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Performance Analysis on Latent Fingerprint Enhancement Matching System for Large Databases

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Abstract: *Finger print is the finger biometric feature, which is widely used for the identification purpose. Hence to identify the differentiation of the each person, finger print recognition technique is widely used. In this finger print matching process, the minutiae detection plays a major role to identify the maximum matching point of the finger print of the input image to the train dataset. In this finger print matching method, the segmentation is based on the thresholding algorithm. By using the thresholding algorithm, the region of interest ROI area is segmented and then the minutiae of the maximum matching point is detected on that region. Then the features are extracted from the ridged surface of the image. The centroid value of each ride is calculated from the input image and the minutia of each ridge is detected.*

Keywords: *Image enhancement; Latent fingerprint; structured noise; ridge structure*

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I. Introduction

Finger print is the biometric feature used for the identification purpose. Although finger print is the most ancient technique used to identify the unique person from the other. In olden periods, the finger print recognition is carried out with the help of lens. By the manual recognition system, there are some of the error occurred in the process. To overcome the error occurred in the manual process, we use the automatic finger print recognition system using the MATLAB software. In this process, the recognition and classification plays a major role for the identification purpose. In the identification process, the finger print is scanned and the scanned image is introduced into the MATLAB.

- Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it.
- It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image.
- Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too.
- Image processing basically includes the following three steps:
- Importing the image via image acquisition tools;
- Analyzing and manipulating the image;
- Output in which result can be altered image or report that is based on image analysis.

II. Proposed Method

- We present a fast fingerprint enhancement algorithm, which can adaptively improve the clarity of ridge and valley structures of input fingerprint images based on the estimated local ridge orientation and frequency.
- We have evaluated the performance of the image enhancement algorithm using the goodness index of the extracted minutiae and the accuracy of an online fingerprint verification system.
- Experimental results show that incorporating the enhancement algorithm improves both the goodness index and the verification accuracy.
- Then using the extracted features the code is generated using Genetic Algorithm. The data is first embedded into the finger print after that the finger print is encrypted using the key generated using genetic algorithm.
- Then the receiver gets the data by first generating the same key and then decrypting the finger print using the key after that the data hided is extracted from the finger print. Only the authenticated user can get the data.

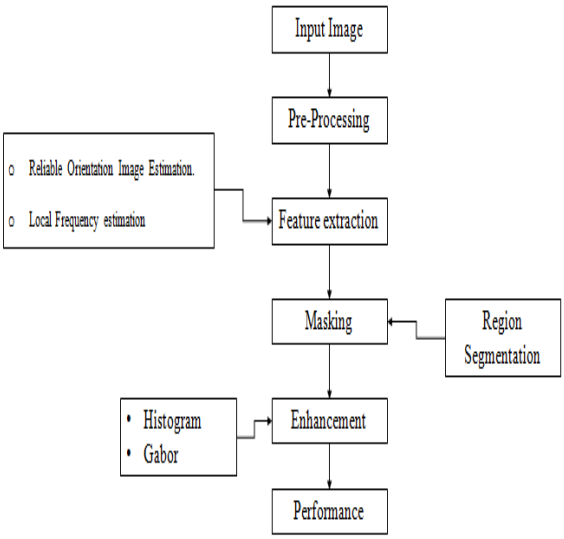


Fig.1 Flow Diagram

- **Input Image**
  - The first stage of any vision system is the image acquisition stage.
  - Image acquisition is the digitization and storage of an image.
  - After the image has been obtained, various methods of processing can be applied to the image to perform the many different vision tasks required today.
  - First Capture the Input Image from source file by using uigetfile and imread function
  - However, if the image has not been acquired satisfactorily then the intended tasks may not be achievable, even with the aid of some form of image enhancement.
- **Preprocessing :**
  - **Image Resize**
  - In computer graphics and digital imaging, scaling refers to the resizing of a digital image. In video technology, the magnification of digital material is known as upscaling or resolution enhancement.
  - When scaling a vector graphic image, the graphic primitives which make up the image can be scaled using geometric transformations, without any loss of image quality. When scaling a raster graphics image, a new image with a higher or lower number of pixels must be generated.
  - In the case of decreasing the pixel number (scaling down) this usually results in a visible quality loss.
  - From the standpoint of digital signal processing, the scaling of raster graphics is a two-dimensional example of sample rate conversion, the conversion of a discrete signal from a sampling rate (in this case the local sampling rate) to another.
- **Masking**
  - A binary image is a digital image that has only two possible values for each pixel.
  - Typically the two colors used for a binary image are black and white though any two colors can be used.
  - The color used for the object(s) in the image is the foreground color while the rest of the image is the background color.
  - Binary images are also called bi-level or two-level. This means that each pixel is stored as a single bit—i.e., a 0 or 1.
  - The names black-and-white, B&W, monochrome or monochromatic are often used for this concept, but may also designate any images that have only one sample per pixel, such as grayscale images
- **Image Enhancement**
  - Contrast is an important factor in any subjective evaluation of image quality. Contrast is created by the difference in luminance reflected from two adjacent surfaces.
  - In other words, contrast is the difference in visual properties that makes an object distinguishable from other objects and the background. In visual perception, contrast is determined by the difference in the colour and brightness of the object with other objects.
  - Our visual system is more sensitive to contrast than absolute luminance; therefore, we can perceive the world similarly regardless of the considerable changes in illumination conditions.
  - Many algorithms for accomplishing contrast enhancement have been developed and applied to problems in image processing.

III. Result

- The performance of the process is measured in terms of performance metrics like Accuracy, Sensitivity, Specificity and time consumption.
- TP is the total number of correctly classified foreground (true positives).
- TN is the total number of wrongly classified foreground (true negatives).
- FN is the total number of false negatives, which accounts for the incorrect number of foreground pixels classified as background (false negatives).
- FP is the total number of false positives, which means the pixels are incorrectly classified as foreground (false positives). The performance values were calculated for each frames of the input video based on the metrics described above.

$$\mathrm{MSE} = \frac{1}{mn}\sum_{i=0}^{m-1}\sum_{j=0}^{n-1}[I(i,j) - K(i,j)]^2$$

The PSNR (in dB) is defined as:

$$\mathrm{PSNR} = 10 \cdot \log_{10}\left(\frac{\mathrm{MAX}_I^2}{\mathrm{MSE}}\right)$$

$$= 20 \cdot \log_{10}\left(\frac{\mathrm{MAX}_I}{\sqrt{\mathrm{MSE}}}\right)$$

$$= 20 \cdot \log_{10}(\mathrm{MAX}_I) - 10 \cdot \log_{10}(\mathrm{MSE})$$

MAX= maximum pixel per image
MSE= mean Square Error

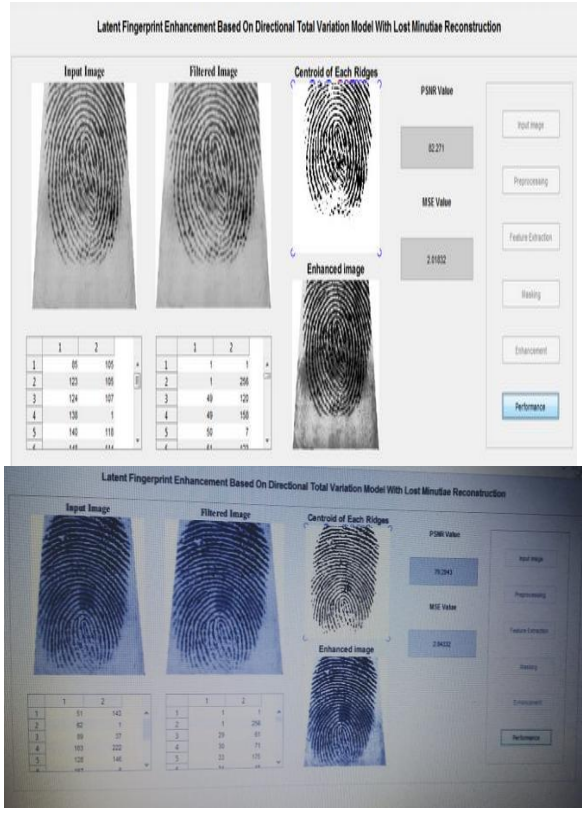


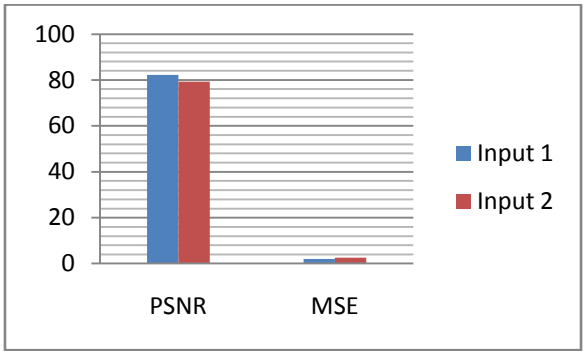
Fig.2 Result Image

Figure 2 shows the result image of proposed work. In this work we take the input image as a fingerprint image and then applied the all the method preprocessing, feature extraction, masking and enhancement then we get the output in the form of PSNR and MSE.

Table 1: Value of PSNR and MSE

Input image	PSNR	MSE
Input 1	82.271	2.01632
Input 2	79.2943	2.54332

Table 1 shows the different values of PSNR and MSE of we take two input image of fingerprint image.



Graph-1 Representation of PSNR and MSE values

Graph 1 shows the graphical representation of PSNR and MSE values. In this graph input 1 PSNR is higher than the input 2 and input 1 MSE is low than the input 2.

IV. Conclusion

Image enhancement plays an important role in biometric systems, this paper presented automatic latent fingerprint segmentation and matching. While considerable progress has made in both rolled and plain fingerprint image enhancement, latent fingerprint enhancement is a challenging problem due to the poor image quality of latent fingerprint with unclear ridge structures and various overlapping patterns, along with the presence of structured noise. Prior to latent fingerprint segmentation and feature extraction, latent fingerprint image enhancement is important to suppress various types of noise and to clarify the ridge structure. Latent fingerprint Image enhancement plays a significant role in automatic latent fingerprint identification systems. Even though significant development was made for both plain and rolled fingerprint enhancement, latent fingerprint enhancement still is a challenging problem. Poor quality images and existence of structured noise contribute to the challenges of latent fingerprint enhancement.

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