A Survey Report on Ear Biometric

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Abstract **:Ear biometric system refers to an automatic verification system of a person based on some specific biometric features derived from their physiological or behavioural characteristics. Ear is a new comer in aspects of biometric recognition technique and has now reached the adolescence of its development towards a reliable biometric. In this paper, some of the obstructions in the field of ear biometric will be presented among which some are worked out and few are yet to be solved.**

Keywords**: Biometric, Identification, Ear, Recognition.**

I.INTRODUCTION

Biometric is the science of identifying or verifying the identity of an individual and it has the capability to reliably distinguish between an authorised person and a phoney. Nowadays, there are numerous technique (password, pins etc) to classify and verify the identity of a person. Biometric, offers much higher authenticity than the traditional methods. An ideal biometric must be universal, unique, permanent and collectable. Ear biometric has advantages over the other recognition technologies since its structure is not changing during the lifetime of an adult and is unaffected by facial expression unlike other biometrics (face, eyes etc).

The mushrooming of human ear as a biometric for individual identification was recognised and promoted by French Criminologist Alphonse Bertillon [1] in 1890. Next an anthropometric technique of passive identification based on ear biometric was developed by A. Iannarelli [2] in 1989. Burge and Burger [3] were among the first to investigate the ear's prospective as the biometric using graph matching technique on a Voronoi diagram of the curves.

II.PROBLEMS IN EAR BIOMETRIC

A. Occlusion by Hair

One of the stumbling block of ear biometric is that, it may not be used if the subject's ear is covered by hair shown in (fig 1). This problem arises during passive identification since no assistance is provided for the subject as in case of active identification

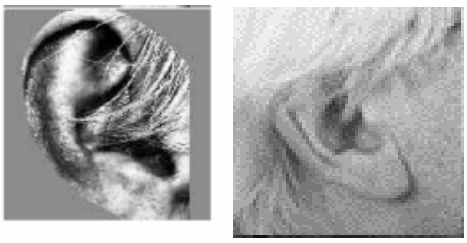

Fig 1 Ear occluted by hair

This problem can be resolved in case of partial occlusion. If the subject's ear is completely covered by hair then there is no possibility of identification using ear biometric. In case the ear is partially occluded by hair it is possible to distinguish the hair and exclude it out of the image.

A thermogram image is one in which the surface heat (i.i., infrared light) of the subject's ear is used to form an image. 7.3.1 is a thermogram of the external ear whereas the counter-part i.e. the subject's hair in case has an ambient temperature between 27.2 and 29.7 degree Celsius, while the pinna (i.e., the external anatomy of the ear ranges from 30.0 to 37.2 degree Celsius. Removing partially occluding hair is done by segmenting out the low temperature areas which lie within the pinna. The Meatus (i.e., the passage leading into the inner ear) of the ear is easily localizable using the thermogram imagery. If subject's ear is visible in a profile image, then the Meatus will be the hottest part of the image, with an expected 8 degree Celsius temperature differential between it and the surrounding hair. In Fig 1.2 the Meatus is the clearly visible section in the temperature range of 34.8 to 37.2 degree celcius. By searching for this high temperature , it is possible to detect and localize ear using thermogram.

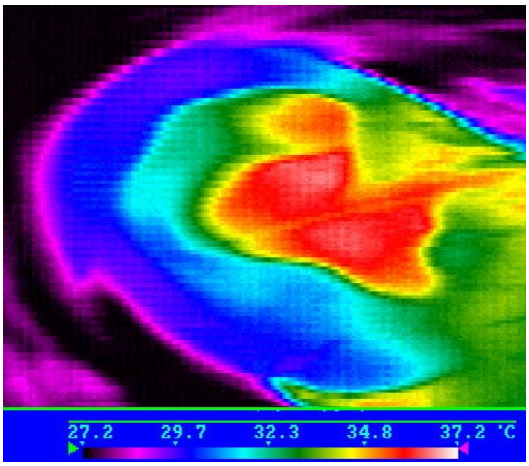

Fig 2. Thermogram of an ear

B. Ear Recognition problem due to invariance in illumination

A biometric based security system is expected to fulfil user's demand such as low error rate, high security levels, testing for liveliness of the subject, possibility of fake detection etc. Most of ear recognition techniques fail to perform satisfactory in presence of varying illumination.

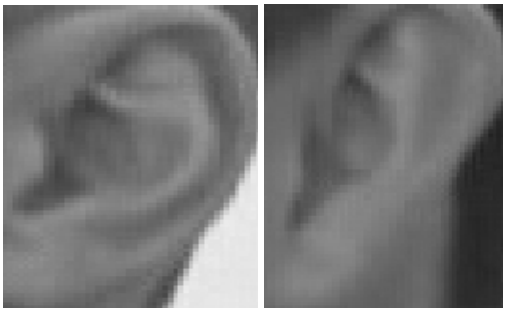

Fig 3. Variation in illumination

To deal with this problem, an ear image is enhanced using three image enhancement technique applied in parallel. SURF (Speeded Up Robust Feature Transform)[5] feature extractor is used on each enhanced image to extract local features. A multi-matcher system is trained to combine the information extracted from each enhanced image. This technique is found to be robust to illumination changes and work well even when ear image are not properly registered.

1 Image Enhancement

The three image enhancement technique Adaptive histogram equalization, Non-Local means filter, Steerable Gaussian filter were used.

a) Adaptive Histogram Equalization :

It improve the contrast of an image. It divides an image into multiple non-overlapping tiles (regions) and performs histogram equalization for each one individually.

b) Non-Local Means Filter :

In this image enhancement is done by using image denoising . The algorithm is based on the fact that for every small window of the image, several similar windows can be found in the image and all of these windows can be exploited to denoise the image.

c) Steerable Gaussian Filter :

These filters are normally used for early vision and image processing tasks such as edge detection etc.

This technique is be used to produce illumination invariant representation of an image,

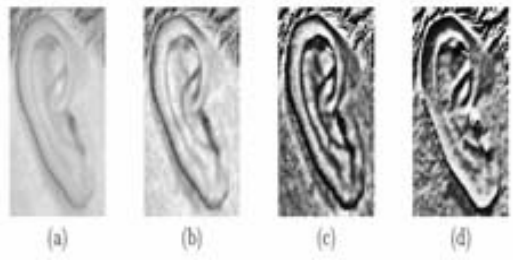

Fig 4. Image enhancement examples :
(a) Original image from UND-E dataset, output after applying
(b) ADHist,
(c) NLM and
(d) SF enhancement techniques

C. Ear Recognition problem due to multi-pose

Multi-pose ear recognition is referred to when the angle between the ear and camera changes, the shape of the ear will be distorted, resulting in the decrease of the recognition performance.

The issue of multi-pose ear recognition is addressed by manifold learning technique such as locally linear embedding (LLE) and an improved locally linear embedding algorithm (IDLLE) [6]. Better recognition result is achieved on applying LLE for multi-pose ear and using the IDLLE can further improve the recognition performance.

1.Locally linear embedding (LLE)

This method find the intrinsic structure of data points by constructing embedded space which preserves their topology relationship, but also can transform the nonlinear problem into the linear problem by local linear fitting and enable us to visualize data structure clearly.

2. Improved locally linear embedding algorithm (IDLLE)

The LLE algorithm selects neighbours according to Euclidean distance. However, in the high dimensional space, the distribution of data points is highly sparse. In this case, neighbours that are selected according to Euclidean distance are generally unstable.

The frontal ear image, ear image with -5 degree and ear image with +5 degree of every individual is taken to calculate the recognition rate.

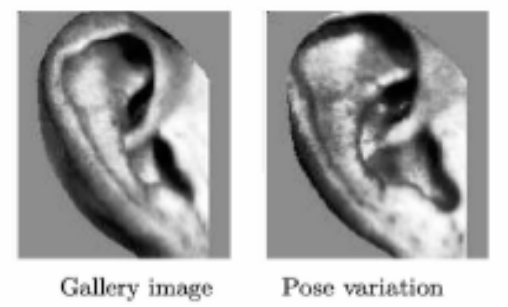

Fig 5. Image distortion due to pose variation.

D. Ear distortion due to victim of accident

Ear recognition is a kind of the novel representative subject in the field of non-disturbance biometric authentication. The problem arises in identification of a subject when met with an accident and undergoes ear deformities.

This hurdle is overcome by comparing two pictures of subject's ear.

1 Post Mortem Picture (PM)

First a completely exposed picture of the subject ear is taken in high resolution, uniform lightning.

2 Anti Mortem Picture (AM)

Secondly subject picture is collected from environment i.e. family, friends, social network. This image is generally not very good since it is not being taken by any professional or from high resolution cameras.

Next both the images were compared to identify the subject.

E. Ear deformities due to piercing

Automated personal identification using ear images has invited lot of research efforts in the biometrics literature. Ear biometric has now reached the adolescence of its development towards a reliable biometric. But still there exist an challenging aspect of identifying an individual after piercing (since the database keep track of subject's image before piercing). In such a case individual identification becomes a complex task to achieve.

Fig 6. Ear deformities due to piercing

III. PROPOSED METHODOLOGY

The purpose behind this study is to unfold the dilemma that is existing in the field of ear biometric. Our main objective is to make it possible to identify a subject even after piercing. In the proposed technique, both the images (i.e., subject's ear image before piercing and after piercing) is being compared to check whether both the images are equal or there exist some variation and if so then how much variation so as to identify the subject even after piercing.

At the very beginning both the images (i.e., subject's ear image before piercing and after piercing) are subtracted and the output is stored in a destined area. Now secondly the resultant image is appended with the pierced image to check whether the original image is achievable or not.

The proposed algorithm to be used is threshold method. It is used to automatically perform histogram shape-based image thresholding or, the reduction of a graylevel image to a binary image. The algorithm assumes that the image to be thresholded contains two classes of pixels or bi-modal histogram (e.g. foreground and background) .Then it calculates the optimum threshold separating those two classes so that their combined spread (intra-class variance) is minimal.

IV. PROPOSED OUTCOME

In the proposed method, both the images (i.e., subject's ear image before piercing and after piercing) will be compared to check for equality or for variation. If the images will be equal then well and good else the variation between the images will be calculated. So that we can analyze the variation and judge the difference between the images. This will help to identify the subject even after piercing.

V. REFRENCES

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