DE-NOISING RADIOGRAPHIC IMAGES USING BILATERAL EDGE PRESERVING FILTER

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ABSTRACT

An improved radiographic image denoising using bilateral filtering and edge preserving by snake method. In digital radiographic input image contain noise and denoise by using bilateral filter. It is a non-linear, and noise reduction smoothening filter. Intensity value at each image pixel is replaced by average of intensity values from nearby pixels. For detecting edges in radiographic images, discontinuous contours can be obtained in traditional approach, due to attenuation of sound wave and speckle noise. Developing snake edge detection.

Keywords: *Noising, De-noising, Weld images, Bilateral filter And Edge preserving.*

INTRODUCTION

Competition among industries, quality of equipment and materials becomes basic requirement to remain competitive across markets. Non-destructive is one of the oldest techniques, even though radiography is obeying as control of weld joints in many industries such as chemical, nuclear, naval, aeronautical industries. For critical applications it plays a important role. Where weld failures breakdown occur. Such as in pressure vessels, power plant and load-bearing. Knowledge of welded joint features and types of defects can be detected can be detected in radiographic welded joint inspection in necessary. However, global economic development has gradually led steal production industries increases it production rate on the quality of product. In order to increase production for high quality in short duration, the use of visual inspection systems increase its production lines. The use of visual inspection systems increases its production lines and automated inspection technique is necessary to improve quality of product as well as to eliminate the need of human intervention in hazardous environment. It has benefit in terms of quality assurance. In joining process welding is major process. It is used as ship, space shuttlers, cars and pipe lines. Weld flaws include lack of penetration, lack of fusion, porosities, gas holes, inclusion etc.

LITERATURE SURVEY

Bhonsle et al processing on denoising medical image using bilateral filter. In medical imaging, quality of medical image reduces by noise and it includes structural details, blurring boundaries, suppression of edges etc. Depend upon Physicians are curing disease by looking MRI, X-ray images, CT scan, etc in the denoising medical image. In bilateral filter, denoising the medical image and its performance depends on parameters. The given filter in medical image removes additive white gaussian noise for different variance values and removing salt and peper noise obtained poor values. Implementation and formulation are easy for obtaining results in bilateral filter. Finally concluded that, bilateral filter is better than remaining filter. At low frequency difficult to remove noise whereas in high frequency gives better performance. Removing salt and peper noise in medical image very difficult to this filter and it gives poor performance in medical image for removing speckle noise.

Rupinder et al implement bilateral filter, neural-network (NN) and LDA for denoising medical image using a hybrid technique. Denoising medical image which includes X-ray, MRI, SPECT and PET plays a vital role in treatment, research and diagnosis have information about heart, brain and nerves. For removing noise in medical image using various methods such as, Wavelets, thresholding based on wavelets and filter. Produce good results, accurate and free from distortion in medical image. Comparison of previous methods having some drawbacks, to overcome the limitation in existing method using neural network algorithm are used for learning. Denoising the medical image, rician noise and preserves the fine structure improving bilateral filter. Another limitation of LDA analyzing, mean and median statistical functions are used for calculation of psnr, mse and ssim in presence of output pixels. Finally concluded, that denoising medical image implements neural network, LDA and bilateral filter. Comparisons of PSNR, MSE and MEANSSIM provide better results.

Hou and Xiao detection of edge for gallstone ultrasound image using active snake algorithm. Discontinuous contours can be obtained on traditional approaches for detecting edged in ultrasound images due to attenuation of sound wave and spekle noise. To overcome this problem, develop on snake algorithm. Snake is active, it removes energy function and exhibits dynamic behavior. In the proposed method implementing snake curve, locks onto region-of-interest (ROI) along the edge position and radius of gallstone, shrinks the curve to the shape and guided by internal force and external forces . Proposed snake can detect edges more accurately and intelligently. Finally concluded that, snake can be used in many aspects of pathological changes, medical image process, sharp gray variation make effectively.

Juan et al described a technique on adaptive network based fuzzy interface system in which welding defects can be detected in radiographic images. The first stage is the preprocessing stage which includes noise reduction, contrast enhancement, thresholding and labeling. These were the techniques used to detect wield defects .Second stage is the feature extraction which includes 12 geometrical features for extracting the defects shape and orientation. These 12 geometrical features were extracted between defect candidates. The third stage includes the ANFIS which is used for the classification of defects. For classification of wield defect four of the 12 features were choosen, these were input for ANFIS out of all possible combination. Comparison of the aim and result was done and they identified the particular features with best classification. 0.84 minimum values was obtained after determing correlation coefficients. The accuracy and prediction obtained by this method was 82.6%. Finally they concluded by stating that the efficient results can be obtained through this proposed methodology where solidity, orientation, eccentricity are given as inputs.

Xueqin et al demonstrated an approach for automated detection of defects in ferrite magnetic tile surfaces having dark colors and low contrast. They used fast discrete curve let transform for detecting the defect. Fast discrete curve let transform was used to remove the effect of regular grinding textures on detection of cracks. In this approach, first the segregation of actual images takes place. Secondly they were re-united. Texture feature measurements were used to describe the segregation parameters. At last, images with crack detects were acquired when contours were extracted from the re-combined images. This proposed method clearly show that cracks with length more than 0.8 mm can be obtained and also the texture counters were eliminated. Finally the author said that, this method additionally requires better intensity of light, enhancing the contrast of crack may improve the detection efficiency and also he concluded that 93.9% of accurate rate was obtained with this methodology.

Usman et al proposed a methodology on classification of defects of nuclear fuels which are exposed to radiation by using gray scale thresholding technology. In this method, these radiographic images were given as input to software which is used to classify the various types of defects in nuclear materials which were exposed to radiation. This software segregates pixels with gray level values which are less in number. By this segregation, it can demonstrate the factors such as cracks, mal information, introduction of new materials, heavy isotope acquisition, etc. Due to this methodology, some locally manufactured metal plates with driven holes are described as defects in them. It clearly shows that 94% true classification was obtained and 8.1% false classification may occur. The author presented an algorithm with following steps. First step, read the grayscale image and calculate the threshold gray value in the range (0 1) and an adjustment factor should be multiplied, rescale the threshold value using formula and identify the location where pixel value less than threshold value and segregate

Yahia et al described a method for the evaluation & radiography based on the usage of artificial neural networks for detection of welding defects .Radiography has different areas of industries on the importance of radiographic inspection on various research projects aiming at the automation of the analysis & the interpretation of welding discontinuities. Edge detection method is the work done by the inspection of welding defects & automatic control .This method is used to emphasize the basis of a Multi layer perception (MPC) origin method was used to detect welding defects in existence of weld radiography by using artificial neural network. Preparation of the data base was done in the first step, Later the first step was used for training MPC in second step. Next step was divided into two main parts i.e., devoted to detection of contours is done at first part and elimination of additional contours consists in second section. Finally real case study was concluded. The author concluded that the errors in database and non-penetrating weld faults should be enhanced.

Rafael et al proposed a method for classifying the defects in wielding materials. Initially, Image processing technique was applied, followed by denoising, improving contrast, thresholding and labeling, later they proposed few geometrical factors which will decide the shape and orientation. Finally they applied artificial neural network, for classification of welding defects. They used few methods like, regularization and bootstrap to improve efficiency. After further classification they conclude that 99.9% (11 input neuron) was conserved when ANN method is adapted to gain good results.

Remi et al presented a method on statistical defect detection in radiographic images by using an adaptive parametric model. A statistical model which is suitable to the content of radiographic images with testing theory was utilized by this method. Initially, A generic model of radiographies depends on the additional pipeline, followed by automatic non-catastophic of the described method was obtained by applying the problem of detection of detects within the structure of testing theory. A false alarm prediction can be calculated by this methodology. Finally the authors concluded that, by this methodology, the severity (or) intensity of theoretically proposed results and appropriate methodology was shown by these numerical results.

Kasban et al proposed an approach for identifying defects in welding materials from radiographic images. From this approach, the characteristics from radiography images were obtained to detect the anomalies. Through this approach, images were arranged lenicographically. By these signals, the factors such as mel-frequency cepstral coefficient and polynomial coefficients were extracted .The transforms such as Discrete wavelet transform, Discrete cosine transform, Discrete sine transform were measured for appropriate extraction of features. The result of proposed method is analyzed by sixteen radiographic images with seventy three weld defects. In this approach, Gaussian, Impulsive, Speckle or Poisson noises degrades the tested radio graphic images. The author had concluded that 100% identification rate can be received by this new cepstral approach besides old geometrical defect detection technique.

DENOISING TECHNIQUE

In the image denoising, the linear filters are quite ineffective and nonlinear filtering techniques are effectively preserve edges and details of images, while methods using linear filters tend to blur and distort them.

Fig 1: DENOISING TECHNIQUE

Fig 1 shows block diagram of denoising technique, Radiographic image is used to view the internal structure of an object, Convert a color image into a grayscale image, pixels are shines through different colors and displayed by varying the amount of green, red, and blue light. This is known as the RGB color model. The existing denoising technique using wiener and Gaussian low pass filter. Wiener filter is used to remove additive noise by an estimate target random process by linear time-invariant filtering and remove the mean square error between estimated random process and desired process. Whereas Gaussian filter remove rise and fall time and it has the property of having step function. In wiener filter results often too blurred and spatially invariant whereas Gaussian smoothing is very effective for removing Gaussian noise. To overcome the drawback of wiener and Gaussian filter proposing a bilateral filter and edge preserving filter.

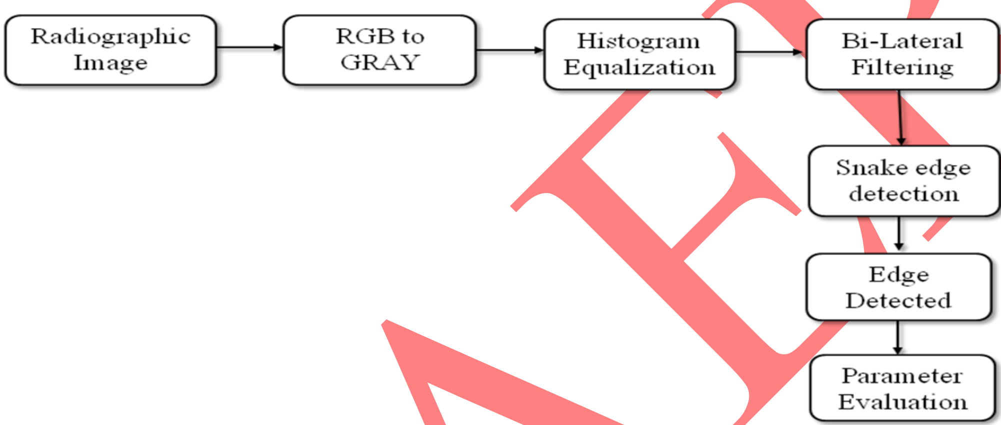

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Fig 2: PROPOSED DENOISING TECHNIQUE

Fig 2 shows that proposed denoising technique. Digital input as radiographic image which usually contain noise and denoising the radiographic image using bilateral filter. Radiographic image is used to view the internal structure of a object. Histogram equalization is used to adjust of contrast adjustment using the image's histogram. After applying bilateral filter, we are applying Edge detection methods for finding object boundaries in images.

Bilateral filter

It is a non-linear and noise reducing filter for images. Intensity value at each image pixel is replaced by average of intensity values from nearby pixels and depends only on size and contrast of the features to preserve. It is easy to setup, adapt and understand and not always the best result, but often good.

Snake edge detection

The snake models are very much in demand in computer vision. These snakes are also known as active contour. The most attractive modality of the snake edge detection is the cost efficiency, generation time and other possible hazards to patients and examiners. This snake edge detection produces an ultrasound image. Though the ultrasound images have their advantage to prove their worth, they have lower quality due to noises and attenuation of sound waves. The snake edge detection detects those edges and results in further enhancement of the image.

Noise Parameters

Peak signal to noise ratio (PSNR in db)

$$\mathrm{PSNR} = 10 * \log 10\left(\frac{255^2}{\mathrm{RmsE}}\right)$$

Root means squared error (RMSE)

$$RMSE = \sqrt{MSE}$$

Mean Squared Error (MSE)

$$MSE = \left(\frac{1}{M * N}\right)\sum_{i=1}^{M}\sum_{j=1}^{N}\left(a_{ij} - b_{ij}\right)^2$$

Where

M, N are Number of Rows and Columns

a_{ij} – Input Image and

b_{ij} –Restored Image

Correlation Coefficient

$$\mathrm{CC}(x/y) = \frac{\sum_{i=1}^{M}\sum_{j=1}^{N}(x_{i,j} - \bar{x})(y_{i,j} - \bar{y})}{\sqrt{\sum_{i=1}^{M}\sum_{j=1}^{N}(x_{i,j} - \bar{x})^2 \sum_{i=1}^{M}\sum_{j=1}^{N}(y_{i,j} - \bar{y})^2}}$$

Where

($M \times N$) is the size of the images and

$\bar{x}$ and $\bar{y}$ stand for the mean values of the two images x and y

Structural Similarity Index (SSIM)

$$SSIM = \frac{[(2u_x u_y) + c_1)(2s_{xy} + c_2)]}{[(u_{x^2} + u_{y^2} + c_1)(s_{x^2} + s_{y^2} + c_2)]}$$

Where

$c1 = (K_1L)^2$,

$c2 = (K_2L)^2$

x, y - Original and restored images,

u_x, u_y - Mean of x and y.

S_{xy} - Covariance of x and y.

S_x^2 - Variance of x.

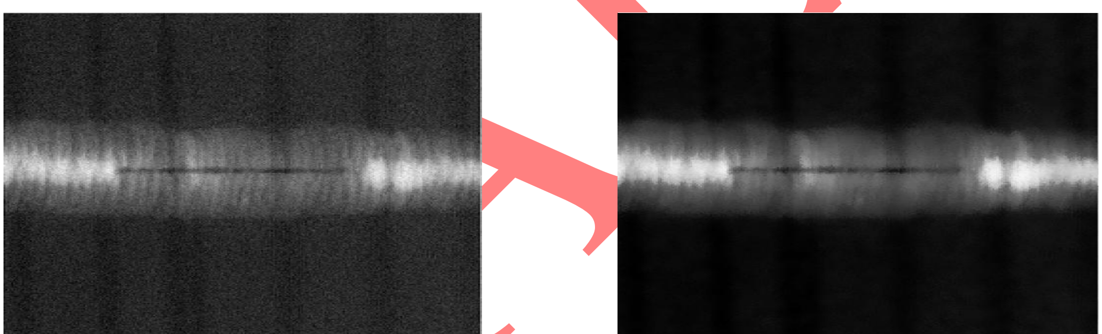
S_y^2 - Variance of y.

L - Dynamic range of intensity values

K_1, K_2 – 0.01 and 0.03 (Default constant values

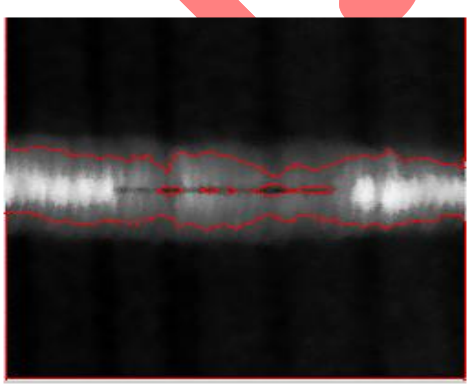
ANALYSIS AND RESULTS

The orginal radiographic image which is noisy in nature is denoised using proposed bilateral filter and edges of the weld image is detected effectively. The red markings on the weld image shows the absolute edges of the weld image.



(a) (b)

Fig 3: Radiographic welded (a) Noise image (b) denoise image



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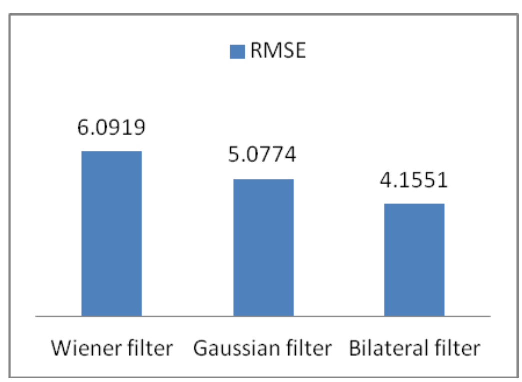

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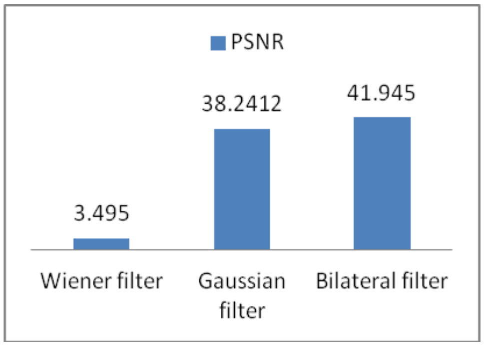

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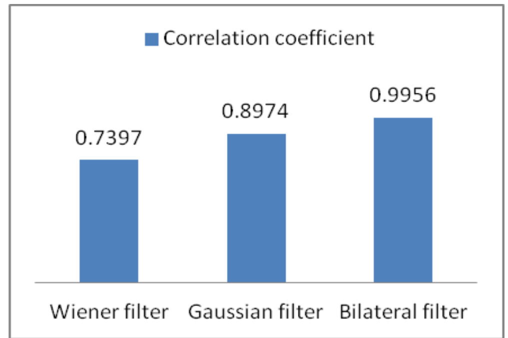

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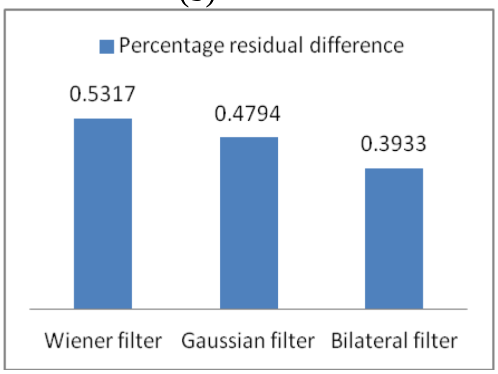
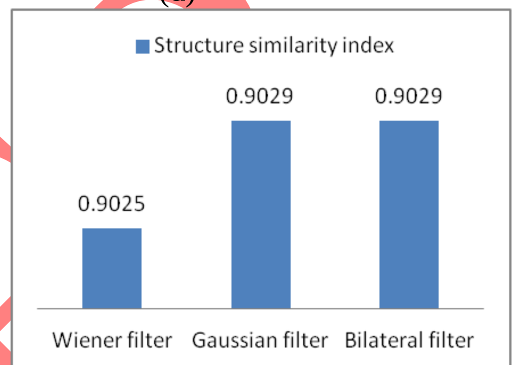


(e)



(f)

Fig 4: (a) snake edge detection (b)PSNR (c)RMSE (d)Correlation Coefficient (e)Percentage Residual Difference (f) Structure Similarity Index

Table 1.Comparing parameters with different parameters

PARAMETERS	WIENNERFILTER	GAUSSIANFILTER	BILATERAALFILTER
Peak signal to noise ratio	37.4957	38.2412	41.9450
Root mean square error	6.0919	5.0774	4.1551
Correlation coefficient	0.7397	0.8974	0.9956
Percentage residual difference	0.5317	0.4794	0.3933
Structural similarity index	0.9027	0.9028	0.9029

CONCLUSION

In our methodology of segmentation, the first step involves the production of a radiographic image. Generally, the radiograph image is bound to have noises disrupting the quality of the images. Bi-lateral filters are used initially to improve the quality of the image by removing the noise of the image. Snake edge detection is then employed to detect the edges of the original image. Thus, the weld image is enhanced through the proposed method.

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