Chapter 5

Conclusion

5.1 Background

Industrial radiography of welds is widely used for the detection of defects in the petroleum, chemical, nuclear, naval, aeronautics and civil construction industries, etc. It is well known to those involved with welding that a high degree of reliability or joint integrity does not come easily. Indeed defects can, and do, occur in welded joints.

A defective welding metal fails under service conditions and causes damage to property and loss of human lives etc. Hence, welding defects detection has become so important in engineering design.

There are basically two large types of research areas in this field: Image processing, which consists in improving the quality of radiographic images and segmenting regions of interest in the images, and Pattern recognition, which aims at detecting and classifying the segmented defects in the images. Because of the complexity of the problem of detecting weld defects, a large number of techniques have been investigated in these areas.

5.2 Summary

In this thesis we have devised some novel methodologies for de-noising digital radiographic images and are discussed in chapter 2. We have presented two novel techniques for enhancement of digital radiographic images. The techniques developed, take the noisy images as input Salt- Pepper and Gaussian noise are added, and appropriate filters are used to de-noise the image. We have compared two proposed enhancement techniques with Median, Wiener, Gaussian and Low
pass filters. We estimated accuracy of proposed techniques by measuring PSNA, MAE and SSIM.

In chapter 3, we proposed two novel techniques for automatic segmentation of digital radiographic images of weld. In the first technique, we have detected weld defects appearing brighter in the images and the second technique applied for defects which appear darker. We have found region of interest in the digital radiographic images of weld before segmentation techniques. We used ground truth for comparison of two proposed segmentation techniques with region growing and watershed methods. The accuracy of proposed techniques has been estimated by PSNR and SSIM measures and Euclidean distance between the obtained result and ground truth.

We have designed two novel classification techniques for detecting five types of weld defects presented in chapter 5. We defined seven geometrical features in segmented digital radiographic images of weld. In the first classification technique, we have found tungsten inclusion defect in segmented images appearing brighter. We have detected gas porosity defect in the first section of second proposed classification technique in segmented images appearing darker. We used length and shape ratio features to detect tungsten inclusion and gas porosity as round defects. In the next section of second classification technique, we have found three linear weld defects by using five position features. These defects include lack of penetration, incomplete fusion side wall and undercut. We compared two novel proposed classification techniques with SVM and KNN.

Finally, in this chapter, a brief summary of all the proposed techniques are presented. In the following section, the list of major contributions accomplished in this research is given.

5.3 Contributions

In this thesis, we have designed some novel approaches for processing radiographic images. We have focused to detection welding defects. The list of contributions made in this thesis is given below:
Image Enhancements

- Design two novel algorithms for de-noising radiographic medical and weld images

Segmentation

- Segmenting digital radiographic images of weld to detect the location of weld defects
- Design two novel algorithm for segmenting defects appear darker and brighter.

Classification

- Classification of segmented digital radiographic images of weld to find the type of defects
- Design two novel techniques to classify five types of weld defects

5.4 Scope for Future works

- Future perspective of this thesis would be the inclusion the detection of other types of defects
- Using image processing and pattern recognition techniques for detection welding defects in other NDT methods such as Ultrasonic testing
- Exploring proposed preprocessing, segmentation and classification techniques for detection of welding defects in other NDT methods such as Ultrasonic testing