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Image Base Ear Biometric System with Smartphone App

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Abstract:- We represent result paper for Ear Biometric by using smartphone app. This paper will discuss about which methods for feature extraction are used. Biometric is used for identification. There many biometric methods are used for eg. Fingerprint biometric, Iris biometric, etc. This app will be very useful for medical purpose .This app is mainly developed by considering public health problem. We are using here a smartphone camera image, Ear photograph will be captured without uncomfortable procedure. We are using IIT Delhi database. This paper will discuss how the app has developed.

***Key Words*: Biometric, Ear Biometric, Smartphone app, Image processing**

1. INTRODUCTION

Biometric is used for human characteristics identification. It is basically technical term for body measurement and calculation. Biometric defines the physiological characteristics related to the shape of body. For example, fingerprint, face recognition, retina, iris recognition, DNA, Palm print, hand geometryetc. These characteristic of human body are different and does not match with each other. Though it looks same but the pattern is different. Also we know there are many biometric available in the market but if we provide low quality input to the system it will get difficult to identify the person's identity. By using ear biometric we will overcome with this problem i.e. though we are providing low or poor quality input to the system, system will provide us with accurate output. Now the question may arise as nowadays we have many biometrics available in the market then why do we need this one? Valid question but what if the person whose identity we need to find out is nonsupportive. We can get easily the image from cctv camera. Obviously the quality of the image will be poor, therefore we have developed this system which will work on low quality image and give more accurate result.

Here we are using ear as a biometric. As the pattern of ear remains same between the age of 7 to 70. By using ear we are making an app which will record the information. Here basically we capture the ear image by smartphone. Then we identify them by using image processing.

1.1 Review

Nowadays smartphone is easily available to us at very cheap cost. So this app will be useful to everyone for aunthentication. There are mainly three methods for authentication

- Knowledge based
- Token based
- Biometric based

Password may be forgotten and token may be lost, but biometric information does not change. As I have mentioned earlier, we already have face, iris, retina, palm biometric system but face changes more significantly than any other part of the body because of cosmetics, beard, mustache, etc. Also colour distribution is more uniform in ear as compare to face, ear, retina, iris etc. In 1890 French Criminologist Alphonse Bertilone find out the potential of ear. After that in 1949 an American Police officer Alfred Innareli collected more than 10000 images and find out 12 characteristic of ear to identify person's identity. We have gone through paper which were publish between the year 2015 to 2017.In 2015 an app was developed for ear biometric. Local Binary Pattern, Generic Fourier Descriptor, and SIFT (Scale Invariant feature transform) these are the parameter used for the system. They have used 2D ear image as input. In the database there were 3 individual images for each. All the images were gathered by using Smartphone app. The app was developed such as it will show top five matched images from the database. One more system was developed in 2015 i.e. Biometric Identification using 2-D and 3-D images. It uses Cascade Pose regression. They have used 2D and 3D ear images as input. For detection purpose the CPR is used it can identify smallest rectangle of the image that consist of object.CPR itself train the model and test the model accordingly. It uses both 2D and 3D imges. In the year of 2015 one more system was developed called Human Ear Recognition by using geometrical feature extraction. They have used 2D images as input, from which they have consider 7 points which are strong and unique. For Edge detection they have used median filter. This filter basically transfer image into binary after that canny edge detector is used for edge detection. Next system developed in 2016 call ear based biometric identification. They used 3D image as input. Two- step Iterative Closest Point (ICP).

For matching error criterion, root mean square (RMS) parameter is used. In 2017 two systems has been developed i.e. Ear Detection under Uncontrolled Conditions with Multiple Scale Faster Region-Based Convolutional Neural Networks and the other is Biometric Ear Recognition System.

2. Flow of the model

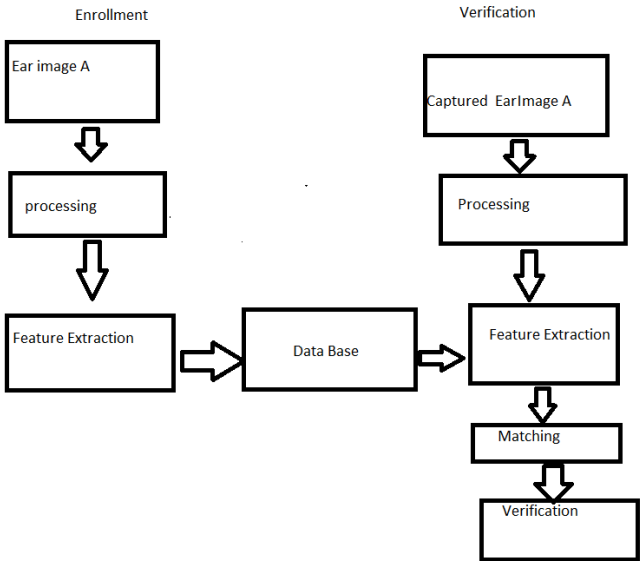

Fig -1: The basic flow of biometric system

1. Fetch Image

2. Pre-processing over image (Morphological /filtering operation)

3. Feature extraction over patch of Image

4. For feature extraction we use LBP+Gabor features (Local Binary Pattern)

5. Use Support Vector Machine for classification.

Block Diagram

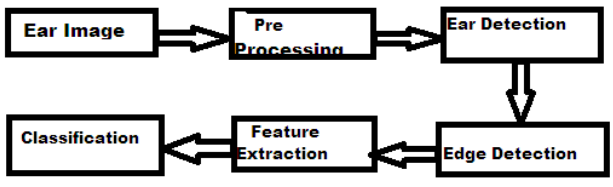

Fig2.Basic Block Diagram

Fig 2 shows the basic block diagram of the system. First we are going to provide ear images to the system. By providing it we are going to prepare dataset which will be further get use for classification. These ear images will proceed for "preprocessing". For preprocessing the first step will be cropping of an image to get region of interest i.e ROI from which we will examine the data. Next step will be resize the image with a size of 150x150 pixel. Then the image will get converted into grayscale image with colour level between 0 to 255.

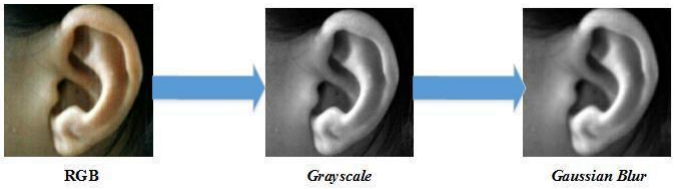

Fig.3Pre Processing Process

Next we are going to use histogram equalization. Histogram is nothing but adjustment of contrast intensity in the image, it is basically use for bone image, it wiil gives the output as x-ray. After Histogram equalization we will get the clear ear image as output. This image will proceed for edge detection. The reason for edge detection is nothing but boundary analysis. Before edge detection we are going to use lbps i.e. "local binary pattern". LBPs are used for texture analysis. The output of this will further get use for classification. We will store the lbp features and apply gabor filter to it. Gabor filters are used for identifying key feature of the object. We will save the gabor features also. Further we will extract the features from LBPs and Gabor features. Our next step will be classification. For classification we are going to use SVM i.e. Support Vector Machine.

Tools can used

1. Android app to capture Image

2. Send image over server

3. Matlab for Image processing and algorithms

4. Display results on system

First step is to capture the image. We are using IIT Delhi base dataset. Pre-processing i.e. filtering operation will be perform to achieve high accuracy.

Feature Extraction

The accuracy of the automated ear identification is highly dependent on this feature extraction and matching process. The next step will be feature attraction. For feature extraction we are using LBP (Local Binary Pattern) and Gabor filter. The reason why we use LBP is it shows the key point of the image. Gabor filter is used for pattern analysis.

There are some techniques for feature extractions:

1) Histogram of oriented gradients (HOG)

2) Speeded-up robust features (SURF)

3) Local binary patterns (LBP)

4) Haar wavelets

5) Color histograms

6) Gabor filter

Local Binary Patterns:

LBP stands for Local Binary Patterns. It is basically used for texture analysis. It works in specific order. Firstly, we convert the input color image to grayscale, since LBP works on grayscale images. For each pixel in the grayscale image, a neighbourhood is selected around the current pixel and then we calculate the LBP value for the pixel using the neighbourhood. After calculating the LBP value of the current pixel, we update the corresponding pixel location. Basically we used LBP filters to show key points from the image.

The feature extraction will be done after collecting LBP features and Gabor features for each image. For that we divide the ear image into eight parts and produce histogram for each region. Basically this system's work is divided into four parts, Database, Feature Extraction, Classification and prediction .So for database we are going to make dataset. In our system we are taking nine subject .Each subject will be having 6 images from which one image we will use for testing purpose. Total we are considering 45 images. For each image we are going to calculate feature vector. For eg. In subject1 there are 5 ear images, initially it is showing 255 features which are very large. So we produce histogram for it which will gives us 59 features. Then we use LBP which will compare the points with neighborhood pixel and eliminate the number if it gets repeated .We will store this feature value to train the data. Likewise we will find out the feature value for each and every image and store it to train the model. For each image the feature value will be different. Initially the image contains 255 features by using lbp we ask for the important feature for extraction which will further get used for classification. For example first image from subject one is giving 59 features after applying lbps. In this first we divide the image into 8 units as shown in fig

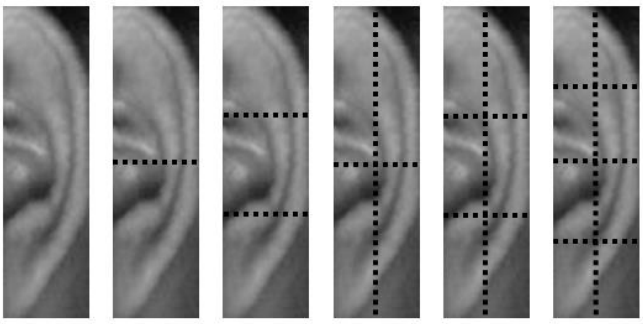

Fig4.Ear image after applying lbps

We will extract this 59 features and store it. This store feature we will provide to train the model. LBP feature vector, returned as a 1by-N vector of length N representing the number of features here it is 59.LBP features encode local texture information which will further get used for classification, detection etc. The function divides the input image into non-overlapping cells. It cancels the cells which are repetitive in this way it will reduce the feature data.

Gabor filter

Gabor filter is also known as linear filter. This is used for texture analysis and face recognition. Gabor filters are used for pattern analysis. For example, it has been used to study the directionality distribution inside the porous spongy trabecular bone in the spine. The Gabor space is very useful in image processing applications such as optical character recognition, iris recognition and fingerprint recognition.

We have used LBP and Gabor filter for Ear detection. Gabor filters we are using for edge detection. It removes the noise from the image. We calculate the minimum value and maximum value of feature. Gabor wavelet is use for feature extraction for pattern recognition because it find out the feature point .The important function of gaborFilterBank.m is to generate a custom sized Gabor filter bank. It creates a u by v cell array, whose elements are m by n matrices. The second function named gaborFeatures.m extracts the Gabor features of an input image. It creates a column vector consisting of gabor features of an input image. The feature vectors are normalized to zero mean and unit variance. This feature data will get stored and further send to train the model. So, basically the extracted features from lbps and gabor filter we use for training the model. It train the model in such a way that for specific feature it will show the result according maximum matching points of the subject. For eg .if the provided image get maximum matching points with subject1 image then it will show the result as the image belongs to subject1.

SVM Library: We have used SVM library here.LIBSVM is a library for Support Vector Machines. This is used to apply SVM to the applications. This is used for two purposes. First, training a data set to obtain a model and second, using the model to predict information of a testing dataset. We should know first what is SVM?Support vector machine is a supervised machine learning algorithm which we are using here for classification. We will consider the region of interest and after feature extraction we will use SVM. The basic working of SVM can be describe as we plot each data item as appoint in n-dimensional space(where n is the number of features we have).SVM are based on the idea of finding a hyperplane that best divides a dataset into two classes. In this support vectors are the data points nearest to the hyperplane. Hyperplane is line that linearly separates and classify the sets of data. So basically hyperplane segregate the data into different classes. Here we are using 2D image as input so that svm can work effectively. The distance between hyperplane and nearest data point from either set is known

as the margin. Main aim is to choose hyperplane with greatest possible margin between hyperplane and any point within the training set, giving greater chance of new data being classified correctly. The goal of SVM is to find the plane that has maximum margin. The dimension of the hyperplane depends upon the number of features. If the number of input features is 2, then the hyperplane is just a line. If the input feature is 3, then hyperplane becomes two dimensional lines. As the input features increases it becomes difficult to classify data for SVM. Another use of this SVM is it will predict the class. As we have trained the model under SVM after providing input image to the system system will predict the class of that image.

3. Advantages

- In modern electronically unified society, a highly consistent and reliable automatic personal authentication method is needed
- Provides high degree of security.

4. Disadvantages

- The structure of ear changes after age of 70
- If the ear get infected then it will be difficult to identify ear
- Plastic Surgery of the ear can be done easily
- We cannot prepare large number of dataset.

5. Output

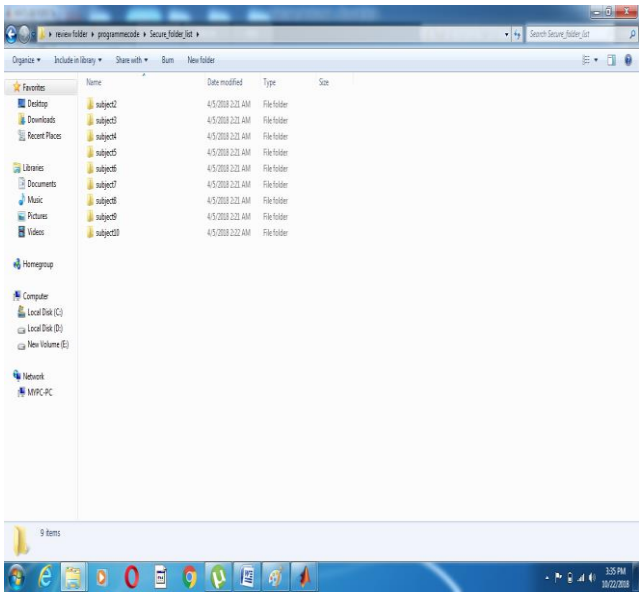

Fig5.Output to hide image

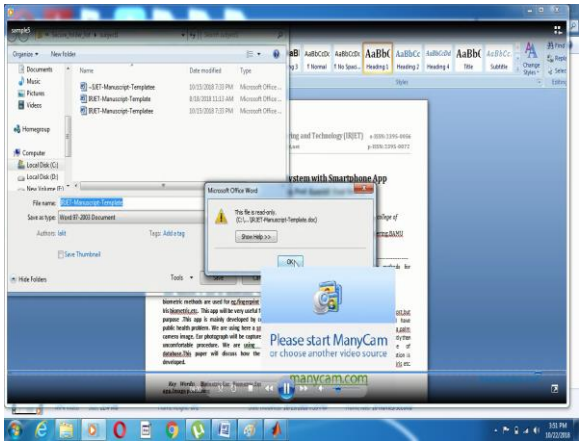

Fig6.Output for read only data application

As shown in fig5.we are unable to see subject1 as we have developed the system where we provide the command to hide subject1.Same way if we enable write command then after authentication if we try to make changes in data it will show us the error message.

6. CONCLUSION

The images are captured from different age group. We are taking 9 subject in dataset. Each subject contain six images. So total we have 54 images. Among these we are taking one image from each subject for testing purpose. Now there are 5 images in each subject and 9 images in testing dataset. After this Feature extraction is done .We train the model and run the matlab program, Ear get detected. We get 90% accuracy. Also we have prepare the application where we can hide the data after authentication or we can keep the data in read only format. Output of the application is shown below.

REFERENCES

[1] Ear Recognition Techniques for Biometrics Using Digital Image Processing. e-ISSN: 2278-0661,p-ISSN: 2278-8727, PP 22-26

[2] Application of Android-based Ear Biometrics Identification. International Journal of Computer Applications (0975 – 8887) Volume 172 – No.10, August 2017

[3] Image-based Ear Biometric Smartphone App for Patient Identification in Field Settings.

[4] Cummings, A., Nixon, M., and Carter, J. (2010). A novelray analogy for enrollment of ear biometrics. Biometrics: Theory Applications and Systems (BTAS), Fourth IEEE International Conference on, pages 1–6.

[5] Fahmi, A., Kodirov, E., Choi, D., Lee, G., M. F. Azli A.,and Sayeed, S. (2012). Implicit authentication based on ear shape biometrics using smartphone camera during a

call. Systems, Man, and Cybernetics (SMC),IEEE International Conference on, pages 2272–2276.

[6] Iannarelli, A. (1989). Ear identification, forensic identification series, fremont. Paramont Publishing Company, Calif, ISBN, 10:0962317802.

[7] Kumar, A. and Wu, C. (2012). Automated human identification using ear imaging. Pattern Recognition,45(3):956–968.

[8] Kwapisz, J. R., Weiss, G. M., and Moore, S. A. (2010).Cell phone-based biometric identification. Biometrics:Theory Applications and Systems (BTAS), Fourth IEEE International Conference on, pages 1–7.

[9] Takala, V., Ahonen, T., and Pietik¨ainen, M. (2005). Blockbased methods for image retrieval using local binarypatterns. Image Analysis, pages 882–891

[10] Wang, Y., Mu, Z., and Zeng, H. (2008). Block-basedand multi-resolution methods for ear recognition usingwavelet transform and uniform local binary patterns. Pattern Recognition, ICPR. 19th International Conference on, pages 1–4.

[11] N. K. A. Wirdiani and A. A. K. Oka Sudana, "Medicinal plant recognition of leaf shape using Localized Arc Pattern Method," Int. J. Eng. Technol., vol. 8, no. 4, pp. 1847–1854, 2016.

[12] N. B. Boodoo and R. K. Subramanian, "Robust multi-biometric recognition using face and ear images," Int. J. Comput. Sci. Inf. Secur., vol. 6, no. 2, pp. 164–169, 2009.

[13] J. Canny, A Computational Approach to Edge Detection. 1986.

[14] Biometrics Authentication Technique for Intrusion Detection Systems Using Fingerprint Recognition," Int. J. Comput. Sci. Eng. Inf. Technol., vol. 2, no. 1, pp. 57–65, 2012.

[15] Abaza A, Ross A. 'Towards understanding the symmetry of human ears: A biometricperspective'. In: Fourth IEEE International Conference on Biometrics: Theory Applications and Systems (BTAS); 2010. .