UNIVERSITI TEKNOLOGI MARA
Institut Pengajian Siswazah

THE DOCTORAL RESEARCH ABSTRACTS

Volume: 13, Issue 13 April 2018

13th ISSUE

IGS Biannual Publication

20

Name : SUHAILA BINTI ABD HALIM

Title : PARABOLIC DIFFUSION MODEL FOR IMAGE DENOISING IN DETECTING WELD FLAWS

Supervisor : DR. FUZIYAH ISHAK **(MS)**
ASSOC. PROF. DR. ING. YUPITER HARANGAN PRASADA MUNURUNG **(CS)**

Image quality is an important feature in image analysis. However noise normally occurs in an image during the process of image transmission, acquisition or compression. Hence, image denoising becomes the key process in image processing. Classical filtering techniques such as Median, Gaussian and Average filters tend to blur the edge in an object's image and hence reducing the image quality. Literature shows that PDE-based models are renowned to preserve the edge in an image very well. Hence the application of the PDE models in image processing has gained a lot of attention for the past few decades because it provides better approximations in which it is able to adaptively adjust the operation of the local information in the image. In this research the two-dimensional diffusion equation in the form of nonlinear PDE of order two and order four denoising models are explored. Existing nonlinear PDE denoising models are analysed and modified with a different diffusion coefficient. The effect of the diffusion coefficient proposed in the PDE is examined on a set of welding digital radiographic images. The nonlinear mathematical model is set in the form of an IBVP and solved numerically using the finite difference approach. Two explicit (Scheme 1, Scheme 2) and two implicit finite difference schemes (Scheme 3, Scheme 4) are derived to serve as the denoising tool. The proposed schemes are tested on digital radiographic images that contain specified flaw. A flawed specimen is used as a benchmark data and an addition of 20 samples of real data are used for experimental purposes. The performances of the schemes are evaluated using Structural Similarity Index Measure (*SSIM*), Peak Signal to Noise Ratio (*PSNR*) and Mean Absolute Error (*MAE*). Results obtained show that the four schemes successfully remove noise in the image by producing high *SSIM* and *PSNR* values with Scheme 3 relatively performing the best. This is because Scheme 3 is an ADI scheme very much similar to the traditional Peaceman Rachford ADI scheme which is known to have unconditionally stability feature. Graphical results based on the Relative Error (*RE*) curve of each scheme show that each reduces and stabilizes asymptotically. All the schemes are experimentally shown to be convergence and stable. After the denoising process, the flaw detection process is adopted and successfully produces the length value of weld flaw in welding image. For automation purposes a GUI is developed using MATLAB. The GUI is very useful for the welding inspectors to analyze and evaluate radiographic data fast. This research opens room for more explorations in terms of the diffusion coefficient and its applications on other digital data types. The findings enrich research knowledge and explorations in this field.