

## Ear Recognition Techniques for Biometrics Using Digital Image Processing: A Review

Dayanand B.Gore<sup>1</sup>, Seema S. Kawthekar<sup>2</sup>, Vipin Y. Borole<sup>3</sup>

<sup>1</sup>(Department of CS & IT Dr.Babasaheb Ambedkar Marathwda University Aurangabad, India)

<sup>2</sup>(Department of CS & IT Dr.Babasaheb Ambedkar Marathwda University Aurangabad, India)

<sup>3</sup>(Department of CS & IT Dr.Babasaheb Ambedkar Marathwda University Aurangabad, India)

---

**Abstract:** Nowadays Biometrics security is very essential technology used in India as well as foreign countries. Biometrics is analysis of physical or behavioral modalities of the human body to solving such type of problems. Ear Recognition is widely used in government, medical, robotics, telecommunication, healthcare, traffic, university, etc. Last few years the researchers are follows the ear recognition techniques. In this paper we discussed about human identification, verification, validation & authors views related to the ear recognition, techniques, algorithms, and models. This paper recognize that ear recognition is most beneficial for the researchers who will work on biometrics techniques. A number of unique researches have already worked on this area. Ear recognition is unique identification technique other than the face recognition; fingerprint recognition so on. For the purpose of result and analysis, experimental the MATLAB tool is very useful for result oriented work.

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

---

### I. Introduction

The basic task of biometrics is that identification the object and how physical structure, behavioral emotion is verified using the various techniques & algorithms. Basically biometrics work under three several tasks are that is first is Enrollment in these techniques the user enrolls in the system by establishing baseline measurement for comparison. Second is Submission in this user present biological behavior of his or her identifying to the capture system. And third is verification in that the system compares the submitted sample with the stored sample. Following are the few applications were biometric system are useful. I) Controlling workplace access II) Identifying criminals by forensics III) Fraud the theft reduction IV) Applying to access control to sensitive information & systems. Biometric system is the basic system to solve such type of the problems using the pattern recognition technique.in this paper we discuss about various techniques, algorithms and authors view for Ear recognition. Ears are the new biometric they appear to maintain their structure with increasing age. The widely used ear detection is based on the structure & the shape of the ear using the ear detection techniques. Ear images have more identification richness than some other part of human body. Our paper survey provides good future prospects for the upcoming researchers in the ear recognition. The various steps of Ear recognition like; preprocessing, feature extraction, segmentation, post-processing, etc.

### 1.2 APPLICATION AREAS IN BIOMETRICS

#### 1.2.1 Banks Security

#### 1.2.2 ATM locations under CCTV camera.

#### 1.2.3 Getting access in highly secure areas.

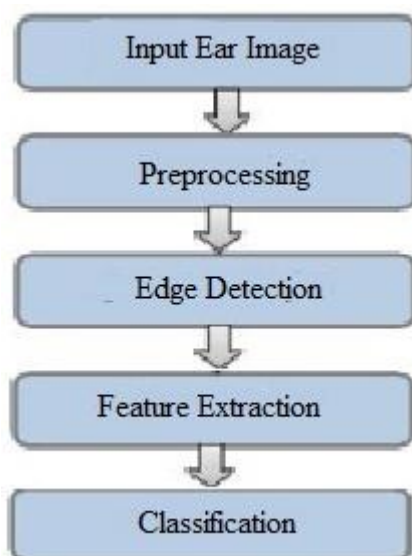
#### 1.2.4 Forensics labs to solve a crime if there is picture of ear in the role of CCTV camera.

#### 1.2.5 Class attendance.

### II. Proposed Methodology

Proposed method shown process related with the ear recognition techniques is basic Methodology for the detection of the ear images. Input ear image taken by the database or captured by CCTV Camera. Preprocessing which is used to find out the edge detection using various techniques such as canny, sobel these are the some examples of the Edge detection. Following are the steps or a methodology to actual work was

implemented. Input ear image was taken by database. Here taken as an example for the IEEE database ear image.in preprocessing detection algorithm used for the purpose of ear image detection. Fig: 1shown steps the how image goes through the each process. In edge detection some techniques are used by helping that result. The edge detection technique helps us in future work to identify the person.



**Fig: 1** Ear Recognition Methodology

### **III. Literature Review**

Ear recognition technique it consists of five stages that is Image acquisition, pre-processing, feature extraction, and classification. ANN classifier used to improving ear recognition and optimization system in MATLAB. Image can be captured is in JPEG format at a distance 8-10 cm. after the image acquisition original image has convert in to gray scale and filtered then by using canny edge detector detect the edges and last remove the noise using noise removal.in gray scale technique the image in original color i.e. RGB it converted into gray scale. Using the filter technique noise has removed these filters smoothest the data while keeping and sharp details. Canny edge detection technique detects the wide range of edges in images.to remove the noise they set the threshold value pixel which having value less then threshold considered. The input image is taken and compared with saved images if the comparisons are less then match is found and person is identified. They used ANN classifier it based on Artificial Neural Network [1]. SIFT Algorithm is used to identify they people using ear images. To extract sift features from ear image we need to do after edge detection. Asmaa S.A,Kareem K.A et al,in his paper they used SIFT Algorithm to identify people to detect the ear image he applied two databases i.e IIT Delhi another is the AMI.SIFT feature Extraction is used to get difference of Gaussian between scales and compare each pixel in DoG images. This algorithm compares the key point location using minimum distance classifier. This algorithm implemented using matlab 7.12[2]. In this paper Lin Zhang, Lida Li, meng yeng et al. proposing a novel 3D ear classification scheme that makes use of K-SVD (LC-KSVD) framework. He also tested performance of the approach which classifies LHST.LBP (Local Binary Pattern) has powerful for image classification task [3]. Gopal Singh Tandel et al.in this paper he taken the average images and that images cropped manually and resize it fixed size After he used the canny edge detector to extract feature[4]. Samuel Adebayo Daramola, Oladejo Daniel Oluwaninyo et al.in this paper author describe the concept of energy-edge density feature and Back Propagation Neural Network(BPNN) Technique.Haar Wavelet transform is used to decompose ear image it is a multi-resolution technique it was proposed in 1909 by Alfred Haar [5]. Ms.Aradhana Singh, Mr.Sonu Agrawal, Ms.Pooja Kamavidar et al. paper consists a new approach i.e distance transform and template matching.he found the skin and non-skin pixel in the image.this paper proposed localization techniques.this system perform the pre-processing steps. For this technique the input is side face image. Ear skin segmentation, ear edge detection, template resizing these are the proper methodology of the system it present by the author [6]. Farida Khursheed and A.H.Mir et al. in this paper if any physiological or

behavioral biometric characteristics are universal, unique, and permanent but it not be usable because of its unacceptability. AR Model counter of the ear obtained using edge detection and binarization and it if followed by counter tracing [7]. Ali Hussein Ali Al-Timemy et al. In this paper, it has implemented a robust algorithm for person identification system based on SOM and geometrical distances. 138 images were taken for 23 persons. These images are transferred to personal computer and read by MATLAB software package [8]. The first attempt of building a classification system for ear shapes was made by Alfred Iannarelli. He has made two large scale ear identification studies [9]. Xin Dong and Yin Guo et al. In this paper, author present a novel algorithm for 3D ear recognition. The basic idea is to rotate each 3D point cloud representing an individual's ear around the x, y or z axes, respectively generating multiple 2.5D images at each step of the rotation [10]. Mostafizur Rahman, Muhammad Sheikh Sadi, Md. Rezwatul Islam et al. proposed methodology to recognize online ear images using geometric features it take place on ear high line, reference lines and angles. Moving persons ear can be captured and process through this technology [11].

#### IV. Edge Detection Techniques

Following table: 1 describes the various techniques, methodology, algorithm and result of different research papers which are study related with Ear Recognition.

Sr. No.	Title	Author, Publication and Year	Methodology	Results
1	The Human Identification System Using geometrical Feature Extraction Of Ear	Yashomati Dhumal, Madhuri Karkud, Pooja Shinde, Varsha Alhat, IJARCSSE, Vol.6, Issue ,ISSN:2277 128X, March 2016	ANN classifier it based on Artificial Neural Network	Input image compared with each saved images by using ANN classifier they present GUI Result [1].
2	Human Ear Recognition Using SIFT Features	Asmaa Sabet Anwar, Kareem Kamal A. Ghany, Hesham ElMahdy IEEE 2015	SIFT feature Extraction	IIT Delhi Ear Database has been acquires during Oct 2006 -Jun 2007 using a simple imaging. Database taken from groups where ages are between 14 and 58 years [2].
3	3D Ear Identification Using Block-Wise Statistics based Features and LC-KSVD	Lin Zhang, Lida Li, Hongyu Li, Meng Yang, IEEE TRANSACTIONS ON MULTIMEDIA 2015	LC-KSVD BASED 3D EAR CLASSIFICATION	The proposed method LCKSVD LHST performs the best on almost all the subsets. This not only attributes to the robustness of the proposed feature extraction scheme against mere misalignment, but also owes to the discriminative dictionary and the linear classifier jointly learned with LC-KSVD[3]
4	Ear Recognition	Gopal Singh Tandel Proceedings of ICIRT 2012	FEATURE EXTRACTION AND MATCHING	Database contains a total of 200 images with 80x150 pixels resolution. A set of 60 people has been used for experiments having three or more images each. Three images of each person have been used for average image calculation. In this experiment, 180 ear images of 60 persons, three image of each person have been used for average image calculation. Ear recognition rate is 100% percent over 180 images [4].
5	Automatic Ear Recognition system using Back Propagation Neural Network	Samuel Adebayo Daramola, Oladejo Daniel Oluwaninyo, IJVIPNS-IJENS	Back Propagation Neural Network (BPNN) Technique. Haar Wavelet transform	The recognition rates of the system based on Euclidean distance and Neural Network is compared. The results showed that the recognition rates of the

				method proposed using BPNN is higher in comparison with other method proposed [5].
6	A STUDY ON HUMAN EAR DETECTION FOR BIOMETRICS IDENTIFICATION	Ms.Aradhana Singh,Mr.Sonu Agrawal,Ms.Pooja Kamavisdar IJARCCCE,Vol.2,Issue.1 ,January 2013	Ear localization technique Preprocessing Ear Edge Detection Verify Localized Ear	Ear images occur in various sizes and the pre-estimated templates are not sufficient to handle all the situations. Further, detection of ear using templates of various sizes and then selecting best detection is a very computation intensive task [6].
7	AR Model Based Human identification using Ear Biometrics,	Farida Khursheed, A.H.Mir IJSIP,Vol.7,No3,2014	Autoregressive modeling for recognition of humans on the basis of ear biometrics.	The test samples that were used to check the effectiveness of the model were taken at different postures. Therefore model is invariant to posture [7].
8	A Robust Algorithm for Ear Recognition System Based on Self Organization Maps	1stRegional Conference of Eng. Sci. NUCEJ Spatial ISSUE vol.11, No.2, 2008	Geometrical distances measured for each ear	For criminal identification this is regarded a very robust and the system is reliable and can be a very robust. the algorithm can be reliable purposes in the police departments[8].
9	A Survey on Ear Recognition	Spyridon Antakis, IEEE Conference on Neural Networks for Signal Processing IX, February 23, 2009	Iannarelli's System,The Invertible Linear Transformation ,Fisher Linear Discriminant Analysis (LDA)	Efficiency of this technique in systems with larger datasets. All recent conducted experiments showed that ear biometric is already capable to be used in real life applications; nevertheless, the adoption of a new biometric is something that takes a lot of time [9].
10	3D Ear Recognition Using SIFT Keypoint Matching	Xin Dong+ and Yin Guo,International Conference on Computer and automation Engineering (ICCAE 2011) (2012)	Novel algorithm, a new weighted key point matching algorithm, Human Ear Recognition Algorithm	They tested the idea of rotating both the test ears and the training ears to obtain more test keypoints.Then they perform the same experiments [10].
11	Human Ear Recognition Using Geometrical Features Extraction	Asmaa Sabet Anwara,d, Kareem Kamal A.Ghanyb,d*, ICCMIT 2015Hesham Elmahdyc	Geometrical Features Extraction (shape, mean, centroid and Euclidean distance between pixels, snake model)	Results showed that the proposed approach gives better results and obtained over all accuracy almost 98%..[11]
12	Personal Identification Using Computerized Human Ear Recognition System	Anam Tariq*, M. Almas Anjumt, M. Usman Akram:◆	Feature Extraction, a novel approach, Haar wavelet based feature extraction and finally fast NCC based ear feature matching	USTB ear image database consists of 180 right ear images, three images per person (60 persons). These images are 8 bit gray scale and under different lighting conditions [12].

**Table: 1** Different Technique in Ear Recognition

### V. Future Scope

In future work using the biometrics ear recognition techniques our aim is implement human ear identification technique using MATLAB as image processing tool we are able to work on image enhancement, filtering and feature extraction, edge detection, segmentation, classification. Prewitt edge detection method gives best results for the ear images which are appropriate properly captured and has proper light. In this reviews techniques, method gives poor results for the ear images which are not captured properly or has high light intensity. By this simple method we can obtain outer shape of ear.

## VI. Conclusion

In this paper we present some techniques related with the ear recognition and also conclude that on the basis of techniques here observation made up from the preprocessing, Edge detection, feature extraction, classification techniques to explore this type of research. Now the motivations for further works are to identify the person by using the alternative and different techniques. Looking at the results we can conclude that the shape and structure of external ear is unique for each individual. This uniqueness property of ear image can be used for biometrics purpose. Ear recognition techniques support to the system which work for the biometrics system to identify the person.

## References

- [1]. Yashomati Dhumal, Madhuri Karkud, Pooja Shinde, Varsha Alhat "The Human Identification System Using Geometrical Feature Extraction Of Ear ", *IJARCSSE, Vol.6, Issue 3, ISSN:2277 128X, March 2016, pg.298-303.*
- [2]. Asmaa Sabet Anwar, Kareem Kamal A. Ghany, Hesham ElMahdy "Human Ear Recognition Using SIFTS Features", *2015 IEEE*
- [3]. Lin Zhang, Lida Li, Hongyu Li, Meng Yang "3D Ear Identification Using Block-Wise Statistics based Features and LC-KSVD", *IEEE TRANSACTION ON MULTIMEDIA, 2015*
- [4]. Gopal Singh Tandel, "Ear Recognition", *Proceedings of ICIRT 2012 pg. 171-173*
- [5]. Samuel Adebayo Daramola, Oladejo Daniel Oluwaninyo "Automatic Ear Recognition system using Back Propagation Neural Network.", *IJVIPNS-IJENS, Vol:11, No.1, pg.26-29.*
- [6]. Ms. Aradhana Singh, Mr. Sonu Agrawal, Ms. Pooja Kamavisdar "A STUDY ON HUMAN EAR DETECTION FOR BIOMETRICS IDENTIFICATION", *IJARCSSE, Vol.2, Issue.1, January 2013, pg.989-993.*
- [7]. Farida Khursheed, A.H. Mir, "AR Model Based Human identification using Ear Biometrics", *IJSIP, Vol.7, No3, 2014, pg.347-360*
- [8]. Ali Hussein Ali Al-Timemy "A Robust Algorithm for Ear Recognition System Based on Self Organization Maps", *The 1st Regional Conference of Eng. Sci. NUCEJ Spatial ISSUE vol.11, No.2, 2008 pp 315-321.*
- [9]. Spyridon Antakis "A Survey on Ear Recognition" *IEEE Conference on Neural Networks for Signal Processing IX, February 23, 2009*
- [10]. Xin Dong+ and Yin Guo, "3D Ear Recognition Using SIFT Keypoint Matching, 2011 International Conference on Computer and Automation Engineering (ICCAE 2011) IPCSIT vol. 44 (2012) © (2012) IACSIT Press, Singapore DOI: 10.7763/PCISIT.2012.V44.27
- [11]. Mostafizur Rahman, Muhammad Sheikh Sadi, Md. Rezwanul Islam "Human Ear Recognition Using Geometric Features" *International Conference on Electrical Information and Communication Technology (EICT) 2013.*
- [12]. Anam Tariq\*, M. Almas Anjumt, M. Usman Akram "Personal Identification Using Computerized Human Ear Recognition System" *20 II International Conference on Computer Science and Network Technology.*