Approach For Palm Vein Blood Vessel Detection Based On Fuzzy Logic

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Abstract

The Palm print is one of the most unique and stable biometric system for identification of human. Biometric is used as an identification tool for person recognition which works on physical or behavioral traits. With the use of biometric technology the confirmation of individual’s identity is easy and accurate. Palm Vein recognition is the most trending field from the security perspective. As per traditional studies, a variety of techniques were applied in order to make this system more reliable and efficient. In this paper fuzzy logic technique is used for edge detection, which is more efficient than the traditional detection methods. High level noise does not cause any error in the purposed work. KNN classifier is used for robust output and classification purpose.

Keywords: edge detection; fuzzy logic; canny edge; Gabor

1. INTRODUCTION

Palm vein recognition is part of biometric for person identification based on its physical characteristics. Large number of biometric system available in the market which distinguish person on the bases of different individuals like height, skin color, texture, retina, voice etc. Palm vein biometric is one of the active research now a day
for implementation of most accurate and cost effective system. As the unlawful interventions are step up day by day we required more protective technique to enhance the reliability and security of the system. The application areas of biometrics are divided into three different group commercial (ATM, physical access control etc.), government (ID card, passport control etc.), forensic (terrorist identification, corpse identification etc.).

**Basic Steps In Palm Recognition System:** The first step is image acquisition, the input image is taken from any input device, image of palm print is capture with the help of different types of palm scanner or digital cameras. After capturing the data or image of the palm print, pre-processing is formed on image. Sometimes noise is present in the captured image, noise can be remove with help of filters in processing phase. In feature extraction the features of palm are extracted like principal lines, orientation field, minutiae, density map, texture, singular points etc. The last step is matching of the input data with the store data present in database. This is the final step that will give output.

**Figure 1:** Basic Flow Diagram

*Setiawan, et.al on [1]*“Features Extraction of Palm Vein Image Using Phase Symmetry” in this paper two dimensional discrete Fourier transform used to convert the image from spatial domain to frequency domain and filtered by using log- Gabor before it is extracted using the phase symmetry.

*Ali Mohsin Al-juboori, et.al [2]* proposed a novel technique to get good result of the identification and verification process and that depends on the quality of input images.
And different step were taken to enhance the image quality. The captured image contains the irregular shades and noises. They proposed the Gaussian-Second-Derivative (GSD) method for image enhancement to enhance the quality of images because the image should be isolate from other unnecessary data.

Zhou Y. and Kumar A, et.al [3] proposed the palm vein images in contactless and touch based imaging. In their work the palm vein imaging typically required infrared illumination which is one component of multispectral illumination for the multispectral palm print imaging. They used Histogram Equalization (HE) for enhancing the vein patterns in the palm vein image by performing segmentation, normalization and image enhancement process. Perform two different techniques for feature extraction Hessian-Phase-Based Feature Extraction and Neighborhood Matching Radon Transform based feature extraction.

S. D. Raut et. al [4] proposed Gabor filters were used along with canny edge detection method in order to detect the edges in the scanned image. And in order to perform matching of the extracted features Euclidean distance were used. The traditional method was not able to perform well in with the variations in the environment or conditions.

II. FUZZY LOGIC FOR EDGE DETECTION

The problem with traditional edge detection approach is that a low threshold produces false edges, but a high threshold misses important edges. Hence the proposed work consider this drawback and replace the canny edge detection with fuzzy logics as the fuzzy logic is a artificial intelligent technique which is quite robust in nature and can perform efficiently with the variation in the environment. The operation fuzzy logic is depend on the set theory. It has various functions these are Dilation, Erosion, Opening and closing. Fuzzy logic is one of the new methods introduced in 1960 by Lutfi Zadeh at University of California. Fuzzy logic provides a simple way to arrive at a definite conclusion based upon vague, ambiguous, imprecise, noisy, or missing input information. Fuzzy logic is a mathematical representation of human concept formulation and reasoning. Fuzzy logic is a widely used tool in image processing since it gives very efficient result. KNN classifiers for detecting the edges and for the purpose classification. The canny edge detection in traditional edge detection method there are different steps for canny edge detection.

1. smoothening the image by applying a filter like Gaussian filter. The shape of filter is major selection if the appropriate filter is not used then the problem in detection of the peak and localization.
2. Finding the image gradient. Image gradient can be find by using different operator (sobel, Prewit, and Robert’s operators) for detection of edge in different direction.
3. Non maximum suppression. To get the darkest edge it is categories in 3 parts ie sure black edge, medium black edge, low black edge.
4. Double Thresholding. In this step threshold value are provided for upper and lower value of threshold for detection of edge.

5. Edge tracking, in this step obtain the full image with the edges.

This is how traditional canny edge detector works. Since canny edge detector is a method which detects the edges on the basis of threshold value which can produce misleading results.

The objectives are as follows:

1. To analyze the traditional methods of edge detection.
2. To replace the canny edge detection with fuzzy logics to get more refined edges in the images.
3. To implement the KNN classifiers for more classified and robust results.
4. To compare the results of present work with traditional work to prove proficiency of the present work.

The flow diagram of the proposed work is as follows:

![Flow Diagram of Proposed work](image)

**Figure 2:** Flow Diagram of Proposed work
The Gabor filter can be defined as follows-

\[
g(x,y,\lambda,\theta,\Psi,\sigma,\gamma) = \exp\left(-\frac{x'^2 + y'^2}{2\sigma^2}\right)\cos\left(\frac{2\pi x'}{\lambda} + \Psi\right) \quad ... \quad ....(1)
\]

Where

\[
x' = x\cos\theta + y\sin\theta \quad ... \quad ....(2)
\]
\[
y' = -x\sin\theta + y\cos\theta \quad ... \quad ....(3)
\]

The 'λ' represent wavelength of the sinusoidal factor, ‘θ’ represents the orientation, and ‘Ψ’ is the phase offset, ‘σ’ is the standard deviation, ‘γ’ is the spatial ratio.

The threshold values are given to equation (1) for extraction of feature.

The KNN (k nearest neighbor) classifier is a algorithm which is used for classification of variables and which categories alike variable to in new approximate variable(e.g. distance functions). KNN classifier is used for pattern recognition. A case is classified by a majority vote of its neighbors, with the case being assigned to the class most common amongst its K nearest neighbors measured by a distance function. If K = 1, then the case is simply assigned to the class of its nearest neighbor.

III. COMPARISON OF RESULTS

The comparison between the canny edge detection and fuzzy logic[5]. The output of fuzzy logic technique are more accurate and sensitive. The margin of error in fuzzy logic is less as compare to the canny edge detection technique.
IV. CONCLUSION

The aim of study to detection of the internal structure of palm vein. In this paper comparison of two different techniques are discussed. In the above discussion it is clear that fuzzy logic technique is superior than the canny edge detection and in future there is more chances of improvement in fuzzy logic to achieve good result and escape from the false detection. And the approach for achieve the internal structure of vein is discuss in this paper through the fuzzy logic. Because in canny edge many edges are misses and which cause to give improper results.

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