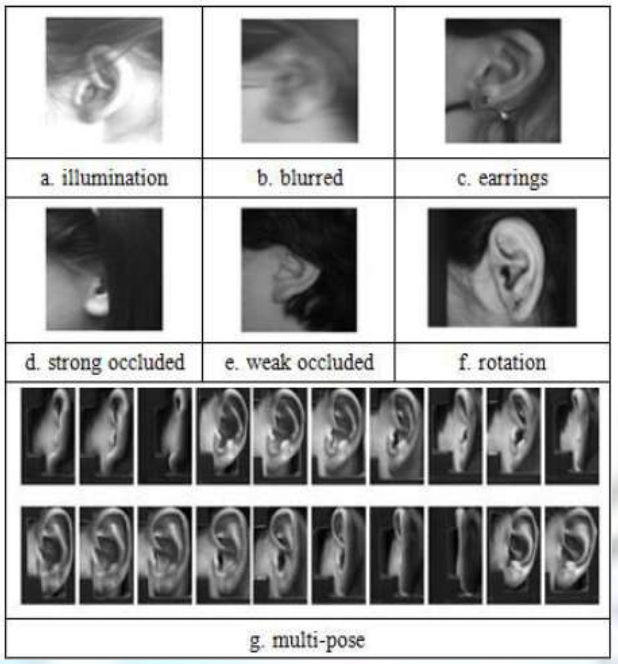

Figure 3: Occlusion problem with ear

II. OVERVIEW OF EAR BIOMETRIC RECOGNITION

In today's research ear biometric is interesting topic because ear has a different characteristics which shown in above topics. Two ways can be used to access the ear image .first, taking whole ear as single unit (when image is free from occlusion).second, means of segmenting the picture to overcome multi-pose and occlusion both problems.

1. Whole ear recognition: ear is first scooped out from side face image is presented in survey conducted by Kisku [15]. Three ways to analysis whole ear as follows :

a. Geometry based: In this CCM (Concentric Circle Method) ear detection [16].center of mass of ear edges is taken to be center point. The concentric circle is crested according to chosen center point with predefined radii. These auxiliary circles will coincide with edges of ear. Finally these interaction points are desired to calculate CCM as they include numerous details like radii, distance, no of interactions. Shailaja & Gupta [20] also described with threshold value.

b. Statistical based: ear image is treated as matrix and with that matrix image each component is individually analyzed and investigated. This preserves the uniqueness of feature. PCA with ear recognition developed by chang et al[17]. It includes tree type of variation like lighting, day, pose variant. Segmentation not used in this work.by using this method around 72% recognition rate obtained. For this method high cost for computation needed.

c. Transformation Based: Kumar and Wu [18] not use segmentation for the cropping of ear part.in this publicly database is used in which no multi-pose problems. Occlusion problem not taken and Gabor filter is also important but high computation cost required

2. Ear recognition by using different parts: the problems which are arise by occlusion like hair, ear-ring etc. can be avoided by this segmenting of the ear. Collaborative ear image in rectangular form with tiny window shown by Nanni and Lumini[19]. On every window Gabor filter is implemented. To minimize information about window Laplacian is implemented .Overlapped windows consumes much time. Laplacian that diminishes tremendous data that laid to bad recognition. Thus Gabor filter enhanced the burden of entire system.

III. CONCLUSIONS AND FUTURE WORKS

In this paper we are discuss about the version stats problems and this proposed solutions. Different recognition rate are shown in table I. Future works is that combing the various techniques and try to get more recognition rate with removing the occlusion problems.

Ref.	Method	Acc. (%)
Shailaja, 2007 [20]	max-line	77
Chang et al.[17]	PCA	72
Nanni & Lumini, 2009 [19]	Gabor + Binary	98.5
Kumar & Wu, 2011 [18]	Gabor	95.93
Arbab-Zavar & Nixon,2011 [8]	Wavelet	68.9

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