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Comparative Result On Feature Extractions Techniques For Human Ear Identification System Using Biometrics Ear Images

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Biometrics comprises the learning of automatic approaches for individual human beings based on physical or developmental characters. The difficulty of finding good biometric features and recognition systems has been studied broadly in current ages. This research reflects the use of ears as a biometric for human recognition. In this paper, feature extraction skills are applied such as Harris Feature, FAST Feature extraction and SURF Feature Extraction. All the images are taken from standard database and every image has different angles because of any criminal examination, accident, or ATM machine room camera taken different types of images. So, using different angular images feature extraction the research goes through these techniques to give the best result to the user.in this researcher used SIFT algorithm.

SIFT is an image local feature description process built on scale-space. Its strong similar capability, SIFT has numerous applications in different areas, such as image recovery, image edging, and machine idea. After SIFT was proposed, researchers have never stopped tuning it.

Keywords: Ear Bometrics, Pre-Processing SIFT, SURF Algorithm

1. INTRODUCTION

The feature extraction and feature matching of this paper are simulated on matlab 5].SIFT algorithm is a gentle of image limited structures, find the extreme points in the measure space, regulate the position, scale and revolution invariant technique, these fundamentals will be joint into a feature descriptor is the feature of the image . The excellence of images is 2448 by 3264 for height and width, correspondingly. [6] In image parts of the database, using first-class

2. Feature extraction

Feature extraction for ear images involves extracting distinctive characteristics or patterns from the images that can be used to differentiate and match them. Here are some commonly used feature extraction techniques for ear images, Geometric features: Geometric features capture the shape and structure of the ear. These features can include measurements of the length, width, and curvature of different parts of the ear, such as the helix, lobe, and antihelix. Geometric features can be extracted using techniques like edge detection, contour analysis, and landmark detection.Texture features: Texture features describe the surface patterns and texture variations present in the ear. These features can be extracted using methods like Local Binary Patterns (LBP), Gabor filters, or gray-level co-occurrencematrices (GLCM). These techniques analyze the texture properties of different regions of the ear image, such as the ridges, furrows, and texture variations.Statistical features: Statistical features provide information about the statistical properties of the pixel intensities in the ear image. These features can include mean, standard deviation, skewness, and kurtosis of the pixel values in different regions of the ear image. Statistical features can help capture unique characteristics of the ear's appearance.Wavelet-based features: Wavelet analysis decomposes the ear image into different frequency bands, allowing the extraction of features at multiple scales. Wavelet-based features can capture both global and local characteristics of the ear image, providing a more comprehensive representation.Scale-Invariant Feature Transform (SIFT): SIFT is a popular feature extraction technique used in computer vision. It detects and describes distinctive local features in the ear image, such as keypoints, which are invariant to scale, rotation, and affine transformations. SIFT features can be used for matching and recognition tasks.Deep learning features: Deep learning techniques, such as convolutional neural networks (CNNs), can automatically learn and extract high-level features fromear images. Pretrained CNN models like VGGNet, ResNet, or InceptionNet can be used to extract features from ear images, either by using the models as feature extractors or by fine-tuning the models on specific ear image datasets.The choice of feature extraction technique depends on the specific requirements and characteristics of the ear image dataset and the intended application. It is common to combine multiple feature extraction methods to capture different aspects of the ear's appearance and improve the accuracy of matching or recognition systems

Geometric features

Geometric features for ear images capture the shape and structural characteristics of the ear. These features can provide information about the overall ear structure, including the shape of the helix, lobe, antihelix, and other anatomical components. Here are some commonly used geometric features for ear images:

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Ear length: Measure the length of the ear from the top of the helix to the bottom of the lobe. This feature represents the overall size of the ear.Ear width: Measure the width of the ear at different points, such as the widest part of the helix or the width of the lobe. This feature provides information about the ear's width or thickness.Curvature: Analyze the curvature of specific parts of the ear, such as the helix or antihelix. Curvature features can capture the variations in the shape and contour of these structures.Ridge count: Count the number of ridges or creases present on the ear's surface. Ridge count features can be obtained by analyzing the ridges along the helix or antihelix and can help in distinguishing individuals.

Landmarks: Identify and locate specific landmarks on the ear, such as the tragus, antitragus, or the concha region. These landmarks serve as reference points and can be used to calculate various geometric features, including distances, angles, and ratios.Aspect ratio: Calculate the ratio of the width to the length of the ear. This feature provides information about the overall ear shape and elongation.Symmetry: Measure the symmetry between the left and right ears. This can be done by comparing the geometric features of the two ears, such as ear length, width, or angles between landmarks.To extract these geometric features, various image processing techniques can be employed, such as edge detection, contour analysis, shape fitting, or landmark detection algorithms. These techniques help identify and measure the specific geometric properties of the ear image, allowing for differentiation and matching of ear images in biometric systems or other applications.4]. Different from the traditional SURF algorithm which uses Hessianmatrix to identify feature points, this paper uses multi-scale FAST algorithm to extract a huge number of feature points, [4]. And then use the better CANNY algorithm to growth the number of stable features quantity conferring to the double threshold adaptively. To find keypoints (distinctive points) in ear images, you can use feature extraction algorithms like SIFT (Scale-Invariant Feature Transform) or SURF (Speeded-Up Robust Features). These algorithms automatically detect and describe keypoints in images. Here, I'll outline how to use the SIFT algorithm in MATLAB to find keypoints in ear images. Keep in mind that you might need to adjust the code and parameters based on your specific dataset and requirements.

In SURF example, we're using the detectSURFFeatures and extractFeatures functions from MATLAB's Computer Vision Toolbox. The detectSURFFeatures function detects keypoints, and the extractFeatures function computes descriptors for those keypoints.

Remember that SIFT and SURF are just two of the many algorithms available for feature extraction. Depending on your requirements, you might also explore other algorithms like ORB (Oriented FAST and Rotated BRIEF) or even deep learning-based methods.

Additionally, you might need to tune parameters such as the threshold for keypoint detection, depending on the quality and nature of your ear images. Experimenting with different settings will help you find the right balance between the number of keypoints detected and their quality.

Lastly, it's important to preprocess your images as needed, including resizing, cropping, and normalizing, to ensure consistent results from the feature extraction process.

2.1SURF (Speeded-Up Robust Features

Certainly, the SURF (Speeded-Up Robust Features) algorithm can also be applied to ear recognition in biometrics. Ear recognition is a less common but increasingly explored biometric modality that relies on the unique characteristics of the ear structure for identification. Here's how SURF could be used for ear recognition: Keypoint Detection: In ear recognition, the first step is to detect keypoints or distinctive points on the ear image. These keypoints could correspond to specific features such as the helix, lobule, concha, and other ear structures. SURF is used to identify these keypoints, which are areas of the ear image that stand out due to their unique visual attributes. Keypoint Description: Once keypoints are detected, SURF generates descriptors for each keypoint. These descriptors are vectors that capture the local texture and shape information around each keypoint. The descriptors are designed to be invariant to various transformations such as rotation, scaling, and changes in lighting, which is important for accurate recognition. Feature Matching: During the recognition phase, a database of previously registered ear images is available. When a new ear image is presented, SURF keypoints and descriptors are generated. The algorithm then matches the keypoints and descriptors of the new image against those in the database. This matching process helps identify the closest matching ear images. Recognition and Authentication: The matching results areused to determine the identity of the individual based on the database entry with the closest matching ear image. Authentication or identification decisions can be made based on the similarity scores between the descriptors of the new image and the database images. 4]. the SURF algorithm executes feature matching, if the adjoining material of the feature points of the similar image is similar or the angle of the image is diverse, the similar matching degree of two different feature point descriptors may be created, exceeding the same feature point descriptor Match. Because the SURF algorithm only uses the Euclidean distance as the matching measure,It's important to note that while SURF is a robust algorithm for keypoint detection and description, its suitability for ear recognition depends on the quality of the ear images and the uniqueness of the ear features. Additionally, the field of biometrics is constantly evolving, and newer algorithms might offer better performance and accuracy for specific modalities like ear recognition. Always consider the most recent research and advancements in biometric technology when designing and implementing biometric systems.

SIFT (Scale-Invariant Feature Transform) algorithm

The SIFT (Scale-Invariant Feature Transform) algorithm is another popular computer vision technique that can be used for ear recognition in biometrics. Like SURF, SIFT is designed to detect and describe distinctive keypoints in images, making it suitable for identifying unique characteristics of the ear structure. Here's how the SIFT algorithm could be applied to ear recognition **Keypoint Detection:** SIFT begins by detecting keypoints or interest points in the ear image. These keypoints are selected based on their distinctive characteristics, such as corners, edges, and blobs. SIFT uses a scale-space pyramid to detect keypoints at multiple scales, which makes the algorithm robust to variations in size 3]. Firstly, SIFT key-points are gained from a gathering of images (datasets) and stored in the place of the complete databank

Orientation Assignment: For each keypoint, SIFT computes a dominant orientation based on the gradient directions of the image in the local neighborhood around the keypoint. This step ensures that the keypoints are invariant to image rotation.

Descriptor Generation: Once keypoints and orientations are determined, SIFT generates descriptors for each keypoint. These descriptors are created by considering the gradient magnitudes and directions in the vicinity of the keypoint. The descriptors are designed to be robust to various transformations, including rotation, scaling, and changes in lighting. 3]. Mixtures of key points that match to a possible pattern are accepted when three or more keypoints approve on the model standards. Feature Matching: During the recognition phase, the SIFT keypoints and descriptors of the query ear image are compared to those in the database of registered ear images. Similarity measures, such as Euclidean distance or cosine similarity, can be used to match the descriptors and identify potential matches in the database.Recognition and Authentication: Based on the matching results, the identity of the individual can be determined by selecting the closest matching ear image from the database. Authentication or identification decisions can be made based on the similarity scores between the query image's descriptors and the database images' descriptors. It's important to keep in mind that while SIFT is a powerful algorithm for feature detection and description, its computational complexity may pose challenges for real-time applications, especially when dealing with large databases. Additionally, the field of biometrics is dynamic, and newer techniques might offer improved performance and robustness for ear recognition. Always stay informed about the latest advancements in biometric technologies when considering the implementation of biometric systems.SIFT has been used for object feature extracting. 3]. It is invariant according to object scaling, rotation. Typically, pre-processing step start by converting the given image into the grey level and the reduction of some noise.

3. Result Using SIFT and SURF Algorithm

Figure1.1 show the study and various phases of the pre-processing techniques.

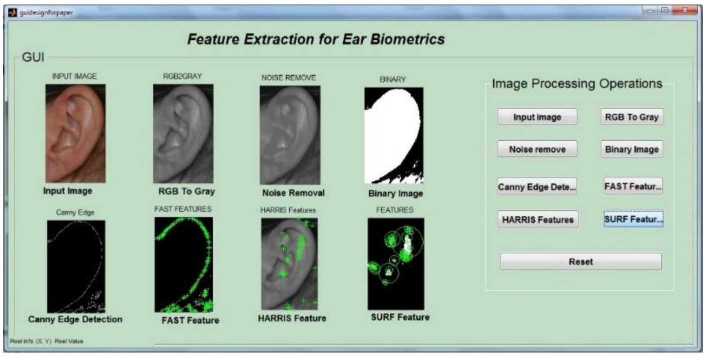

Figure:1.1 Output GUI

3]. after computing SIFT keypoints and determine the descriptors has computed the matching steps. In the experimental results, the proposed method has achieved satisfactory results of up to 91%.Acknowledgementmethod is used to identify user from input image. [7]First the image acquisition is complete with the use of built-in camera.

Experiment Result

earImage = imread ('path_to_your_image.jpg');
imshow (earImage); title ('Original Ear Image');
SIFT Algorithm applied grayEarImage = rgb2gray(earImage); % Create a SIFT object
sift = detectSURFFeatures (grayEarImage);

In this example, we're using the detect SURFFeatures and extract Features functions from MATLAB's Computer Vision Toolbox. The detectSURFFeatures function detects keypoints, and the extractFeatures function computes descriptors for those keypoints. Remember that SIFT and SURF are just two of the many algorithms available for feature extraction. Depending on your requirements, you might also explore other algorithms like ORB (Oriented FAST and Rotated BRIEF) or even deep learning-based methods. Additionally, you might need to tune parameters such as the threshold for keypoint detection, depending on the quality and nature of your ear images. Experimenting with different settings will help you find the right balance between the number of keypoints detected and their quality.Lastly, it's

important to preprocess your images as needed, including resizing, cropping, and normalizing, to ensure consistent results from the feature extraction process. Image Warping and Visualization Apply the estimated geometric transformation to warp one ear image so that it aligns with the other image. This step will help visualize the match and assess the quality of the alignment.Here's a simplified example of how you might perform ear image matching using SURF features and MATLAB's Computer Vision Toolbox% Extract features from both images
then preprocessing and feature extraction take place. After feature extraction, the obtained feature vector is classified
subplot(1, 3, 1); imshow(image1);
title('Image 1'); subplot(1, 3, 2);
imshow(image2); title('Image 2');
subplot(1, 3, 3); imshow(outputImage);
title('Image 1 Warped to Image 2');
figure;
show MatchedFeatures (image1, image2, inlierPoints1, inlierPoints2); title('Matched Features'); legend('Image 1', 'Image 2');

Table1.1 Algorithms Features Points

Algorithm	No of features points detected			Matching features
	Image1	Image2	Image3	
FAST	631	368	809	225
SURF	334	116	680	70
Eigen	3315	1526	7272	1199
Harris	1061	503	2349	325
MSER	225	146	560	115

4. CONCLUSION

This paper introduce the study of SIFT and SURF feature extraction In ear recognition, the first step is to detect keypoints or distinctive points on the ear image. These keypoints could correspond to specific features such as the helix, lobule, concha, and other ear structures. SURF is used to identify these keypoints,

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