EFFICIENT TECHNIQUE FOR MATERIAL NOISE DIMINUTION USING IMAGE PROCESSING

N.Nithyanantham, Dr.P.Suresh, Dr.M.Suganthi

Abstract— The Automated visual inspection systems are developed effectively to identify the defects in various digital images in industries. These visual inspection systems have a scanned digital copy of a image to identify the defects in the image. The visual inspection systems are used textile fabric defect detection fruit defect detection metal crack detection and etc. In our research work we have used median filter high pass filter and low pass filter to eliminate the texture elements in the digital image by dividing the defected area. In this research work we have proposed a new defect detection algorithm which is fast and simple compared other defect detection algorithms. We have implemented the technique of feature extraction and segmentation to identify the defects in the image.

Keywords- *Medianfilter, Hipassfilter, Lowpassfilter, PSNR.*

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1 INTRODUCTION

Noise diminution is the process of removing noise from a signal. Noise diminution techniques are conceptually very similar regardless of the signal being processed, however a prior knowledge of the characteristics of an expected signal can mean the implementations of these techniques very greatly depending on the type of signal. The image captured by the sensor undergoes filtering by different smoothing filters and the resultant images. All recording devices, both analogue and digital, have traits which make them susceptible to noise. Noise is the result of errors in the image acquisition process that results in pixel values that do not reflect the true intensities of the real view.

2.LITERATURE SURVEY

. The Automated visual inspection systems are utilized in many industrial and commercial applications. There are many visual inspection systems such as defect detection of defected tiles, cracked metals, fabric inspection and etc. Keeping this things in mind we propose a new algorithm which uses Gabor filter, Gaussian filter, feature extraction and segmentation in order to identify the defects in gray level digital images. The research work is done by collecting the base knowledge from various papers which have been published in National and International journals. Extensive Literature

review is done as prescribed below[1]Yi-Ling Chen, Tse-Wei Chen, Shao-Yi-Chien revealed fast texture fast extraction based on segmentation [2] Claus Neubauer said the method of

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- *Author:N.Nithyanantham, Research scholar, Department of Computerscience,Karpagam University,Coimbatore.Email-nithyananthn@gmail.com*

- *Co-Author1 : Dr.P.Suresh, Professor and Controller of Examination, Karpagam College of Engineering, Coimbatore. Email:suresh.me2004@gmail.com.*

- *Co-Author2 : Dr.M.Suganthi,Professor and HOD,Department of ECE,Mahendra College of Engineering,Salem.Email-msuganthib@gmail.com*

fabric defect detection using segmentation [3]Tam nun E Mursalin,Fajrana Zebin Eishita,Ahmed Ridwanul Islam revealed the method of fabric defect detection using perceptron and micro controller.[4]M.Ghazvini,A.Monadjemi,K.Jamshidi said defects can be identified using detail matrices which consist of median, max and min points.[5]Kaicheng Yin and Weidong Yu used segmentation for defect detection in garments production system. References[6,7]reveals the various techniques of defect detection in digital images.[8] A new defect detection algorithm which is fast and simple compared other defect detection algorithms. We have adopted the technique of feature extraction and segmentation to identify the defects in the image

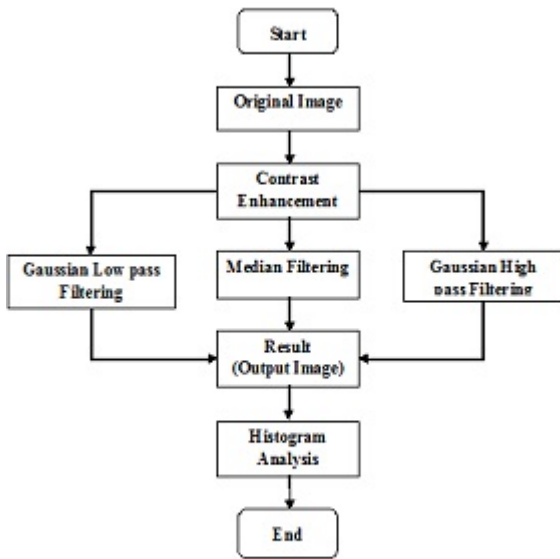## 3.SOURCES OF NOISE IN DIGITAL IMAGES

Image noise is random variation of brightness or color information in images, and is usually an aspect of electronic noise. It can be produced by the sensor and circuitry of a scanner or digital camera. Image noise can also originate in film grain and in the unavoidable shot noise of an ideal photon detector. Image noise is an undesirable by-product of image capture that adds spurious and extraneous information. The original meaning of "noise" was and remains "unwanted signal"; unwanted electrical fluctuations in signals received by AM radios caused audible acoustic noise ("static"). By analogy unwanted electrical fluctuations themselves came to be known as "noise". Image noise is, of course, inaudible.

4.REMOVING NOISE FROM IMAGES BY FILTERING

Image noise is an inescapable side-effect occurring as a result of image capture, more simply understood as inaudible, yet inevitable fluctuations. In a digital camera, if the light which enters the lens misaligns with the sensors, it will create image noise. Even if noise is not so obviously visible in a picture, some kind of image noise is bound to exist. Every type of electronic device receives and transmits some noise and sends it on to what it is creating.

4.1 Flow chart of filtering process

4.2 Median Filter

The median filter is non-linear digital filtering technique, often used to remove noise from images or other signals.

a. Store the neighboring pixels in an array
b. Sort the window in numerical order
c. Pick the median from the window as the pixel value

The median can be calculated as

Median=Xm|(X1,X2,…Xm,Xm+1,..Xn

Where n is odd

The above mentioned equation states Xm is the middle value of the intensities of the image when arranged in ascending order. The above case can be only applied if the number of pixels in each row is odd. The median value is found for even number of pixels using the following equation

Median(M)=(Xm+Xm+1)/2|(X1,X2…Xm,Xm+1….Xn)

Where n is even

The above mentioned equation states in case the number of pixels in the row is even the middle value xm of the ascending order wise arranged row and the next value to middle value xm+1 is averaged to find the median value.

4.3 Gaussian Low pass Filter

A Gaussian low pass filter has the most natural and well behaved filter shape (blurring with a Gaussian filter corresponds to heat diffusion).Gaussian low pass filter is used smoothing of an image which is inverse of sharpening. The following algorithm for Gaussian low pass filter.

Algorithm:

Step1: First image is read and then its shown as a figure just below in screen shots.
Step2: Calculate size of image.
Step3: Shift domain of image into fourier or frequency domain by this command
      fft2(input image).
Step4: Shift the origin of this transform into center by this command fftshift(f_transform).
Step5: And then apply the equation of low pass filter that is exp(-(distance)^2/(2*(d0^2))).
Step6: After taking transform again shift and convert the image back into the time domain this is done by taking inverse fourier by this command ifftshift();
 Step7: abs function is used to convert the negative values into the positive values.

4.4 Gaussian High pass Filter

Gaussian High pass filter is used to sharpening of an image which is inverse of smoothing. The following algorithm for Gaussian high pass filter.
Step1: First image is read and then its shown as a figure just below in screen shots.
Step2: Calculate size of image.
Step3: Shift domain of image into fourier or frequency domain by this command fft2(input image).
Step4: Shift the origin of this transform into center by this command fftshift(f_transform).
Step5: And the apply the equation of High pass filter that is 1-exp(-(distance)^2/(2*(d0^2))) or
      1-   low pass.
Step6: After taking transform again shift and convert the image back into the time domain this is done by taking inverse fourier by this command ifftshift()
    Step7: abs function is used to convert the negative values into the positive values.

5. PERFORMANCE MEASURE

The Peak Signal to Noise Ratio (PSNR) is the value of the noisy image with respect to that of the original image. The value of PSNR and MSE(Mean square Error)for the proposed method is found out experimentally. The PSNR and the Mean Square Error of the retrieved image can be calculated by using the equation number 1 and 2.

$$PSNR = 10\log(2^n-1)^2/MSE = 10\log\frac{255^2}{MSE} \text{----------------------(1)}$$

$$MSE = \frac{1}{MN}\sum_{j=1}^{M}\sum_{k=1}^{N}(x_{j,k}-x'_{j,k})^2 \text{--------------------------------(2)}$$

There are two common textbook definitions for the standard deviation s of a data vector X.

$$(1)\ s = \left(\frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{x})^2 \right)^{\frac{1}{2}}$$

$$(2)\ s = \left(\frac{1}{n} \sum_{i=1}^{n} (x_i - \bar{x})^2 \right)^{\frac{1}{2}},$$

where

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i$$

s = std(X), where X is a vector, returns the standard deviation using (1) above. The result s is the square root of an unbiased estimator of the variance of the population from which X is drawn, as long as X consists of independent, identically distributed samples.

If X is a matrix, std(X) returns a row vector containing the standard deviation of the elements of each column of X. If X is a multidimensional array, std(X) is the standard deviation of the elements along the first non singleton dimension of X.

s = std(X,flag) for flag = 0, is the same as std(X). For flag = 1, std(X,1) returns the standard deviation using (2) above, producing the second moment of the set of values about their mean.

s = std(X,flag,dim) computes the standard deviations along the dimension of X specified by scalar dim. Set flag to 0 to normalize Y by n-1; set flag to 1 to normalize by n.

The input array, X, must be of type double or single for all syntaxes.

The results of the calculations for the proposed method are given in Table I.

6. HISTOGRAM ANALYSIS

An image histogram is a type of histogram that acts as a graphical representation of the tonal distribution in a digital image.[1] It plots the number of pixels for each tonal value. By looking at the histogram for a specific image a viewer will be able to judge the entire tonal distribution at a glance. Image histograms are present on many modern digital cameras. Photographers can use them as an aid to show the distribution of tones captured, and whether image detail has been lost to blown-out highlights or blacked-out shadows. The horizontal axis of the graph represents the tonal variations, while the vertical axis represents the number of pixels in that particular tone. The left side of the horizontal axis represents the black and dark areas, the middle represents medium grey and the right hand side represents light and pure white areas. The vertical axis represents the size of the area that is captured in each one of these zones. Thus, the histogram for a very dark image will have the majority of its data points on the left side and center of the graph. Conversely, the histogram for a very bright image with few dark areas and/or shadows will have most of its data points on the right side and center of the graph.

7. RESULT AND ANALYSIS

Various images with varied sizes have been used to identify the defected area in the image. Around 100 samples of image have been tested with the help of the proposed algorithm. We have given samples hereby
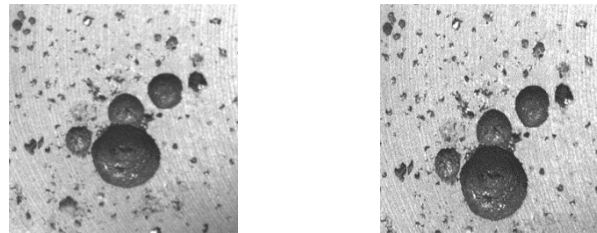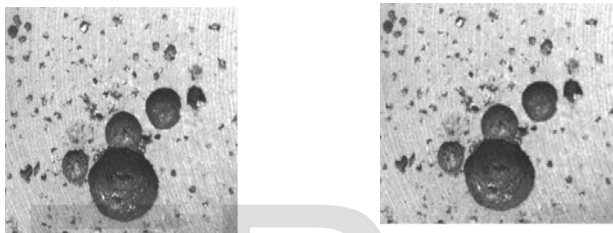

Figure1 (a)   **(b)**

(c)   **(d)**

Figure1 Shows the casting surface after machining blow holes (a) shows the original image.Figure1 (b) is image from the median filter.Figure1(c) shows the Gaussian low pass filter output and figure1(d) shows the Gaussian high pass filter.
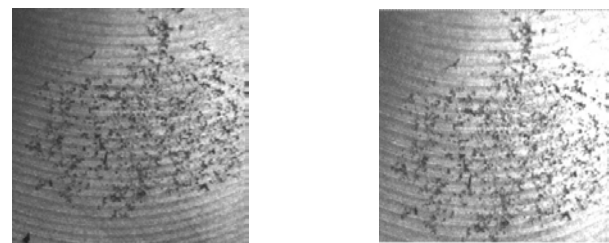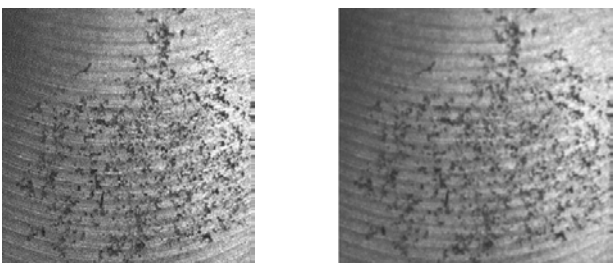

Figure2(a)   **(b)**

(c)   **(d)**

Figure2 Shows the casting surface after machining shrinkage porosity (a) shows the original image.Figure2 (b) is image from the median filter.Figure2(c) shows the Gaussian low pass filter output and figure2(d) shows the Gaussian high pass filter.
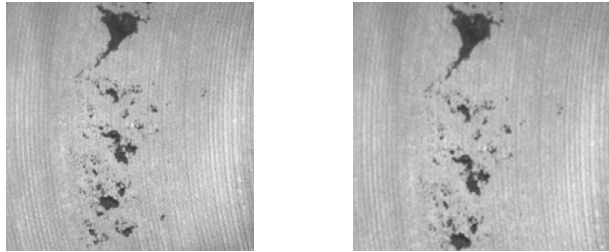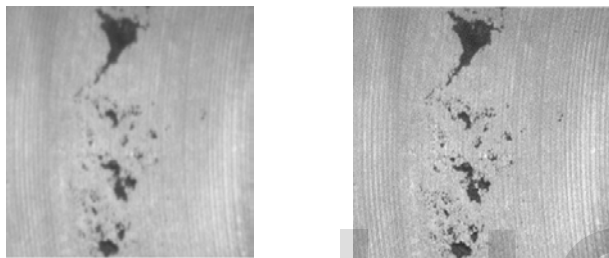
7.2 Histogram Analysis

Figure3 (a)   **(b)**

(c)   **(d)**

Figure4: Histogram Analysis for median filter

Figure3 Shows the casting surface after machining shrinkage cavity (a) shows the original image.Figure3 (b) is image from the median filter.Figure3(c) shows the Gaussian low pass fil-ter output and figure3(d) shows the Gaussian high pass filter.
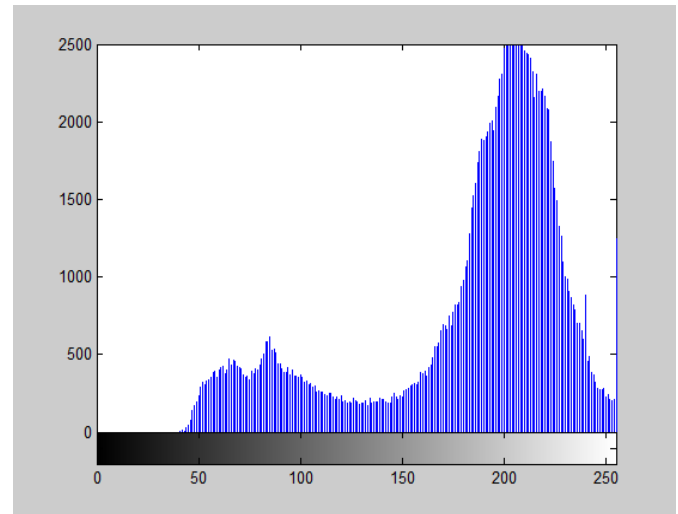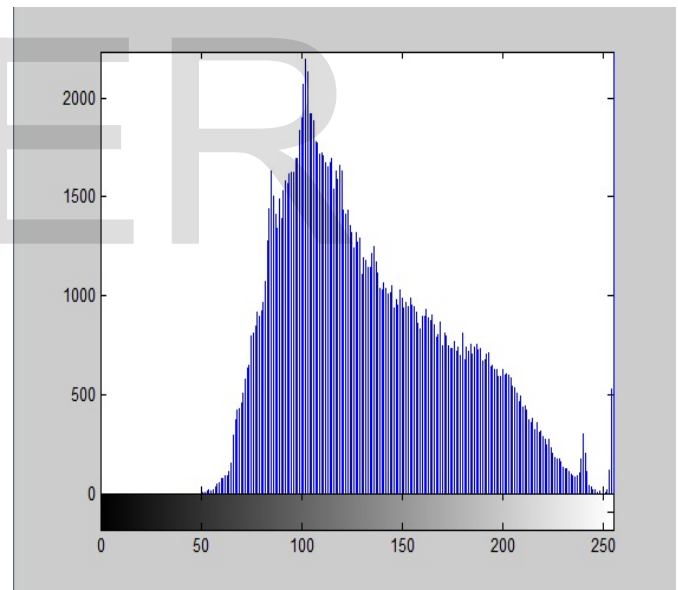
7.1 Table

Analysis Report

S.No	Name	Filter	Mean Square Error (MSE)	Peak Signal to Noise Ratio (PSNR)	Standard Deviation (SD)
1	Figure1	Median Filter	187.42	25.40	45.5
		Gaussian Low pass Filter	328.39	22.96	51.3
		Gaussian High pass Filter	410.96	21.99	53.7
2	Figure2	Median Filter	176.09	13.96	51.3
		Gaussian Low pass Filter	138.71	22.06	44.3
		Gaussian High pass Filter	379.93	22.33	49.1
3	Figure3	Median Filter	206.28	24.98	26.3
		Gaussian Low pass Filter	525.31	20.92	26.1
		Gaussian High pass Filter	250.50	24.14	31.7

Figure5: Histogram Analysis for Gaussian low pass filter
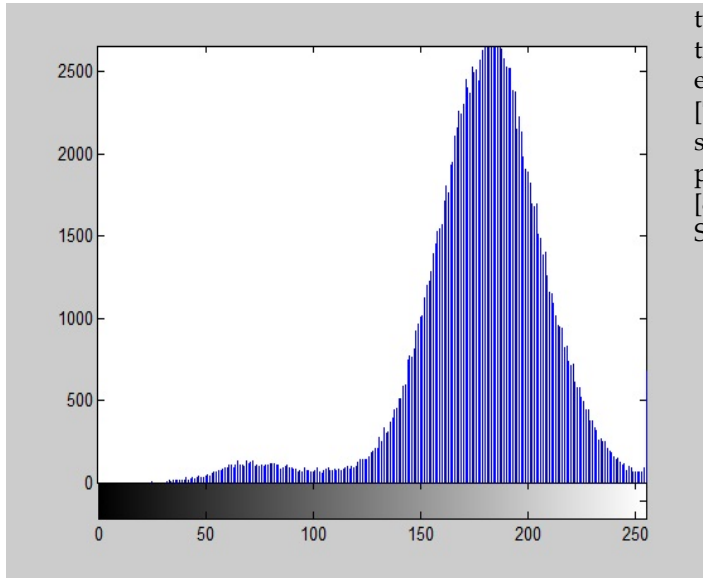
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Figure6: Histogram Analysis for Gaussian High pass filter

8. CONCLUSION

In this paper, we discussed different filtering techniques for removing noises in or image. Furthermore, we presented and compared results for these filtering techniques. The proposed algorithm is tested with various sample images with defects. The Algorithm has proved to be 90% efficient in the sample images which we have tested. The Algorithm is suitable for both texture and non texture images. This proposed research work detects the defects in texture images with non texture methods. How ever this algorithm is suitable for images which have defects in low intensity levels. For detecting defects in high intensity levels further analytical and algorithmic research has to be done.

9. REFERENCES

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