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Feature Extraction of Ear by using Histogram Equalization, Binarization and Edges

Shekhar Karanwal*

Assistant Professor, CSE Department
FET, GKV, Haridwar, INDIA
shekhar.karanwal@gmail.com

Abstract

This paper compares the information extracted from the ear biometric trait. The proposed method consists of ear images which go through different phases for information extraction. During first phase Histogram equalization is performed, in second phase Binarization is performed and during third phase Edges are considered for ear biometric trait. In each of the above described phases information is extracted by using SIFT feature extractor.

Keywords— Unibiometric systems, Histogram Equalization, Binarization, Canny edge, Sobel edge, Prewitt edge, SIFT

I. INTRODUCTION

Humans have been using physical characteristics such as face, voice, gait, finger, ear etc. to recognize each other for thousands of years. With new advances in technology, biometrics has become an emerging technology for recognizing individuals using their biological or behavioral traits [1]. This technology makes use of the fact that each person has specific unique physical traits that is ones characteristics, that can't be lost, borrowed, or stolen. Using biometrics, it is possible to confirm or establish identity based on "who the individual is", rather than by "what the individual possesses" (e.g., an ID card) or "what the individual remembers" (e.g., a password). Detecting objects from images is one of the most essential tasks of vision systems. In addition to this, the stability of tracking systems greatly depends on the detection of targets. A new class of biometrics based upon ear features was introduced for use in the development of passive identification systems by Alfred Iannarelli [2]. Identification by ear biometrics is promising because it is passive like face recognition, but instead of the difficulties to extract face biometrics, it uses robust and simply extracted biometrics like those in fingerprinting. The ear is a unique feature of human beings. Even the ears of “identical twins” differ in some respects. There are persons in crime laboratories that assume that the human external ear characteristics are unique to each individual and unchanging during the lifetime of an adult. Over the years, suggestions have been made in the occasional literature that the shapes and characteristics of human ear are widely different and may be in fact sufficiently variant such that it is possible to differentiate between the ears of all individuals [3].

Fig 1 .Down ear

The work comprises of histogram equalization, Binarization and Edges detection [9] from down ear image. After that SIFT is applied for keypoint extraction though all the phases and lastly results are compared from SIFT extracted keypoints.

I section introduces some aspects of biometrics, in section II related work is described, section III explains description of SIFT, after explaining SIFT section IV describes proposed algorithm, V section evaluate results and conclusion is drawn on section VI

II. RELATED WORK

David G. Lowe [4] [5] [6] used the SIFT for feature extraction. The approach is efficient on feature extraction and has the ability to identify large numbers of features. Our implementations based on obtaining SIFT features from a down ear image and compares the result obtained from three phases which are Histogram equalization, Binarization and Edges.

III. SIFT(SCALE INVARIANT FEATURE TRANSFORM)

The scale invariant feature transform, called SIFT [7] descriptor, has been proposed by and proved to be invariant to image rotation, scaling, translation, partly illumination changes. The investigation of SIFT features for biometric authentication has been explored in. The basic idea of the SIFT descriptor is detecting feature points efficiently through a staged filtering approach that identifies stable points in the scale-space. Local feature points are extracted through selecting the candidates for feature points by searching peaks in the scale-space from a difference of Gaussian (DoG) function. Then the feature points are localized using the measurement of their stability and assign orientations based on local image properties. Finally, the feature descriptors, which represent local shape distortions and illumination changes, are determined.

IV. PROPOSED ALGORITHM

During first step an ear image is converted into gray scale image and gray scale image is further converted into filtered image as shown on fig 2. Now all the further processing is done on filtered image. During phase 1 histogram equalization is performed, Binarization is performed on II phase and edge detection is performed on III, IV and V phase as shown below on fig 3.

Fig2. Conversion of ear image to gray scale image and then to filtered image

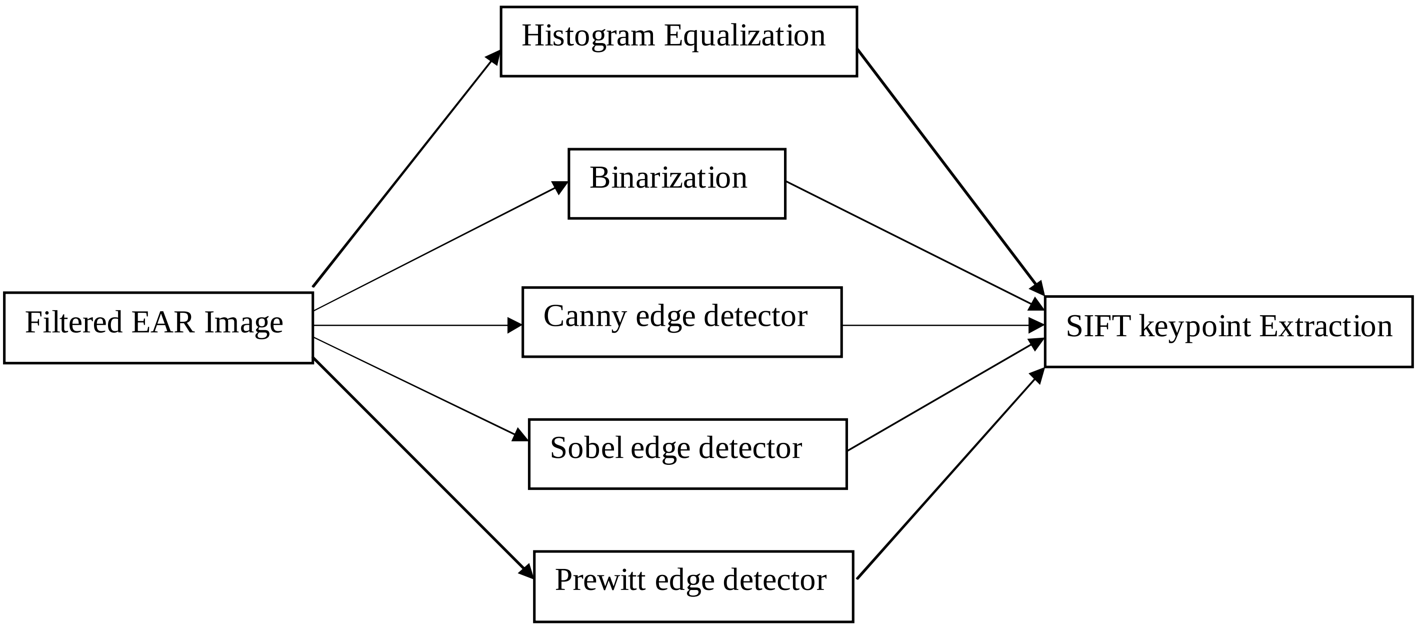

Fig3. Different phases of EAR image

V. RESULTS AND WORKDONE

This section basically shows how the ear image is processed. The database is taken from AMI Ear Database [8] by Esther Gonzalez, Luis Alvarez and Luis Mazorra. Image size is set to 150X250 and resolution is set to 72 dpi. During first step RGB image is converted into gray scale image and gray scale image is converted into filtered or sharpened image as shown in figure 4, now all the processing is done on Filtered ear image. In the first phase histogram equalization is performed on filtered ear image as shown in figure 5, in the second phase Binarization is preformed and finally on third phase canny edge, sobel edge and prewitt edge detector are performed as shown in figure 6, figure7, figure8 and figure 9. Finally SIFT is used to extract keypoints from the image as shown on figure 10, figure 11, figure12, figure13 and figure 14.

Fig 4 Conversion of RGB Image Gray Scale image and further to Filtered Image

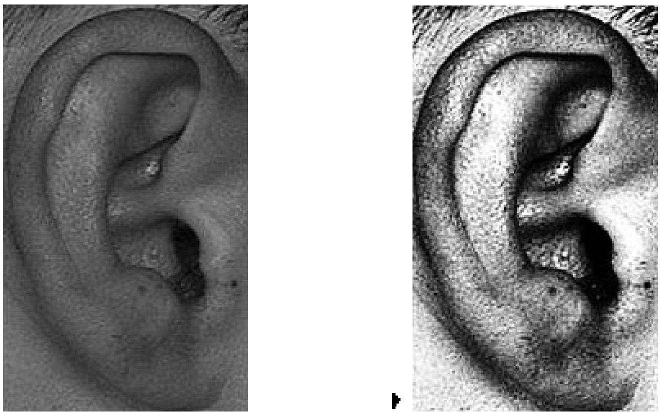

Fig.5 Conversion of Filtered ear image to histogram equalization image

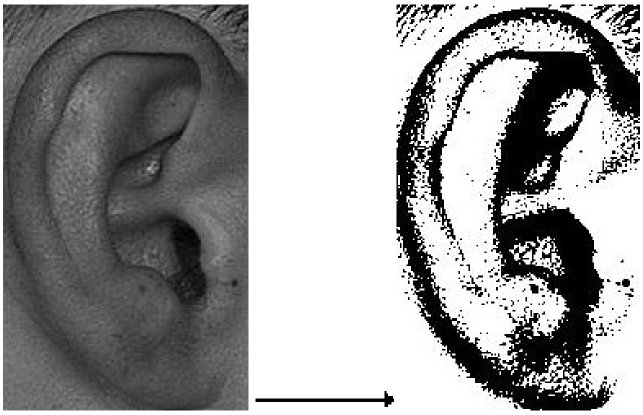

Fig.6 Conversion of Filtered ear image to Binarized image

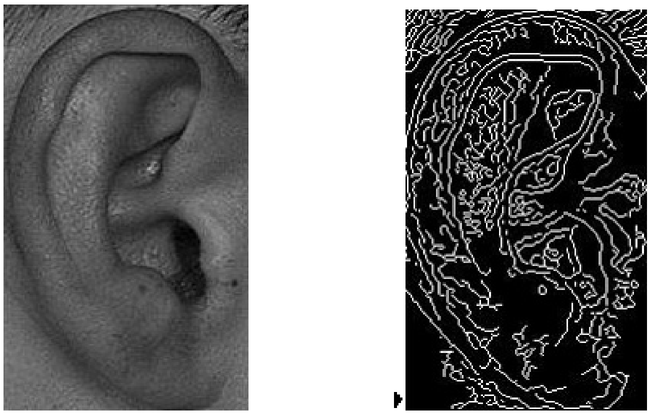

Fig.7 Conversion of Filtered ear image to canny edge

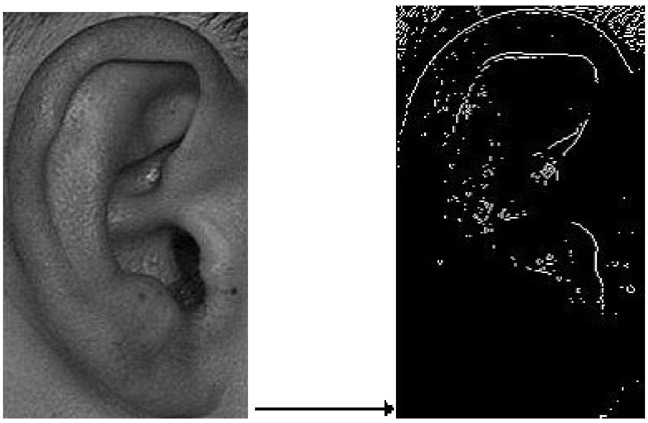

Fig.8 Conversion of Filtered ear image to sobel edge

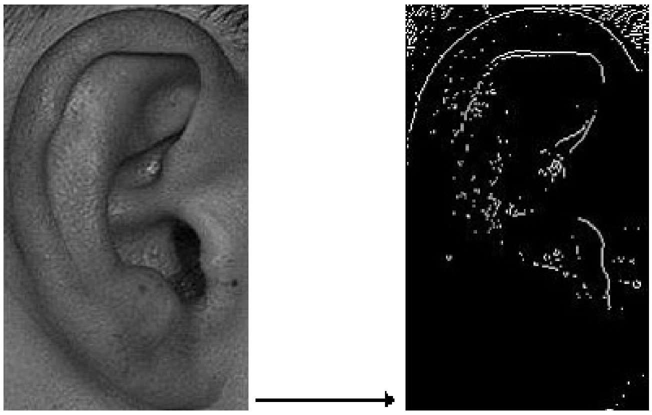

Fig.9 Conversion of Filtered ear image to Prewitt edge

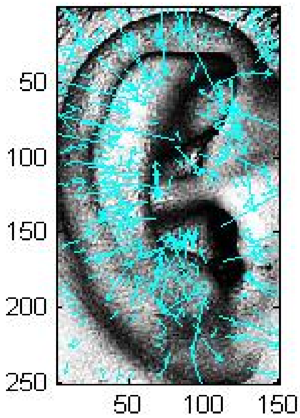

Fig.10 (345 keypoints are found)

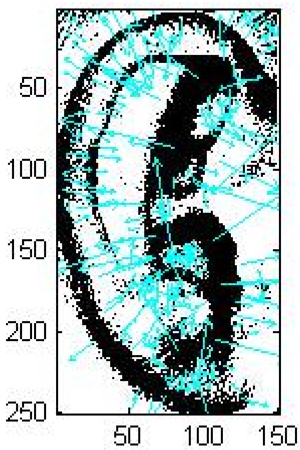

Fig.11 (279 keypoints are found)

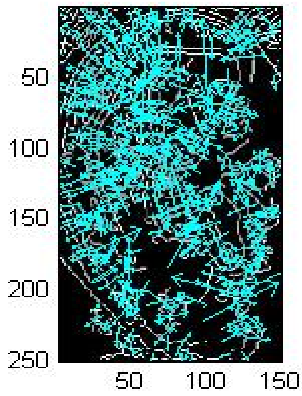

Fig.12 (736 keypoints are found)

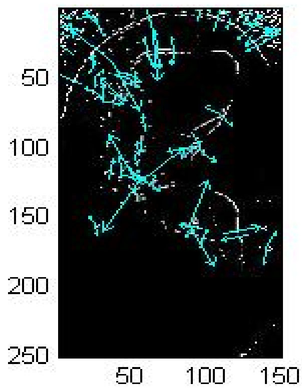

Fig.13 (99 keypoints are found)

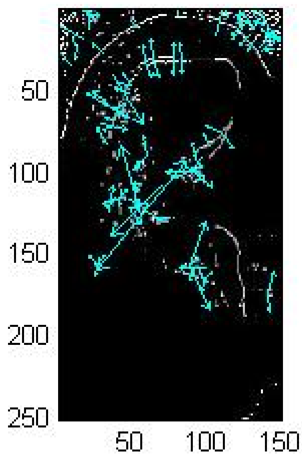

Fig.14 (102 keypoints are found)

After applying SIFT to images the results which obtained are, histogram equalization of image produces 345 keypoints, Binarization of image produces 279 keypoints, canny edge detector produces 736 keypoints , sobel edge produces 99 keypoints and finally prewitt edge produces 102 keypoints. This process is repeated for more than 100 Ear images but more information is extracted in case of Histogram Equalization of Images and Canny edge detection.

VI. CONCLUSION

From the results which are obtained by applying SIFT it is clearly concluded that information is extracted on all the phases but in case of histogram equalization, Binarization and canny edge detector more information is extracted as compared to other ones.

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