

# Efficient Finger Vein Technology Based on Fast Binary Robust Independent Elementary Feature Combined with Multi-Image Quality Assessment Verification

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**Abstract**— Recent years, fingerprint recognition has a high market share in biometrics, but humans’ hands are often covered with oil and sweat that they secrete, rainwater or dirt, which often affect the accuracy of fingerprint recognition. This work proposed a finger vein identification technology for low response time that can be implemented in a cost-efficient embedded system using the binary robust invariant elementary feature. In this method allows the features matching with binary robust invariant elementary feature and verification with multi-quality assessment process. In experimental results, that the EER performance are 0.13% and 0.69%, using homemade and public (FVUSM) datasets when the data were collected with training and testing. The method is very suitable for real-time finger vein recognition applications.

## I. INTRODUCTION

In recently, the field of biometric technology, convenience and security of the system are highly demanded. More than more information in database, usually leads to long response time and low accuracy rate. Personal recognition technology has important role in security systems. To protect the data stored in any consumer device, traditional ways are mainly through a password or personal identification numbers. Although these ways are easy to be implemented, password and personal identification numbers easily to be forgotten. Biometric recognition uses an intelligent method to identify an individual with some unique features of a human [1]. Moreover, a cost-efficient biometric device suffices to identify finger-veins. Vein images are collected because hemoglobin in human blood absorbing infrared light, which means that the information of veins can be obtained only from a living human body. When the blood of a dead one no longer flows, it is impossible to obtain the vein image [1].

To solve the above-mentioned problems, a vein identification, the multiple assessments method with a feature points method and multi-quality assessment in this presented. Firstly, we propose a fast and efficient feature point extraction method. Secondly, we use the image quality assessment strategy to make a double verification after the result of feature points matching. Finally, multi-quality assessment verification will be decided according to the corresponding thresholds to classify the input image into binary quality.

The rest of this study is organized as follows. We briefly describe the proposed algorithm and compares a simulation

result with other existed methods in Section II. Finally, the summaries are given in Section 3 to conclude this work.

## II. PROPOSED METHOD AND STANDARD ELEMENTS

The multi-step verification vein system includes features-based matching and quality assessment method to provide a recognition. These will be introduced in the following as below. Figure 1 shows the flowchart proposed in this work, which was primarily divided into image enhancement, feature extraction, normalization, feature descriptor, matching, and homograph examination.

### A. Feature Point Extraction

#### Feature Point Matching

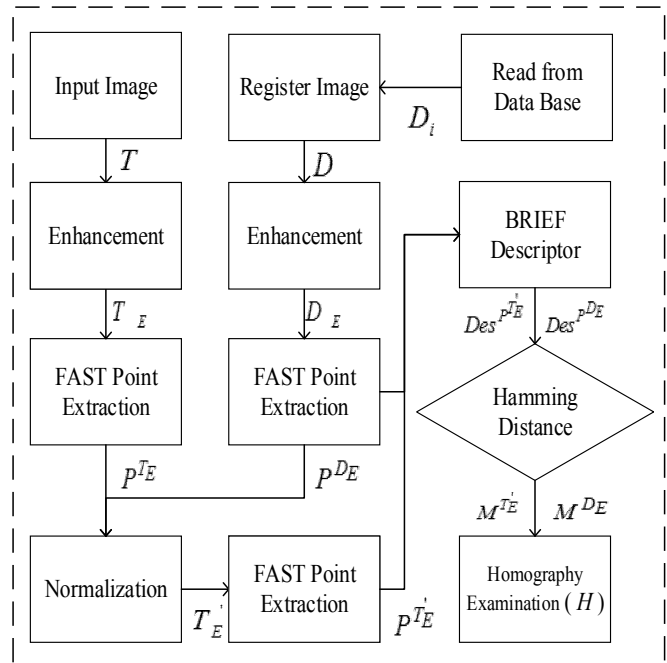


Fig. 1. Framework of the recognition process.

Since the low-contrast of captured image from CMOS camera, the adaptive histogram enhancement using POHE [2] is utilized for enhancing the contrast of vein image after Gaussian filtering to suppress the noise that binary robust invariant elementary feature is sensitive to image noise, and the mask size is  $N \times N$  ( $N = 3$ ). The proposed method combines FAST using binary robust invariant elementary feature descriptor by feature extraction process. Next, the feature extraction, the binary robust invariant elementary

feature descriptor is a bit string description that is calculated by comparing the intensity of an image patch. The intensity comparison,  $\Delta$ , "1" is when the intensity of location  $x$  of pair  $p$  is less than that for location  $y$  of the corresponding pair of the binary robust invariant elementary feature patch.

In [4] presented the vein method using a linear filtering, Gabor filter for texture analysis and a feature detection algorithm, scale invariant feature transform (SIFT) matching to perform the vein identification. The length of BRIEF vector is also chosen  $n = 256$ .

### B. Normalization and Matching

The aim is to prove the robustness of our algorithm and the feature selection algorithm. To verify the proposed method, a few experiments are performed using the public dataset (FVUSM). The normalization is proposed to solve these problems to get a stable region of interesting for processing. In this work, the normalization based on extracted feature points is firstly extracted.

TABLE I  
PERFORMANCE COMPAESION OF THE FVC2002 DB1  
DATABASE

Methods	EER	Response Time
Asaari <i>et al.</i> [10]	1.78%	24.22 ms
This work	0.69%	18 ms

The corresponding feature set that divided into two parts using the center location to compute at each side. The operations of rotation/shifting that can be using *cvWarpAffine* by OpenCV with  $\Delta\theta$  and  $\Delta Dist$ . an ideal matching in this rigorous normalization region for multi-quality assessment method. The accuracy error of matching using Hamming distance [5].

After, the SIFT matching to criteria the homograph between the two coordinate sets and to measure the elemental difference in the matrix. This work applies random sample consensus [6] to remove the erroneous matching.

### C. Assessment

Biometrics technology is one of the most important factors for vein recognition. A good vein recognition technology must be able to detect the human finger effectively with the requirement of lower EER, lower FPR, and real-time processing capabilities [11].

A quality measurement is used to check the similarity between original and compared images. There is many image processing used quality assessment methods, such as MSSIM, HPSNR, MS-SSIM, PSNR, SSIM [7-9],[12]. We can use to the standard deviation of kernel parameter. Using these quality assessment methods for constructing a multiple measurement method using voting strategy that section the three most effective methods. In experimental result included the homemade and the public database FVUSM to demonstrates EER and response time are used to assess the performance of this work. Finally, the finger vein recognition system was compared in this presented with the results of the studies as shown in Table I. It shows the response time to reduce about 0.26% of the entire database, this work using the self-capturing

of images as a homemade and a public FVUSM database show that the error equal rate is 0.13% and 0.69%. Finally, the biometric recognition system recognizes the vein patterns. The proposed method is consistent in achieving an efficient vein recognition system. The good performance verifies that the proposed technique can offer competitive practical values in pattern recognition related fields [13].

## III. CONCLUSION

In this work, the proposed multi-steps identification system using FAST and binary robust invariant elementary feature descriptor. As results, this work using the self-capturing of images as a homemade and a public FVUSM database show that the error equal rate is good results for these datasets. In comparison with the results of relevant works, the method proposed in this work achieved a low error equal rate and low a response time. Finally, a full-fledged cost-efficient biometric identification system using the proposed method could be made available. This will highly reduce the computing cost to obtain the real-time processing in finger vein recognition system.

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