It makes all the difference whether one sees darkness through the light or brightness through the shadows.

*David Lindsay*

### 7.1 INTRODUCTION

### 7.2 FINDINGS

### 7.3 CONCLUSION AND SUGGESTION

### 7.4 SCOPE FOR FUTURE RESEARCH

**Abstract**

This chapter is about introduction of the whole research the observations found during the research the conclusions and suggestions and the future scope for the new researchers.
7.1 INTRODUCTION

Image enhancement techniques are usually applied to remote sensing data to improve the appearance of an image for human visual analysis. Enhancement methods range from simple contrast stretch techniques to filtering and image transforms. Image enhancement techniques, although normally not required for automated analysis techniques, have regained a significant interest in recent years. Applications such as virtual environments or battlefield simulations require specific enhancement techniques to create ‘real life’ environments or to process images in near real time.

This research is about the improvement of the image quality because of some problems the image quality decreases and noise occurs this types noise is problem maker for the fingerprint identifications.

The whole research is about study of the fingerprint image enhancement methods which are existing and the new proposed enhancement methods in the chapter 4 ,chapter5 and chapter 6 the researcher carried out this experiments and results came through that techniques are illustrated in respective chapters.

Some observation seen during the experiments and problems are overcame by new proposed techniques we will discuss these observation in this chapter apart from that we are focusing on the area where the researcher put some conclusions we are looking all these conclusion as well as suggestions in the further paragraphs.

There are scope for the future researcher which are concluded in the same chapter at the end.

7.2 FINDINGS

During the studies of the fingerprint image enhancement ,some observation are seen which are describe here as follows;

- Based on Special Domain :
  
  The experiments carried out based on special domain by applying the existing methods and the new proposed techniques.

- The image having the different types of noise like disappear of minutiae, cuts of minutiae, and minutiae existing but cant view
because of the darken area as discuss in the chapter three and fig no 5.7(a),(b),(c).

all these noise are removed by the help of the proposed techniques, which is quite difficult in special domain.

- The noise which is because of the darken area or say black spot are overcame by increasing the light intensity of the images, by the help of contrast enhancement, the image which is some what extent black there only used the negative enhancement, but some time both noise are included in the image there only these exiting techniques are fail, the researcher promoted new enhancement techniques based on special domain which can remove these types of noise.

- As the noise can’t be seen by naked eye researcher uses the parameters like MSSIM, SC.NAE and Standard deviation and observed that, as the MSSIM value increases the quality increase and vice versa and as standard deviation decrease the quality increase, through that, researcher seen the proposed techniques returns best MSSIM value near to 1.0 and lowest standard deviation value to 3 to 4 range after getting the results, and the noisy image has changed drastically.

- Based on Frequency Domain:
  
  The experiments carried out based on Frequency domain by applying the existing methods as well as the new proposed techniques. The noise discussed above are little bit acceptable as it can repair by above discussed method.

  - Some time the noise are too difficult to repair, the observation telling that it need to be a different technique, the researcher seen these type of noise in images which are standard minutiae like core, curve, dot and bridge, but in some noisy images these minutiae are not seen clearly, in such a cases it should be goes through different transformation like stationary wavelet.

  - Transformation of the image is based on standard minutiae, and it help to put those minutiae as the database image, it can be
checked by the MSSIM algorithm some time it repaired but some where fails, and here the researcher promoted new enhancement techniques based on frequency domain which takes help of all possible techniques and get success to repair the image.

- Researcher seen that the some noise need the special as well as frequency enhancement methods to repair, where image is black and minutiae are missing, the researcher observe some images cant be repaired by special as well as frequency domain with the existing methods and proposed techniques, it will be only possible by the help of fusion of the domains, the researcher promotes the new proposed techniques as described in chapter six, which is returns best results.

7.3 CONCLUSION AND SUGGESTION

after completions of the experiments under special and the frequency domain some conclusions are carried out those are as follows,

- The use of enhancement techniques is based on the type of noise, perfect use of enhancement techniques returns good results.
- The image having the black dots, darken area and minutiae not clear or say light best way to use of the proposed techniques based on the special domain discussed in chapter four.
- As it clear the quality of the image or the de noising ratio can be calculate by use of standard deviation expression and the MSSIM algorithm suggested in chapter four and five illustrated in Annexure –I.
- The image where black spots and darken are as well as the missing of minutiae can go through the proposed techniques suggested in the chapter five and chapter six for the best results.
- The new researcher can take the help of these techniques, for there understanding of the noise remove during there research.
• Researcher suggesting to use of these proposed techniques in the identification system, at bridge level that is for preprocessing for different level of noises discussed in the chapter four, five and six.

7.4 SCOPE FOR FUTURE RESEARCH

There is still some scope for the future research for the enhancement of the images as,

• There are some limitation in the light intensity to be decrease or increase to repair the image for such a noise which are totally black image.
• The fingerprint of hard workers like farmers, industrial worker are very difficult to repaired as the ridges, crossover, spur island are difficult to identify.
• The limitations of the proposed techniques is that it is not possible to join cut minutiae like bifurcation, ridge, crossover, edge end.