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Finger Knuckle Recognition System for Person Verification

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Abstract:
Generally, the recognition and verification of the person can be done by using the cards which will have the pin numbers, passwords or some patterns, etc. which can be hacked by any illegal hackers. Solution for this kind of illegal activities is use of biometric. Biometric is a different and effective technique which is based on anatomical and behavioral characteristics of humans. These characteristics can be used for person recognition. This paper suggests a new recognition technique of biometric characteristic known as Finger Knuckle Print (FKP). Here we use a Feature Extraction of Finger Knuckle Print (FKP) based on Scale Invariant Feature Transform (SIFT) algorithm. Key points are derived by SIFT. The Centroid value of these key points is stored in a database. These values are then compared with the query image of FKP. Hence this paper gives a novel recognition method to provide person verification.

Keywords: Biometric Characteristic, SIFT algorithm, Feature Extraction, Histogram Equalization, Matching Technique.

I.INTRODUCTION

Biometric means the characteristics of the human body such as Fingerprint, Palms, Eye retina, Iris, Voice pattern etc. These are the effective and different tool based on anatomical and behavioral characteristics of human beings. The Characteristics such as Fingerprint, Iris, etc. are used for security purposes. Such a characteristics are known as anatomical characteristics. The behavioral characteristics such as voice patterns, face, signature, etc. are used for recognition of humans. Nowadays these characteristics are used in real time systems at airports, multinational companies for security purpose. Generally cards, passwords are used for authentication purpose. But these tools are not 100 percent safe. Well trained hacker can hack the user data. At that time we cannot even check who genuine user is and who imposter is. So the use of biometric characteristics is the solution for these problems. Here we offers new biometric identifier characteristic known as Finger Knuckle Print (FKP). This is new emerging biometric characteristic. FKP has different characteristics such as fingerprint, Iris, etc. Lots of research is done on the finger knuckle print and still going on. Recently it has been found that the FKP is highly rich in textures and can be used to uniquely identify a person. In this recognition system image acquisition, ROI extraction, feature extraction, coding and matching process is done. Feature extraction is done by using Scale Invariant Feature Transform (SIFT) algorithm. The average values of global and local orientation features of FKP are considered and matched with features of query image. Mainly four steps involved in SIFT algorithm are Scale Space Extrema Detection, Keypoint localization, Orientation Assignment, Keypoint Matching. The general recognition system involves two phase: - 1. Enrollment Phase, 2. Verification Phase. In enrollment phase the first extracted features of any Finger Knuckle Printare stored in database. And in verification phase same features are matched with features of query image. The sample Finger Knuckle Print (FKP) is shown in Figure (1).

Figure.1. Finger Knuckle Print

II. STRUCTURE OF PROPOSED WORK

The Block diagram of proposed work is shown in Figure (2).

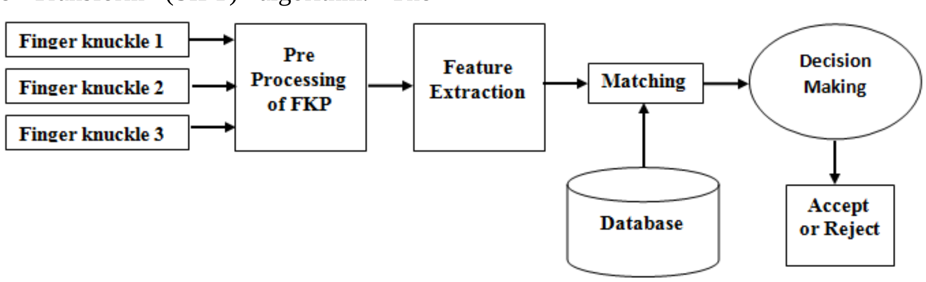


Figure.2. Block Diagram

In this methodology firstly the acquisition of FKP image done. Image acquisition is done by using any digital camera. Each FKP image needs localization of ROI which means Region of Interest for the extraction purpose. The ROI is the region having important knuckle curves and patterns. These are important to make a local coordinate system for knuckle image. According to such coordinates the ROI is cropped from the FKP image. The ROI must be extracted using the edge detection based technique which gives segmented FKP image. The finger knuckle has the different curves which also generates shadows. Therefore image has low contrast and non-uniform brightness. This kind of effects can be reduced in the image enhancement process. Here we have used Histogram equalization technique for enhancement of image. Then this enhanced image has important curved lines and creases. These curves and creases are detected and features are extracted from the image. Here we have used the Scale Invariant feature transform algorithm for feature extraction. Then the database is generated by extracting the FKP images of different users. Then by using feature matching algorithm the person will be recognized. The Work flow diagram for proposed Finger Knuckle Recognition System is shown in Figure (3).

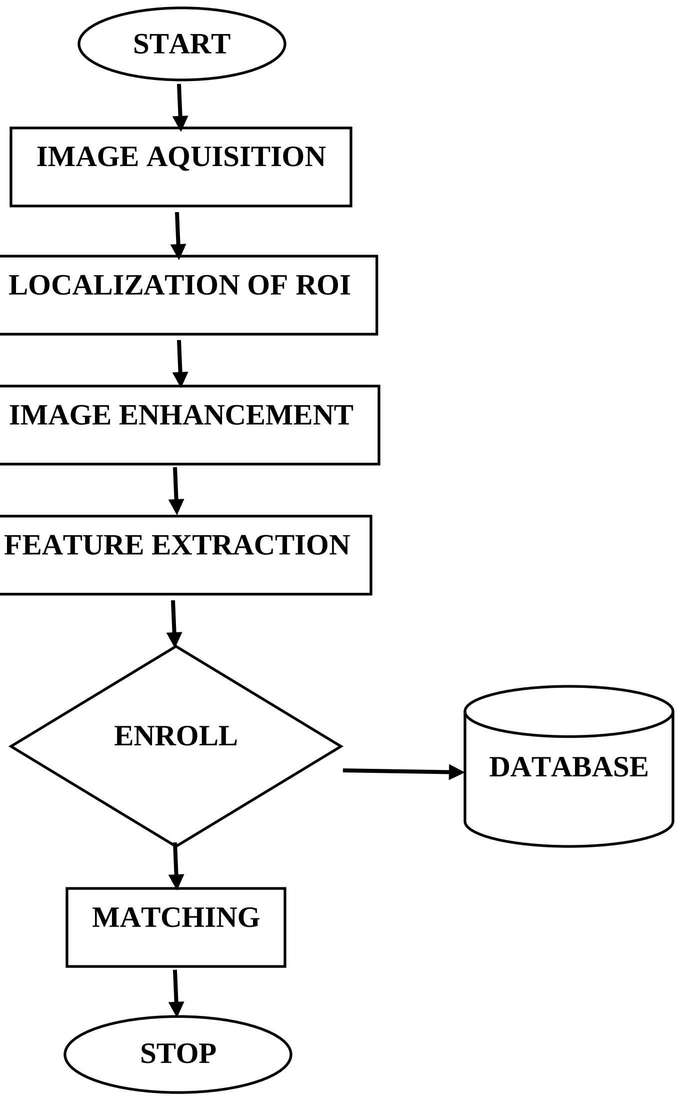


Figure.3. Flowchart

III. FEATURE EXTRACTION OF FINGER KNUCKLE

A) Image Preprocessing

The knuckle images sometimes get corrupted because of the noise. Images with noise cannot be used for the authentication purpose and if used then it causes the incorrect recognition rate and accuracy of the system. Also the finger knuckle has the different curves which also generate shadows. Therefore image has low contrast and non-uniform brightness. This kind of effects can be reduced in the image enhancement process. In enhancement, the image is made smoothen. Smoothing filters are used for blurring and to reduce the noise from the image. Blurring is used for removing all the small details from an image. Here linear as well as non-linear filters can be used. Different enhancement techniques are there such as reflection removal, contrast stretching with histogram, min-max normalized technique, etc. are used. We are using the histogram equalization technique for enhancement of finger knuckle image. Following figure (4) shows the original image and its enhanced version.

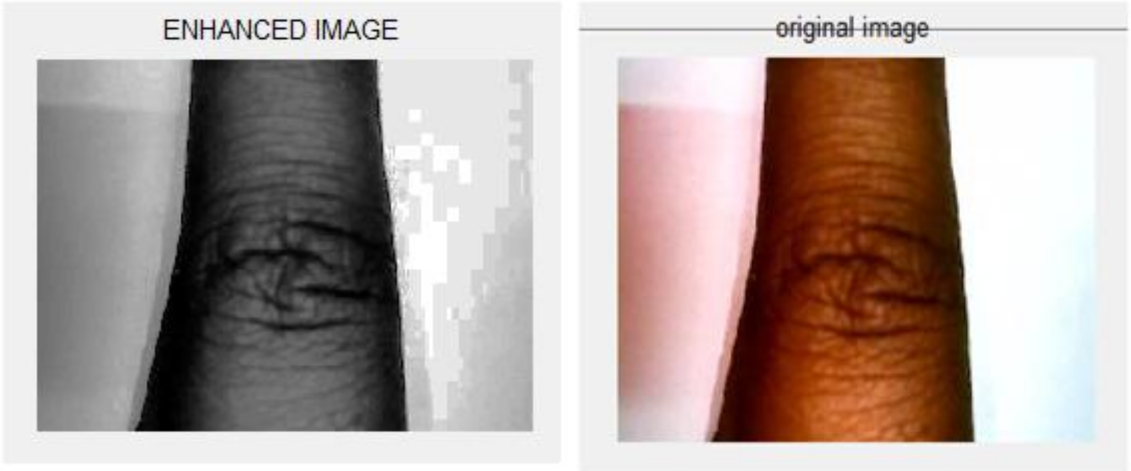


Figure.4. Enhanced Image

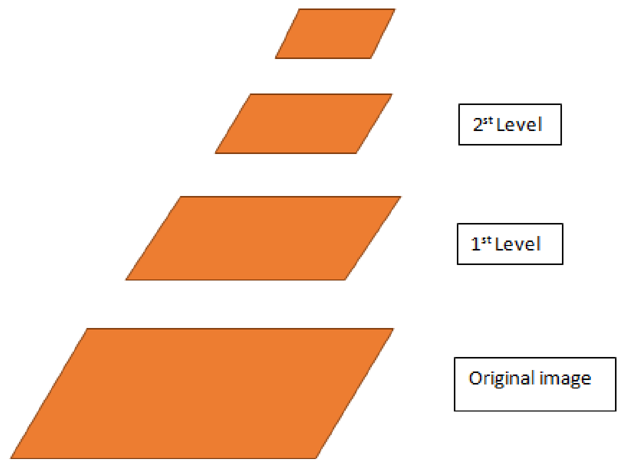
B) Feature Extraction

1. Scale-space Extrema Detection

The following figure shows keypoint extraction of the finger knuckle image.

Figure.5. Scale space extrema detection

Scale space extrema detection is used to identify the location and scales that can be repeatedly assigned under various views of the single object or the single scene. Search for the stable features across multiple scales using a continuous function of scale. Previous work has shown that under a various assumptions, the good function is a Gaussian function. The scale space of an image is a function $l\ (x,\ y, \sigma)$ which is produced from the convolution of Gaussian kernel at different scales of input image. Consider the Figure (6). In this figure bottom level is the original image. Secong level is the derived from the original image according to some functions. Third level is derived from the second level according to the same funcion and so on. This process is carried out for various octaves of the image in Gaussian Pyramid.



2. Keypoint Localization

Once the keypoints are located, they have to be processed to get more accurate results. Taylor series expansion is used for the accurate location extrema if the intensity of this extrema is less than the threshold value then it is rejected. This threshold value is also known as contrast threshold. DoG has higher portion of edges, so edges needs to be removed. Harris corner detector is used for this purpose. We know that the one Eigen value is larger than the other. If the ratio is larger than threshold value then it is discarded.

3. Orientation Assignment

Here to achieve invariance to image rotation the orientation is assigned to each keypoint. A neighborhood is found around the keypoint depending upon the scale, and directions and gradient magnitude is calculated. An orientation histogram covering 360 degrees is created. The peak of the histogram is and peak above 80% is also considered to calculate the orientation. Same location and scale keypoints are created but they of different directions.

4. Key point Descriptor and Matching

Here keypoint descriptors are created. A 16x16 neighborhood is considered around the keypoint. They are divided into 16 sub-blocks of 4x4. 8 bin orientation histogram is created for each block. So 128 bin values are available which represents a vector form keypoint descriptor. By matching nearest neighbors the keypoints between two images are matched. But sometimes the second closest match may be nearer to the first keypoint. It may happen because of noise or some other reasons. In such a case, ratio of closest distance to second closest distance is taken. They are rejected if the ratio is greater than 0.8.

IV. CONCLUSION

This paper proposes a new method of person recognition system based on the FKP bit generation using Scale Invariant Feature Transform algorithm. According to this paper, the recognition is done by generating binary values. For analysis of the work of this system, FKP image database is generated. This type of system is very efficient and cost effective. It is also a user friendly FKP based identification system. In future we can use this system in multi biometric security system. This proposed system improves security in comparison traditionally used biometric identification.

V. REFERENCE

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