IJMRSETM

e-ISSN: 2395 - 7639

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING, TECHNOLOGY AND MANAGEMENT

Volume 10, Issue 2, February 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.580

| ISSN: 2395-7639 | www.ijmrsetm.com | Impact Factor: 7.580| A Monthly Double-Blind Peer Reviewed Journal |

| Volume 10, Issue 2, February 2023 |

| DOI: 10.15680/IJMRSETM.2023.1002012 |

Medical Ear Image Analysis with Active Contour Algorithm

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ABSTRACT- Security plays an increasingly vital role in our daily life and the biometric technology are becoming the solution for secured recognition and verification .Now a day's human ear is used in biometrics rather than using face, finger print, signature, iris biometrics and etc. Ears have gained attention in biometric due to the unique characteristics of its shape. The ear shape does not change due to emotions on our face and age. In this project, we present the basics of using ear as biometric technology for person identification and authentication. This work can be identified both outer curve (helix) and inner curve (anti-helix) of the ear and extracting features of the inner portion of the ear edge. Canny Edge detection algorithm is used here for finding the ear edge and active contour algorithm used for shape identification, segmentation, edge discovery and stereo matching. Finally, all the extracted images compared with the database of saved ear images and this will provide the best recognition system.

KEYWORDS: Contour tracking , Histogram equalization.

I. INTRODUCTION

Among the biometric verification methods EAR recognition is considered one of the most accurate and robust. EAR features can be easily extracted from EAR images and they can be efficiently compared. However if the biometric reference template or set of biometric features are disclosed,
the whole biometric system becomes useless for an individual, because the biometric information cannot be canceled or revoked as passwords. Therefore there is a need to perform iris features matching without revealing either the biometric data acquired during the verification process or the reference template from the database. Generally the biometric verification is based on the comparison between the features extracted from the input and the template. Due to the uniqueness of the biometric characteristics, the storage of the reference template is a key factor for the entire system security. Therefore it is essential to protect the template from possible attacks. One approach is to encrypt the template using a secret key before storing it. When a verification task is requested, the matcher decrypts the template and performs the comparison. A significant research effort has gone into this area and a number of research works were published, Biometrics is a growing technology, which has been widely used in forensics, secured access, prison security, medical, and robotics areas financial services, ecommerce, telecommunication, government, and traffic, health care the security issues are more important.

Ear biometrics can be applied for the verification and identification or recognition. Ear biometric can also be merged with the bank credit and debit card, thus enhancing the authentic issues further more. Ear biometric system must be used in the hospital premises to prevent the error of baby swapping, mixing among the new born babies. Ear recognition system is an idle for the task of surveillance and forensic picture examination. It was also reported that German police department uses the benefits of ear biometric to identify the presence of suspects in the surveillance image.

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Figure 1. Human EAR

The uniqueness of EAR texture lies in the fact that the processes generating those textures are completely chaotic but stable. Hence in order to use the iris as a biometric, the feature is extracted and it should be able to capture and encode this randomness present in the EAR texture. Human EAR contains large amount of specific and unique features that allows for human identification.

Bometric is an individual identification ability based on physiological characteristics such as fingerprint, handwriting, retina, iris and face. There are many advantages of employing biometric system for identification but there are also some disadvantages. We can mention to high recognition accuracy, uniqueness, and no needs to memorize a code as advantages and low public acceptance, and complex or expensive equipments as disadvantages. Any way the advantages of using the biometric systems are more than its drawback, so using is increasing daily. Based on an extensive literature survey, we classify iris recognition systems into three categories depending on the method by which the features are extracted for matching purposes. Those three categories are (a) appearance based, (b) texture based (c) feature based extraction.

II. RELATED WORK

Beginning from 1987, automatic EAR recognition systems have been proposed. In [4], Daugman developed an EAR recognition system using 2D EAR for feature extraction and hamming distance for verification. It became the basis for most of the current commercial iris verification products. Like most other biometric authentication systems, the input EAR contained images need to be processed so that the characteristic iris features can be extracted for comparison. EAR matching was performed by computing Euclidean distance between the input and the template feature vectors. To measure the consistency of EAR images from the same EAR. Filtering an iris image with a family of filters resulted in 1024 complex-valued phasors which denote the phase structure of the EAR at different scales. It turns out that even although growth is proportional ear, gravity can cause the ear undergo stretching in the vertical direction. The effect of this stretching is more pronounced in the earlobe, and Measurements show that change is not linear. The cup of stretching is about five times higher than normal during the period of four months from the age of eight, after that is constant up to about 70 when increases again. In this system only trace the outer boundary of the ear image. Only outer boundary does not give the efficient feature value(unique value) for identification.

If the edge of the ear image is broken or vague then the whole methodology will be fall and the ear orientation is another limitation of this method. If the ear height line can be in appropriate due to noisy edge and broken edge. So the angle measured will be also incorrect.

An active contour algorithm along with a tree-structured graph to segment the ear region from the profile images. The segmented ear database is then categorized based on the geometrical feature values, computed from the ear shape, into oval, round, rectangular, and triangular categories.

For the categorization based on the depth information, the feature space is partitioned using tree-based indexing techniques.

We used indexing techniques with balanced split (k-dimensional (kd) tree) and unbalanced split (pyramid tree) data structures to categorize the database separately and then compared their retrieval efficiency.

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III. ARCHITECTURE DESIGN

Input Design is the process of converting a user-oriented description of the input into a computer-based system. This design is important to avoid errors in the data input process and show the correct direction to the management for getting correct information from the computerized system. It is achieved by creating user-friendly screens for the data entry to handle large volume of data. The goal of designing input is to make data entry easier and to be free from errors. The data entry screen is designed in such a way that all the data manipulates can be performed. It also provides record viewing facilities. When the data is entered it will check for its validity. Data can be entered with the help of screens. Appropriate messages are provided as when needed so that the user will not be in maize of instant. Thus the objective of input design is to create an input layout that is easy to follow.

Contour algorithm is designed to perform this decompression by exploiting a graph composed of the bit pairs in EAR Code compression (Contour) algorithm, prior knowledge from iris image databases, and the theoretical results. The post processing techniques are Normalization, Segmentation and also the Gabor filters which influence the distributions of the bits, that the bitwise Hamming distance can be regarded as a bitwise phase distance to be calculated using graph-based estimation algorithm. For these reasons, the human EAR is an ideal feature or highly accurate and efficient identification systems. Like most other biometric authentication systems, the input EAR contained images need to be processed so that the characteristic iris features can be extracted for comparison which is shown in below at Figure 1

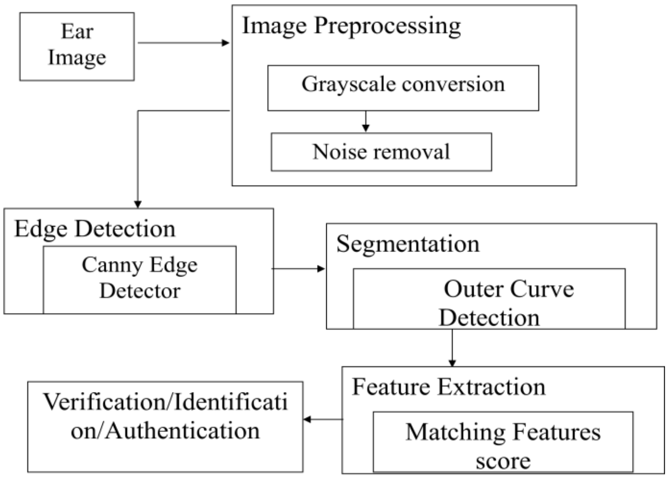

Figure 2. Architecture design

A. IMAGE CONVERSION

Grayscale images are distinct from one-bit black-and-white images, which in the context of computer imaging are images with only the two colors, black, and white (also called bi-level or binary images). Grayscale images have many shades of gray in between. Grayscale images are also called monochromatic, denoting the absence of any chromatic variation. Grayscale images are often the result of measuring the intensity of light at each pixel in a single band of the electromagnetic spectrum (e.g. infrared, visible light, ultraviolet, etc.), and in such cases they are monochromatic proper when only a given frequency is captured. But also they can be synthesized from a full color image; see the section about converting to grayscale.

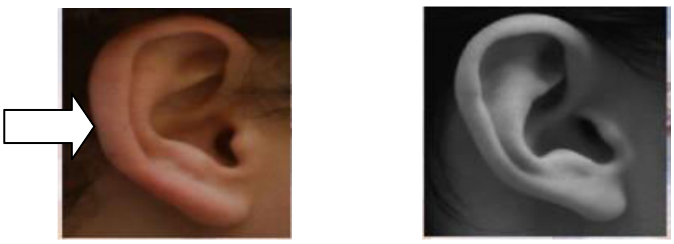

Figure 3. Conversion of original image to grayscale image

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B. Edge Detection

Edge detection is a fundamental tool in image processing and computer vision, particularly in the areas of feature detection and feature extraction, which aim at identifying points in a digital image at which the image brightness changes sharply or, more formally, has discontinuities. The edges extracted from a two-dimensional image of a three-dimensional scene can be classified as

- Viewpoint dependent
- Viewpoint independent.

A viewpoint independent edge typically reflects inherent properties of the three-dimensional objects, such as surface markings and surface shape.

A viewpoint dependent edge may change as the viewpoint changes, and typically reflects the geometry of the scene, such as objects occluding one another.

IV.LOCALIZATION OF IRIS WITH CANNY EDGE DETECTION

Detection technique used for segmentation and it is implemented using image management tool in LABVIEW and vision module. Here, after getting the input image, the next step is to localize the circular edge in the region of interest. Canny edge detection operator uses a multi-stage algorithm to detect a wide range of edges in images. It is an optimal edge detector with good detection, good localization and minimal response. In localization we used this detection, in which the inner and outer curve of the EAR is approximated.

The outer boundary is detected between the helix and the EAR. At the same time, the inner boundary of the EAR is more difficult to detect because of the low contrast between the two sides of the boundary. So, we detect the outer boundary by maximizing changes of the perimeter along the circle. Iris segmentation is an essential process which localizes the correct iris region in an EAR image. Circular edge detection function is used for detecting EAR as the boundary is circular and darker than the surrounding.

Canny Edge Detection

The Canny algorithm basically finds edges where the grayscale intensity of the image changes the most. These areas are found by determining gradients of the image. Gradients at each pixel in the smoothed image.

The algorithm runs in 5 separate steps:

1. **Smoothing**: Blurring of the image to remove noise.
2. **Finding gradients**: The edges should be marked where the gradients of the image has large magnitudes.
3. **Non-maximum suppression**: Only local maxima should be marked as edges.
4. **Double thresholding**: Potential edges are determined by thresholding.
5. **Edge tracking by hysteresis**: Final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge.

Figure 4. Canny Edge Detection

C .SEGMENTATION

Segmentation is an initial stage of image analysis. In this stage segmentation per formed by edge detection method. Ear edges can be detected by canny edge operator.

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The Canny edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images. It takes as input a gray scale image, and produces as output an image showing the positions of tracked intensity discontinuities.

In our project canny edge detector was applied to identify the main edges on the ear image.

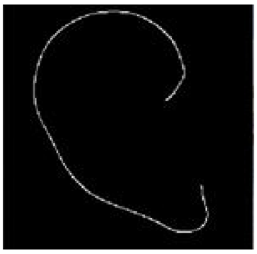

Figure 5. Detection of outerl boundary

External noise is removed by blurring the intensity image. But too much blurring may dilate the boundaries of the edge or may make it difficult to detect the outer EAR boundary. Thus a special smoothing filter such as the median filter is used on the original intensity image. This type of filtering eliminates sparse noise while preserving image boundaries. After filtering, the contrast of image is enhanced to have sharp variation at image boundaries using histogram equalization.

D.CONTOUR TRACKING

Since the ear has quite a lot of ridges, it seemed like as a suitable choice. We assumed that the longest edge detected would be the out contour area of the ear.

Active Contours are deformable models which operate under internal and external forces to fit object boundaries. Since ears have a very strong gradient around the helix. For generate the feature score based on selection of contour line of an ear.

Figure 6. Detection of outer pupil boundary

Feature Extraction

Corners in the normalized iris image can be used to extract features for distinguishing two EAR images. The steps involved in corner detection algorithm are as follows:

S1: The normalized EAR image is used to detect corners using covariance matrix.

S2: The detected corners between the database and query image are used to find cross correlation coefficient.

S3: If the number of correlation coefficients between the detected corners of the two images is greater than a threshold value then the candidate is accepted by the system.

C. MATCHING

Matching of two iris code is performed using the Hamming distance. The Hamming distance gives a measure of how many bits are the same between two bit patterns. Using the Hamming distance of two bit patterns, a decision can be made as to whether the two patterns were generated from different irises or from the same one. In comparing the

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bit patterns X and Y, the Hamming distance, HD, is defined as the sum of disagreeing bits (sum of the exclusive-OR between X and Y) over N, the total number of bits in the bit pattern distance is the matching metric employed by Daugman and calculation of the Hamming distance is taken only with bits that are generated from the actual iris region.

Two irises are determined to be of the same class by a comparison of the feature vectors, using a Daugman like X-OR operation. Finally matching would be done of the iris. The matching would be done with the trained images. So that, if the images are matched and present in our database it shows the details of that person. Details such as his personal details, health details. If it is not matched with the database, then the details will be collected for further investigation, if it is needed.

V.CONCLUSION

This process includes curve fitting of the outer ear edge and finding the proper orientation of the ear. Although proposed methodology works weakly in low hysteresis threshold, it recognizes the ear more accurately and accustomed with the real environment. Through this methodology and can be traced out with a better accuracy than existing domain approach. This project proposes a new methodology to recognize ear with a random orientation.

VI.FUTURE WORK

This work can be extended for inner curve fitting of the ear and extracting features of the inner portion of the ear edge in future.

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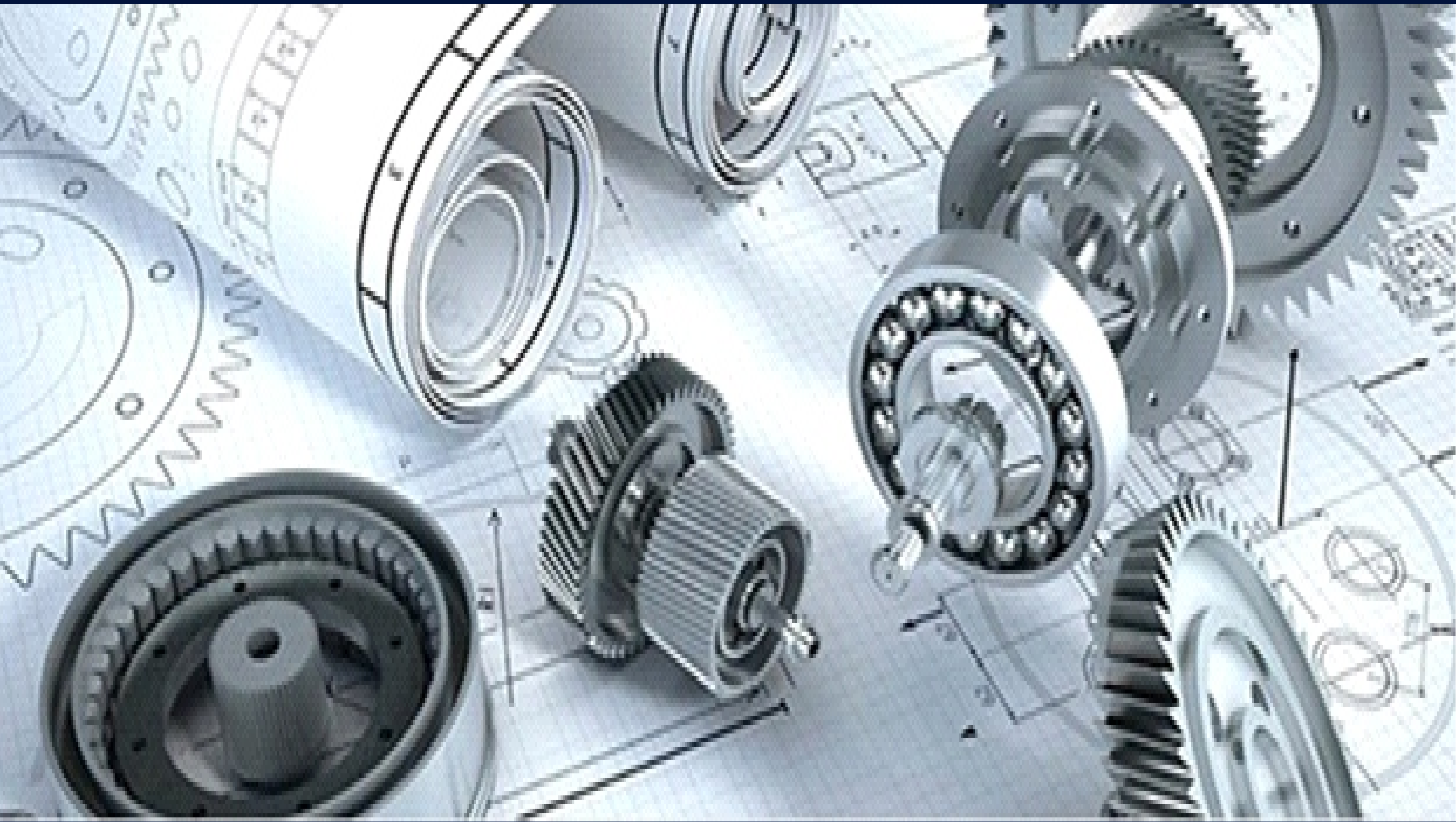

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