

## Crime Scene Investigation using TLP Techniques

Pavan kumar, Mrs. Renuka sharma

M. Tech, CSE, CGC-COE landran, Punjab , Assistant Professor, CSE, CGC-COE landran

*\*Corresponding Author:* Pavan kumar, M. Tech, CSE, CGC-COE landran, Punjab

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### ABSTRACT

In this Research work design, we have extracted the edges of the latent fingerprint using the edge detection techniques. Then we have segmented the image using watershed segmentation technique. Image segmentation can be considered as the preliminary step in the pattern recognition system. The result obtained using the MATLAB2012a software provides a more informative output of the original image than the previously used techniques. The output image can be used to determine the matching accuracy of two latent fingerprint impressions.

**Keywords:** Fingerprint Recognition, Crime Scene Investigation (CSI)

### INTRODUCTION

Fingerprint impressions play a very important role in identifying criminals in the court of law. Fingerprint recognition systems are widely used for nailing down the criminals or identifying an innocent person in the CSI (Crime scene investigation) departments. It is also used in the passport office, adhaar card centres for issuing personal ids. Hidden fingerprints which are found in various objects are called latent fingerprints. Latent fingerprints can be acquired with the help of chemical dusting or by clicking a simple photograph. Latent fingerprint impressions are found to be of poor quality because of the presence of large amount distortion [18]. It can also be affected by the presence of scars, wounds, poor background light and small common area. The three main steps of fingerprint recognition system are pre-processing, feature extraction and post processing. Fingerprint impressions which are of bad quality can be enhanced in the pre-processing stage prior to the feature extraction process in order to make the image more informative. Feature extraction can be done by detecting the minutiae points (consisting of ridges and valleys).Ridges are the dark regions found in the fingerprint impression and valleys are white regions located in the fingerprint impressions.

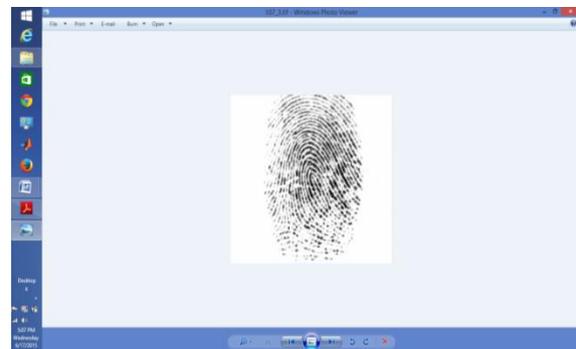


Figure 1. Example of an latent fingerprint impression

### PROPOSED WORK METHOD

#### Image Enhancement

Enhancement can be done in the pre-processing step prior to the segmentation process in order to improve the clarity of the image and to make the image more informative. Enhancement of the image can be done with the help of anisotropic filter, Gabor filter and histogram equalization.

#### Image Segmentation

Segmentation can be of two types. They are region based and object based segmentation. Segmentation can be done till the desired object is detected. Segmentation can also be done to connect the broken paths. Segmentation can be useful in the field of computer process and automatic target acquisition. Segmentation in based on the discontinuity and similarity of the

changes in the intensity of the edges. Segmentation can be done with the help of Thresholding, region growing and region splitting.

### Point, line and Edge Detection

Edges pixels are the points where the intensity or the edges changes abruptly. Edge detectors such as Sobel filter are used to find these edge pixels. First order derivatives produce thick edges. Second order derivatives produce finer edges such as thin lines, isolated points and noise. The second order derivatives produce double edge response such as ramp and step intensity. The second order derivative also helps in determining the transition of images from light to dark or dark to light area.

### Line Detection and Edge Models

Edge detection can be performed in order to segment the images. Edge models works on the basis of the intensity profiles. Transition which occurs between two intensity levels is called step edge. It occurs between the distances of 1 pixel. Step edge transition occurs in the images after it is processed by a computer, for example solid modelling and animation. Digital images are often blurred and have noisy edges. The simulation of the edges can be done with the help of ramp profile. In ramp edge profile, slope is inversely proportional to the edge blurring. The width of the roof edge is determined with the help of its thickness and line sharpness. Region lines can found on roof edge. Roof edge commonly occurs on thin objects near sensors. Edge models have sharp edges and moderate noise. First order derivative produces edge point and the second order derivative produces dark or light edge border. Image smoothing can be done for Image segmentation purpose. Detection of edges can be helpful for extracting the points in images. Edge points can be helpful in selecting the candidate for the edge points. Sobel masks helps in better noise suppression. Post processing of image can be done iwth the help of edge-based segmentation. In watershed segmentation process, dams are built in the flooding process which is known as the watershed lines. These dams are also known as the catchment basins. This image is later imposed on the original image. The second method is to use markers for the segmentation. The marker helps to avoid the over segmentation of images. The marker helps in connecting the irregular components. The

connection points can be done on the basis of same intensity values, gray blob like regions. The external marker passes the highest points. The external markers help in partitioning the image. After the partition of the image, the region contains the internal markers and the background. Marker selection can be done on the basis of values, connectivity and distances

## RESULTS AND DISCUSSION

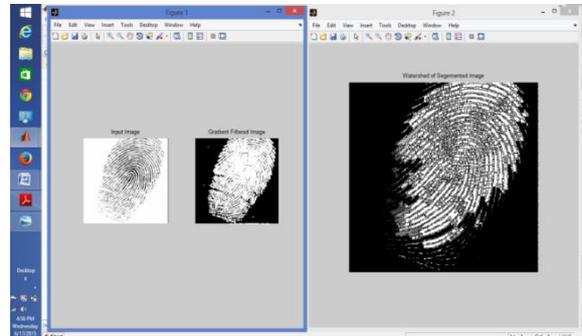


Figure 2. Output showing input image with detected edges and watershed image

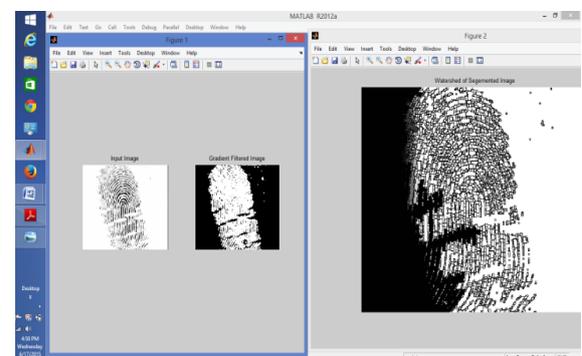


Figure 3. Output showing latent image with detected edges and watershed of the second image

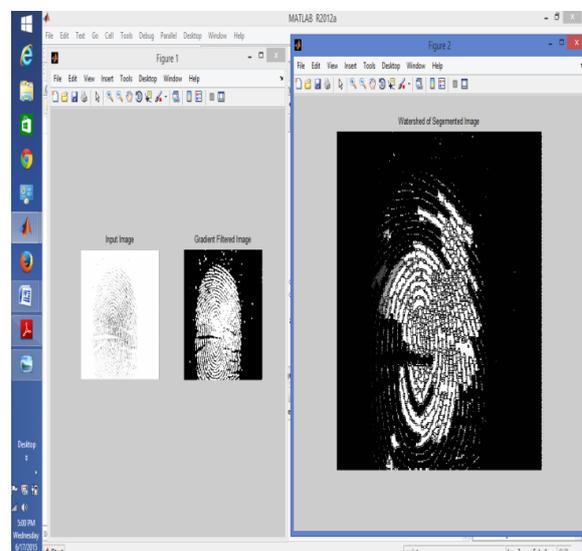
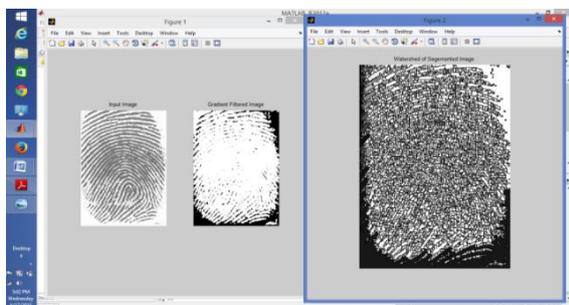


Figure 4. Output showing latent image with detected edges and watershed of the third image



**Figure 5.** Output showing latent image with detected edges and watershed of the fourth image

## CONCLUSION

From the study and analysis of matching fingerprint impressions after detecting the edges and segmenting the image using watershed technique, we have come to the conclusion that it helps in providing an efficient matching accuracy and also provides a better result.

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