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Ear Pattern Recognition and Compression Using Surf and SVM-A Review

Ummer Akber Tali[1], Ashish Sharma[2]

M. Tech Student, Dept. of CSE, BIMT, Mehli, Shimla, H.P, India[1]

Assistant Professor, Dept. of CSE, BIMT, Mehli, Shimla, H.P, India[2]

ABSTRACt: Ear biometric is a new high class research area in the field of recognition that is vision based biometric. This biometric is invariant from childhood to early old age as compared to other biometrics because this biometric is not concern with the change in facial expression or cosmetics, wearing eye glasses, etc. Recognition by using human ear is an extensive field of research and this biometric is unique and stable as compared with face or iris biometric. The human ear recognition is the challenge but still researcher wants to explore this area for the identification purpose. Earlier, the researchers started to consider the obstacles which are related to computations for recognizing ear image. The researches show that recognition by ear pattern is relevant and suitable to a great extent. This paper provides the delineated review on the techniques which are used for recognition based on behavioural or analytical characteristics of the ears. To enhance the certainty and precision of the recognition by ear biometric, the attributes of different ear pattern images based on their shape and size are incorporated.

KEYWORDS: Biometric, Force Field Transform ,SURF,SVM ,PCA.

I. INTRODUCTION

Biometric can be defined as the group of methods which are used to measure the physical and behavioural characteristics of human being for human recognition and verification. Examples of physical biometric are face recognition, eye retina and iris scanning. Hand shapes are very common related to their shape and size and easier than behavioral biometric which in turn are hand writing, gait and typing pattern recognition. Physical and behavioral methods are two different types of biometric methods which are divided again in two types invasive and non invasive. In invasive method we require a human being cooperation to gain the data which is needed for the comparison of human feature to the data already stored in the dataset. In non invasive method we do not require any human being to cooperate because we can also use their captured data without telling anything about our work. And the person does not know anything about it. Biometric methods are most applicable in robotics, security and medical purposes. In these areas we can use face recognition, iris, retina scanning, and fingerprint. In these areas research communities gave their most attention.

II. RELATED WORK

French criminologist Alphonse Bertillon was first who gave the idea of using ears for human identification and verification in 1890. Ear pattern recognition can be used in place of face recognition because it does not change according to mood, expression and health. Significantly, outer part of ear called as auricle does not change with increase in age. Research communities gave a least attention towards ear pattern recognition than other biometric techniques like iris scanning, face pattern matching, fingerprint and gait recognition. But in the previous year some researchers have started for considering the problem for computations of ear image recognition. This research can show that ear pattern recognition is applicable to a great extent like all other biometric techniques. In this we can do compression of image or dimensionality reduction of an image. Before doing this we can also enhance image by removing noise. **Ajay kumar et al.** investigated an approach for human ear identification using holistic gray information to extract the phase information from gray level signals. The query images are used in the database and find the hamming distance through rotation to improve the distance of the ear images [2]. **Iannarelli** has worked very prominently in this field, who examined more than 10,000 ears. By undergoing to some procedure found that all of them are different. Iannarelli developed an anthropometric method in which he used 12 measurements to distinguish

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the human beings depending on their ear images [3]. Later in 1995 **Carreira-Perpiñán** gave a contribution to research by using artificial neural network linear nodes used for feature extraction. Because of linear nodes, there was very little bit difference in singular value decomposition and the decision rule was made by exceeding the given threshold value for reconstruction error. More recently, **Chang et al.** gave a comparison between face recognition and ear image matching using a standard principal component analysis known as eigen faces approach for face recognition and ear images acquired at university of south Florida. They reported that there is a very little bit difference in recognition performance for these two methods. They gave accuracies obtained in the baseline experiment [17]. In another study in ear recognition, **Hurley et al.** considered a new research on "force field" feature extraction technique that is based on simulated and potential energy fields. This force field transformation helps the face images and finds the located area for ears as an array of mutually attracting particles that act as the sources of a Gaussian force field. A potential energy field analysis is extracted from the force field transformation across the existing location which is used to discover potential energy wells. The experiments for result were performed on a database of ear images selected from the XM2VTS face database for the better analysis. Performance priority based cutting-edge biometric technologies including ear recognition that attracted attentions due to noise and invariant texture patterns and physiological structures as well as behavior of biometrics characteristics. Many researchers have presented some results and discussed ear biometrics as user requirement to recognition from both controlled/uncontrolled environments [15]. **M. Choras** presented a study on ear biometrics using geometric feature extraction for improvement purpose. This first step of this biometric method is divided into image normalization, contour extraction (edge detection), and calculation of the centroid, coordinate normalization, and second step consists of geometrical feature extraction. The geometric features extracted are based on intersection points between circles of different radius with the calculated centroid as their centre and the contours extracted from the ear image. The experiment was conducted on more wide quality images with valid conditions for recognition, and without illumination changes. For ideal environment to improve recognition, an error free recognition technique was reported [6]. **Moreno et al.** performed two experiments with neural network classifiers in such manner where the features were extracted from ear images to perform edge detection analysis for the first experiment and extracting seven known feature points of the outer ear to form the feature vector. For the second experiment a "morphology vector" is formed from intersection points between h horizontal cuts, v vertical cuts, and $2(h + v)$ diagonal cuts performed operation over the profile images of an h x v size image [7]. Another approach was presented, recognition by using compression networks which was previously suffering to suggest operation for face recognition by Cottrell. In Moreno's research, six images per individual has been used; all were divided into three images for training, one image of them for validation, and two images of them for testing where they reported recognition rate for an "eigen-ear", PCA-based approach. The same approach was used to perform Hausdorff matching of edge images, edge matching on 3D ear images was achieved to high recognition rate. **Prakash and Gupta** recently described a new approach on ear recognition using edges. They used skin segmentation and classified the edges into 2 groups: convex and concave. Thereafter, the edges in the skin region are broken up into edge segments, which form an edge connectivity graph. The convex hull of all edges is computed from this connectivity graph. The enclosed region is the ear region [5]. **H. Alastair et al.** proposed the ray transform approach, which detects the ear in different positions and ignores straight edges in the image (which are caused by glasses or hair). This method uses a light ray analogy to scan the image for cylindrical and curved structures, such as the outer helix. The simulated ray is reflected in bright tube-shaped regions, highlighting these regions in the transformed image. Since glasses have straight edges, they are not highlighted by the ray transform. In early investigative research analysis, they performed experiments on scenarios with help of different feature extraction methods and different classification techniques to classify. The research was performed on a smaller data set that comprised seventeen individuals with six images per individual in resultant. In this works, four classifiers utilized feed-forward artificial neural networks (ANN), and three classifiers that were based on a nearest neighbor rule location search techniques. Image subdivision was first investigated in this study using the discrete cosine transform as a feature extraction technique, and feed-forward artificial neural networks for classification. Mu et al. have been attempted such characterization of ear shapes from the gradient operations of ear images, using long axis based shape and structural feature extraction to achieved promised results on the database of 77 subjects. It has detailed the usage of neural network classifiers on ear profile images derived from the gray level ear images. Ear shape features have shown to offer promising performance but on small size databases. Nanni and Lumini have recently exploited true colour information from the ear images and detailed the selection of colour spaces analysis, using the sequential forward floating selection scheme, when the fitness function is related to the optimization of performance this function for the ear recognition. Human ear is highly curved 3D surface and therefore provides rich 3D discriminate features for better biometric identification.

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A. Previous Approach:

Authors	Approach	Classifier	Database Size
A. Ianarelli	Manual ear measurements	-	10,000 images
Chang et al.	PCA	Eucledian Distance, K-NN	197 images
Burge and Burger	Voronoi Diagram	Graph Matching	-
Mottaleb and Zhou	Differential Geometry	Hausdroff Distance	29 images
Zhang et al.	ICA	RBF Network	60 images
Hurley et al.	Force Field transform, PCA	Eucledian Distance, K-NN	63 images
Kumar and Zhang	Log-Gabor wavelets	Hamming Distance, K-NN	113 images

III. TECHNIQUES DISCUSSION

A. Force Field Transform:

This method treats the images as an array of mutually attracting particles which act as source of Gaussian force field. Viewpoint invariance or illumination invariance, either in intensity or direction, is not essential for ear recognition. It provides the special shape based on the feature extraction. It extracts the essential ear signature with the need of explicit ear extraction. The image is transformed by pretending that consists of an array of N Gaussian attractors which act the main source of the force field. Each pixel is generated a spherical and symmetrical force field such that force $F_i(r_j)$ exerted on a pixel value for unit intensity at the each pixel location with position vector r_j through other pixel with position vector r_i and the pixel intensity value $P_i(r_j)$ is given as follows:

$$F_i(r_j) = p_i(r_j)\frac{r_i - r_j}{|r_i - r_j|^3}$$

B. PCA:

Principal Component Analysis is more powerful technique for reducing a bigger set of correlated variables to a smaller set of uncorrelated variables. It is suitable for ear representation and recognition. It deals with noise and outliers.

C. Support vector Machine:

Support Vector Machine is a classifier. It is a supervised learning method and associated with learning algorithm. It is used to classify the data to measuring the properties of the used data. SVMs have high generalization capabilities in many different tasks including the object recognition problem.

D. SURF ALGORITHM:

SURF algorithm is the feature point extraction algorithm. It is purposed by Bay H,Tuytelaars T,Gool L V in 2006. This algorithm is similar with SIFT algorithm. But, at the same time, it is three times faster than SIFT in calculate speed.

IV. PROBLEM DEFINITION

Ear pattern recognition using eigen ears is a biometric technique for human identification in which we use PCA(principal component analysis) image compression. Here we prefer eigen ears and if we have some problems regarding image quality we can improve the same by removing the noise from the image to make it fit for recognition. The image segmentation is done uniformly, horizontal or non horizontal. We can calculate eigen values, covariance between two images to find the match. we can also match images by computing Euclidean distance between two images, minimum distance gives the higher match.

- Our first problem is to check whether image is clear or blurred because if image is not clear we have to enhance it.

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- Our second problem is to pre-process it, means to transform it in required format.
- Third problem is to recognize it.

V. RESEARCH METHODOLOGY

To solve the problem mentioned above, mathematical modelling will be used for position estimation and MATLAB/Scilab will be used as simulation tool to analyse the performance of proposed scheme and to compare the existing techniques. The method uses a training dataset and testing dataset of ear images. The basic procedure is outlined in Figure 1.1 below:

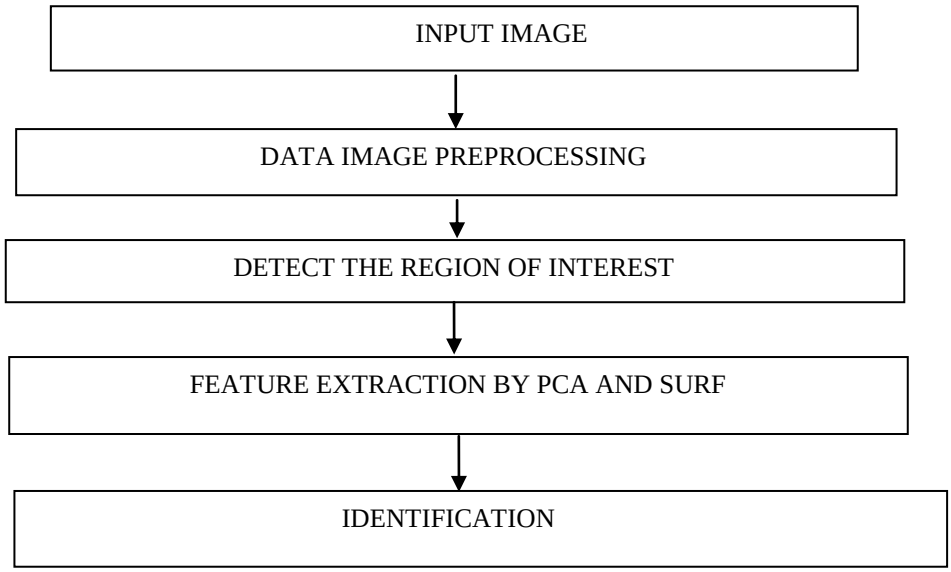

Figure 1: Overview of the System

A. Pre-processing:
Pre-processing involves converting the image to grey scale, performing histogram equalization, and Gaussian filtering. Pre-processing is essential in order to remove noise and smooth the image.

B. Feature Extraction:
Feature extraction deals with isolating distinct features of the ear in the image. I will mplement either PCA, LBP and spatial histograms to accomplish this. These three methods can be used for the feature extraction for image.

C . Identification:
Identification is the final act of classifying an ear image as belonging to a certain individual. It involves using the set of features that were extracted and comparing them to the database to determine which image matches the closest to it. In order to achieve this, I will implement the SVM classifier and the SURF.

VI. CONCLUSION

In this paper, the assorted literature which is related to the recognition methods based on ear biometric has been studied. These methods were anguished with some restricting issues to obtain the high performance results. These days, there is possibility and feasibility for the improvement in the field of human recognition by ear. The enhanced and excelling result can be retrieved on the basis of above mention techniques.

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