A Novel Approach to Authenticate the Person Using Ear Shape Biometric

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Abstract- *The identification and verification are done by passwords, pin number and pattern which is easily cracked by others. Biometrics is a powerful and unique tool based on the anatomical and behavioural characteristics of the human beings in order to prove their authentication. One of the current trends in biometric human identification is the development of new emerging modalities. This paper proposes a novel recognition methodology of biometrics named as Ear Authentication. The pre-processing stage the gray scale values generated from the original image. The generated gray scale values are then passed to sobel edge detection technique . The output of edge detection process is used to increase the intensity values of the original image. Scale Invariant Feature Transform (SIFT) is used for feature extraction.*

Keywords- Biometric, Identification, Scale Invariant Feature Transform (SIFT), Unique.

I. INTRODUCTION

Biometrics is a key component to a person's security. It deals with authentication and based on their biological or behavioural characteristics such as fingers, eyes and voice using pattern recognition. The ear has several unique key points that can be used for human ear identification. Ear biometrics is gaining high acceptance for human identification in high security areas. Human ear is based on biometric information is very reliable and successfully used for recognizing individuals. Several methods have been suggested for personal authentication using outer shape of the ear.

II. MOTIVATION

Authentication is based on biometric techniques demand upon educational, research and industrial applications because of their reliability, high accuracy in the contemporary e-world. The need for dependable computerized user authentication techniques has been important. Many researchers have thoroughly explore the different biometrics traits like fingerprint, face, iris, palm print, hand geomentry and voice etc. Ear Authentication is highly useful for user identification. Ear Authentication is new biometric modality providing wide scope for researchers. One of the current trends in biometric human identification is the development of new emerging modalities.

The structure of the ear does not change radically over time. Ear provide better biometric performance than images of the face. The shape of ear does not change due to emotion. Crime investigation is interested in using ear identification. Ear authentication could be possible in different scenario. As per the study it had been seen that researchers have less focus on the ear authentication which is actually provide high level security to identifier.

III. EAR BIOMETRICS

Choosing biometrics is the challenging task for researcher. Biometrics is based on authentication, it is just impossible to help us if we don't know what are the requirements. Biometrics authentication must provide the security level, unattended system, Spoofing and Reliability. Among all the modalities ear authentication broadly explored which has not yet attracted significant attention of researchers. The ear has several unique key points that can be used for identification. It does not change much with the age and facial expressions. The shape of ear does not change due to emotion. No stigma of potential investigation associated with this approach. The ear is basis for a new class of biometrics, there is the need to show that (i.e., Universal, unique, Permanent, Collectable). In the same way that no one can prove that finger prints are unique, there is no absolute way to show that each human has a unique pair of ears.

Universal : Each person should posses the characteristics
Unique : No two persons should share the characteristics
Permanent : The characteristics should not change
Collectable : Easily presentable to a sensor and quantifiable

Feature extraction of ear authentication is totally depends upon the user. Some of the researcher extracted the

features for authentication. Feature are marked as outer shape of Ear.

The greatest strength of biometrics is at the same time is greatest liability. The user only has a limited number of biometric features (one face, two hands, ten fingers, two eyes, two ears). The biometric data are compromised, the user may quickly run of biometric features to be used for authentication. Any pose variations is possible for authentication, due to the feature extraction of the ear image using Scale Invariant Feature Transform.

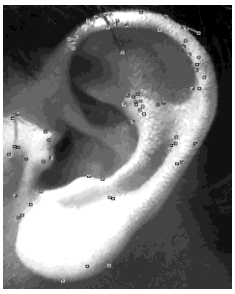

Figure 1: Ear Authentication Features

IV. IMPLEMENTATION

A Novel Approach for Person Authentication Using ear Based Biometric system are described in this Block diagram. The various modules are explained in Block Diagram of ear Recognition as shown in Figure 2

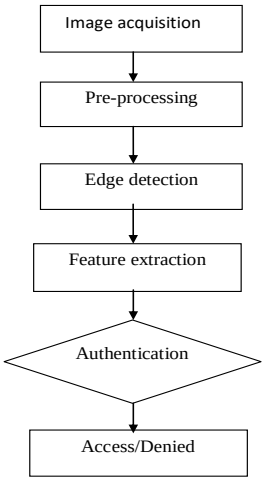

Figure 2: Block Diagram

V. MODULE DESCRIPTION

5.1 Image Acquisition

The first stage of vision system is image acquisition .After the image has been obtained, various methods of processing can be applied to the image. The side face images have been acquired in the same lightening conditions. All images taken from with a distance of 15-20 cms between the ear and camera. The image should be carefully taken such that outer ear shape is preserved.

Figure 3: Image Acquisition

5.2 Pre-processing

Each acquired ear images are firstly subjected to thresholding operation to obtain the binarized image. The resulting binarized image contains noise that generate spurious results. Filters such as Median Filter, Mean Filter, Gaussian Filter, Range Filter, Gabor Filter are used .

Figure 4: Pre-processing Image

5.2.1 Median Filter

Median filters are very effective in removing salt and pepper noise and / or impulse noise while retaining image details because they do not depend on values which are significantly different from typical values in the neighbourhood. Median filters work in successive image windows in a fashion similar to linear filters.

Replace each pixel value with the median of the gray values in the region of the pixel:

1. Take a 3 x 3 (or 5 x 5 etc.) region centered around pixel (i,j).
2. Sort the intensity values of the pixels in the region into ascending order.
3. Select the middle value as the new value of pixel (i,j).

5.2.2 Computation of Median Values

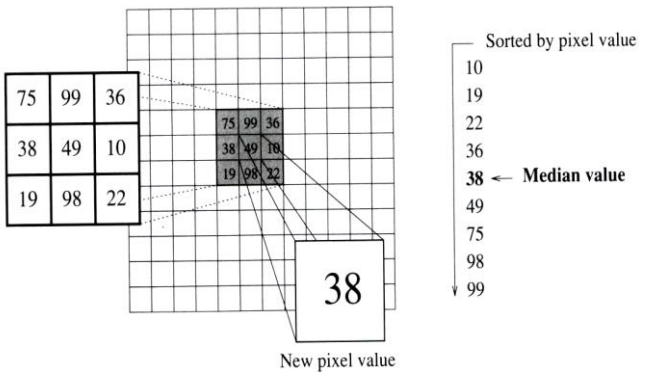

Figure 5: Computation of median values

5.3 Edge Detection

The sobel operator is used for edge detection algorithms. Technically, it is a discrete differentiation operator, computing an approximation of gradient image intensity function. At each point in the image, the result of the sobel operator is either the corresponding gradient vector or the norm of this vector. The sobel operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical directions and is therefore relatively inexpensive in terms of computations. The operator calculates the gradient of the image intensity at each point, giving the direction of the largest possible increase from light to dark and the rate of change in that direction. The result therefore shows how "abruptly" or "smoothly" the image changes at that point, and therefore how likely it is that part of the image represents an edge, as well as how that edge is likely to be oriented. In practice, the magnitude (likelihood of an edge) calculation is more reliable and easier to interpret than the direction calculation.

Mathematically, the operator uses two 3×3 kernels which are convolved with the original image to calculate approximations of the derivatives - one for horizontal changes, and one for vertical. If define as the source image, and and are two images which at each point contain the horizontal and vertical derivative approximations, the latter are computed as:

$$\mathbf{G_x} = \begin{bmatrix} -1 & 0 & +1 \\ -1 & 0 & +1 \\ -1 & 0 & +1 \end{bmatrix} * \mathbf{A} \quad \text{and} \quad \mathbf{G_y} = \begin{bmatrix} -1 & -1 & -1 \\ 0 & 0 & 0 \\ +1 & +1 & +1 \end{bmatrix} * \mathbf{A}$$

Where here denotes the 1-dimensional convolution operation. Since the Prewitt kernels can be decomposed as the products of an averaging and a differentiation kernel, they compute the gradient with smoothing. Therefore, it is a separable filter. The x-coordinate is defined here as increasing in the "right"-direction, and the y-coordinate is defined as increasing in the "down"-direction. At each point in the image, the resulting gradient approximations can be combined to give the gradient magnitude, using:

$$G=\sqrt{{G_x}^2 + {G_y}^2}$$

Using this information, we can also calculate the gradient's direction:

$$\Theta=\alpha \tan 2(G_y, G_x)$$

Figure 6: Edge detection

5.4 Feature Extraction

Feature extraction is a special form of dimensionality reduction. The input data of an algorithm is too large to be processed and it is suspected to very redundant, then the input data will be transformed into a reduced representation set of features (also named features vector). Transforming input data into the set of features is called feature extraction. If the features extracted are carefully chosen it is expected that the features set will extract the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input. Scale Invariant Feature Transform(SIFT) is an appearance based method is used to extract ear features .

5.4.1 Scale Invariant Feature Transform (SIFT)

Scale-invariant feature transform (or SIFT) is an algorithm in order to detect and describe local features in images. The algorithm was published by David Lowe. SIFT can robustly identify objects even among clutter and under partial occlusion, because the SIFT feature descriptor is invariant to uniform scaling, orientation, and partially invariant to affine distortion and illumination changes. The SIFT descriptor comprised a method for detecting interest points from a grey-level image at which statistics of local gradient directions of

image intensities were accumulated to give a summarizing description of the local image structures in a local neighbourhood around each interest point. The first stage is to construct a Gaussian "scale space" function from the input image. This is formed by convolution of the original image with Gaussian functions of varying widths. The scale space of an image is defined as a function L(x,y) that is produced from the convolution of a variable-scale Gaussian, G(x,y,σ) with an input image, I(x,y):σσ

$$\mathbf{L(x, y,\sigma) = G(x,y,\sigma) * I(x,y)}$$

Where$*$ is the convolution operation in x and y, an

$$\mathbf{G(x, y,\sigma)= \frac{1}{2\pi\sigma^2} e^{-(x^2+y^2)/2\sigma^2}}$$

To efficiently detect stable key point locations in scale space, Lowe proposed using scale space extrema in the difference of Gaussian function convolved with the image, D(x, y, σ),which can be computed from the difference of two nearby scales separated by a constant multiplicative factor .

There are a number of reasons for choosing this function. At first, it is particularly an efficient function to compute, as the smoothed images L need to be computed in any case for scale space feature description, and DOG can therefore be computed by simple image subtraction. To detect the local maxima and minima of DOG(x, y, σ) each point is compared with its 8 neighbors at the same scale, and its 9 neighbors up and down one scale. If this value is the minimum or maximum of all these points then this point is an extrema.

Figure 7: Feature Extraction image

5.5 Authentication

Authentication process in which the credentials are compared to database and authorized users information are local operating system or within an authentication server. If the credentials match, the process is completed and the user is granted authorization for access. The process of an administrator granting rights and the process of checking user account permissions for access to resources are both referred to as authorization. Else the user is not authenticated means the person could not allow to access the resource.

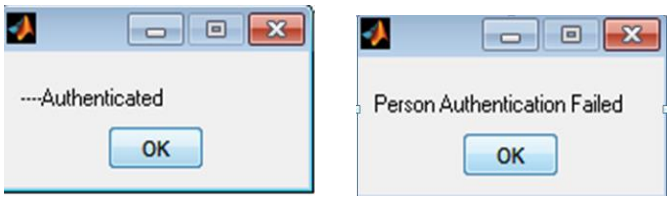

Figure 8: Authentication

VI. CONCLUSION

In this paper highly useful for user identification. Ear authentication biometric modality providing wide scope for researchers. Biometric identification is the development of emerging modalities. It's helpful to identify human ear in forensic department. Ear has unique for all person. If any person ear accidently damage means its difficult to identify. Ear Biometrics performance is increases to give best authenticated result.

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