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Patterned Fabric Defect Detection Using Wavelet Golden Image Subtraction Method

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Abstract: ***In this paper decomposition of fabric, the image is done using wavelet transform method. The wavelet decomposition for the defective image as well as for original image is done. The wavelet decomposed defective image vertical component is subtracted from the non-defective image. Finally thresholding and filtering techniques used to get a defect.***

Keywords: Morphological filter, Thresholding, Wavelet, Wavelet decomposition, Wavelet Filter.

I. INTRODUCTION

This Fabric defect detection is an important phase in order to improve quality. It is a process of finding defect location and remarkable deviation in pixel intensity values. Considering global economic issues it is necessary to produce high-quality product and more competitive. The production demand goes on increasing because of the need of people. Therefore industry requires automation to fulfill all requirements in time with the quality product. Because of image processing and pattern recognition automatic fabric defect detection becomes accurate, fast and cheap. For fabric inspection both frequency and spatial information are necessary, the frequency and spatial information are necessary, the frequency information for identification of the defect and spatial information gives the location of the defect.

II .RELATED WORK

Chan and Pang [1] explained fabric defect detection using Fourier transform which gives only frequency information, due to the absence of spatial information it is not a much suited method. Jay Kumar[2] explained fabric defect detection using Gabor filter which gives both spatial and frequency information but computationally complex because in this method. Fabric image is passed through a number of filters which gives spatial information. Hammed Sari-Saraf [4] had introduced wavelet transformation method. Using wavelet transform the image is decomposed into no of subbands, gives different information from various subbands. LL quadrant which contains low-frequency coefficient, gives approximate features of the fabric image, LH contains high-frequency coefficients of vertical direction features. HL contains high-frequency coefficients of horizontal direction features and HH contains high-frequency coefficient of diagonal direction features. These three subbands give detailed feature information of the captured fabric image. High and low-frequency components are not required always. Hence direct thresholding method is proposed which is based on coefficient of high-frequency signals. Morphological filtering is used to remove noise. Wavelet analysis sense line defects very efficiently and low complexity is main advantage

III .PROPOSED METHODOLOGY

The defect detection is done in two stages.
1) Training Stage 2) Testing Stage
It has following steps
A) Image Acquisition and Preprocessing

In fabric image the information required for pre-processing may be degraded due to vibration of machine, fluctuation of light illumination and the same image captured by line scan camera is a raw image. The image quality can be improved by preprocessing.

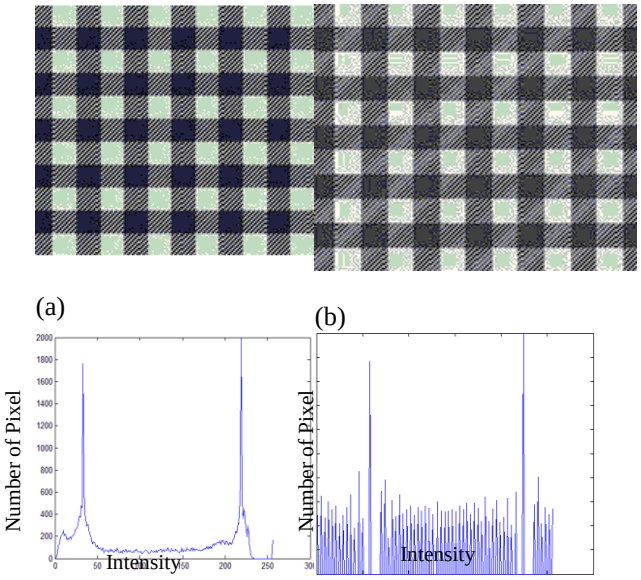

Fig 1. Image preprocessing a) Gray image b) histogram equalized image c) Histogram of gray images d) Histogram of equalized image

Step 1: RGB to Gray Conversion: Along with technological changes the black and white cameras replaced by color camera. Basic color images are red, Green and blue that is a 3D image. I require more memory and slow processing. The RGB image is converted into Gray image to reduce memory space and less processing time.

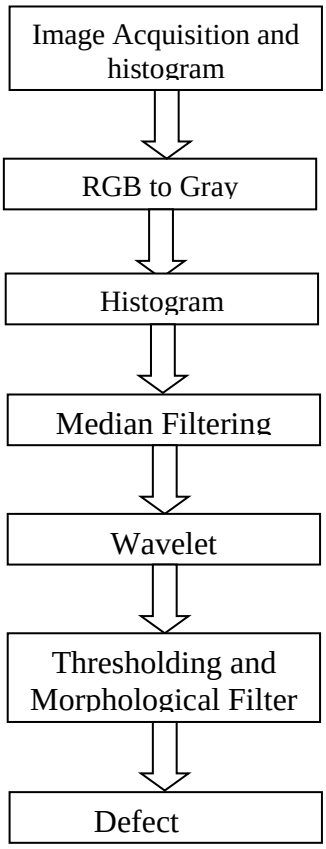

Fig 2. Flow Chart of Proposed Method

Step 2: Histogram Equalization: It is a graphical representation of the intensity of pixel versus no of occurrence of same pixel values. In this stage reduces the effect of contrast, shadow and blur are done.

Step 3: Median Filter: Filtering is required to balance overall pixel intensity and to reduce noise level as well as removes very low and very high-intensity pixels with median pixel intensity values.
Step 4: Wavelet Decomposition: A wavelet function is a compact, finite duration signal which is helpful in image compression. It is a trade-off between time and frequency characteristics. LL retains original information. HL, LH, and HH give horizontal, vertical and diagonal information of the image respectively[6][7] as shown in Fig3.

Table 1: Decomposition of image

LL	**LH**
HL	**HH**

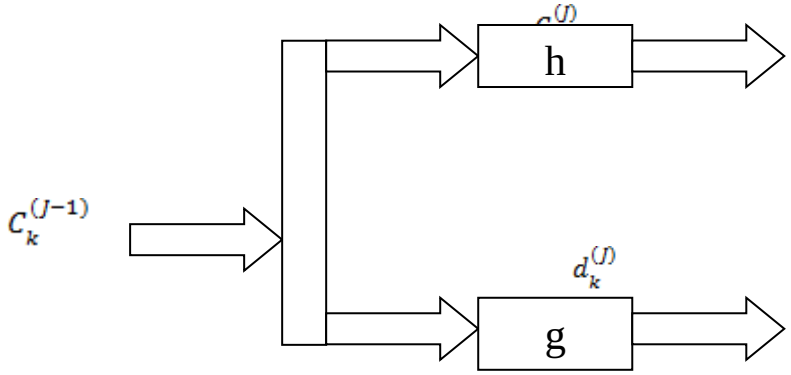

Fig 3. Wavelet Decomposition

$$C_K^{(J)} = \sum_{n=-\infty}^{n=\infty} \mathrm{h}(2\mathrm{k}-1)\, C_K^{(J-1)} \quad (1)$$

$$d_K^{(J)} = \sum_{n=-\infty}^{n=\infty} \mathrm{g}(2\mathrm{k}-1)\, C_K^{(J-1)} \quad (2)$$

Step 5: Thresholding: In this comparison of each pixel of gray scale image with some threshold value is done. If the pixel value is more than threshold that indicate defect.
Step 6: Morphological Filtering: It has two operations like dilation and erosion. Erosion eliminates very small noise signal and dilation expands the defective portion of the fabric [4] [5]

IV. THE PROCEDURE FOR GOLDEN IMAGE SUBTRACTION

Obtain the golden image of repetitive unit of patterned fabric. The golden image that is wavelet decomposed defective image either vertical or horizontal component is subtracted from non-defective image. Finally thresholding and filtering techniques used to get a defect.

V. EXPERIMENTAL RESULTS

This method is implemented using MATLAB R2015b on Windows environment having 2.27 Ghz Core i3 processor with 8 GB RAM. Extensive experiments are carried out on the TILDA textures database [8] to detect the hole, thick bar, knot, thin bar and oil strain as shown in fig 4. In this method, image is reduced to 50% and sensitive to line defects such as horizontal, vertical and diagonal.

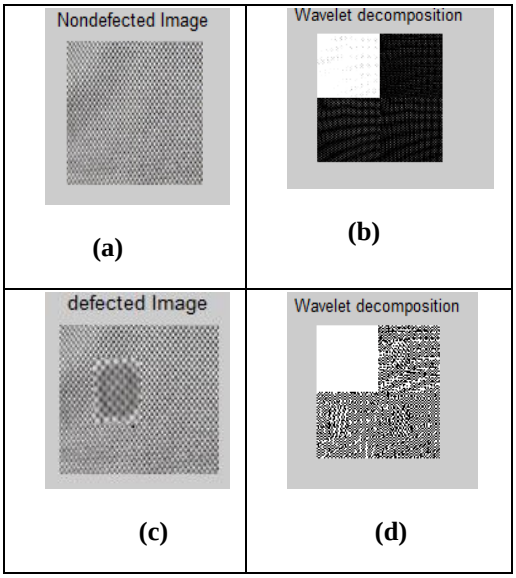

Fig 4 (a) Non defected image (b) wavelet decomposition (c) Defected image (d) wavelet decomposition

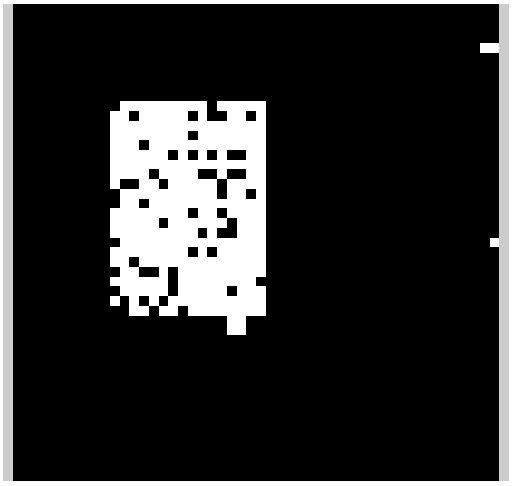

Fig 5 Defect detected

CONCLUSION

In this paper, we have proposed the supervised pattern fabric defect detection method using regularity analysis using Wavelet golden image subtraction method. It shows that Wavelet golden image subtraction method has high accuracy up to 96.7% and fast processing method

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