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Fault Detection Using Graph Based Segmentation

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***Abstract*: This paper presents an approach to find the defects in fabrics using digital image processing. Fabric defect detection has been carried out manually with visual inspection for a long time. In the manual fault detection system very less percentage of the defects are been detected while a real time automatic system can increase this to a maximum number. Fabric analysis is performed on the basis of digital images of the fabric. The recognizer acquires digital fabric images by image acquisition device and converts the image into binary image by restoration and threshold techniques. To upgrade this process the fabrics when processed in textiles the fault present on the fabrics can be identified using graph based segmentation techniques with MATALB. This image processing technique is done using MATLAB. This research thus implements a textile defect detector with system vision methodology in image processing & find 89% of accuracy.**

Keywords: Image processing, MATLAB, Histogram, local Thresholding, graph based segmentation.

I. INTRODUCTION

The textile industry, as with any industry today, is very concerned with quality. It is desirable to produce the highest quality goods in the shortest amount of time possible. Fabric faults or defects are responsible for nearly 85% of the defects found by the garment industry. Manufacturers recover only 45 to 65 % of their profits from seconds or off-quality goods. It is imperative, therefore, to detect, to identify, and to prevent these defects from reoccurring. Here it can analyze all faults present on fabrics such as hole, scratch, dirt spot, fly, crack point, color bleeding etc. automatically. Hence the efficiency is also reduced in this process. To overcome all these drawbacks this automation process can be implemented. Fabric defect detection is an important part of quality control in the textile industry.They have to detect small detail that can be located in wide area that is moving through their visual field by feature extraction technique in Matlab.

II. DEFECTS CLASSIFICATION

In textile sectors, different types of faults are available i.e. hole, scratch, stretch, fly yarn, dirty spot, knot, slub, cracked point, misprints, color bleeding etc; if not detected properly these faults can affect the production process massively. Proposed textile analysis mainly detects four types of faults: hole, scratch, fresh as no fault and remaining faults as other fault. Inspection of 100% of fabric is necessary first to determine the quality and second to detect any disturbance in the weaving process to prevent defects from reoccurring.

Yarn Defects

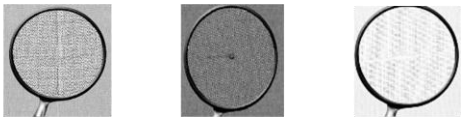

Fig.1

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Weaving Defects

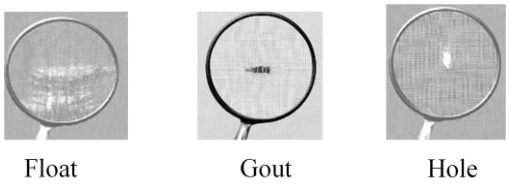


Fig. 2

III. LITERATURE REVIEW

Fabric defect detection using digital image processing has received considerable attention during the past two decades and numerous approaches have been proposed in the literature. Navneet Kaur [1] proposed a Gabor flter scheme. A Gabor filter was chosen as a suitable representative of this class of techniques. This research then successfully applied optimized 2-D Gabor filters to the textile flaw detection problem and provided a further support of their suitability for this task. By Kang T.J. et al. [9],A novel optimized 2-D Gabor algorithm presented in this study is an automatic solution which is adaptable to detect a large variety of textile flaw types, both structural and tonal. S.Priya [4] has separating a digital image into its bit planes is useful for analyzing the relative importance played by each bit of the image. Instead of highlighting gray level images, highlighting the contribution made to total image appearance by specific bits is examined. Most of the algorithms used today for fabric defect localization.

IV. METHODOLOGY:

The digital analysis of two-dimensional images of fabric is based on processing the image acquirement, with the use of a computer. The image is described by a two-dimensional matrix of real or imaginary numbers presented by a definite number of bytes. The system of digital image processing may be presented schematically as shown in Figure below. The method used in this paper is processed using MATLAB with image processing toolbox. The toolbox supports a wide range of image processing operations, including: open image file, add noise to intensity image, 2-D median filtering and adaptive filtering, Image analysis and enhancement, Color Image decomposition into RGB Channels, Image histogram, Image segmentation, signal plotting and etc. The given Algorithm shows the general flow of the Various Modules of Matlab Software:Textile fabric surface image is acquired by using a CCD camera from top of the surface from a distance adjusted so as to get the best possible view of the surface.

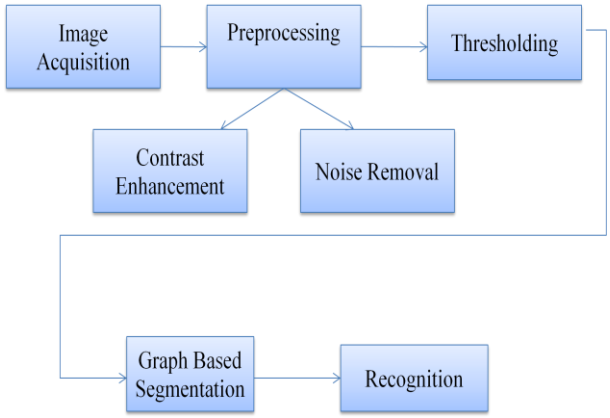


Fig.3

A. Image acquisition: Acquire Input color fabric image to the MATLAB in image processing system. The image formats are .tif, .Jpeg, and .png. In this paper we used color images (RGB images) and separated into their components (Red, Green, and Blue).

Fig. 4

B. Contrast Enhancement: The Image Processing Toolbox contains several image enhancement routines.

- **Step 1: Load Images**

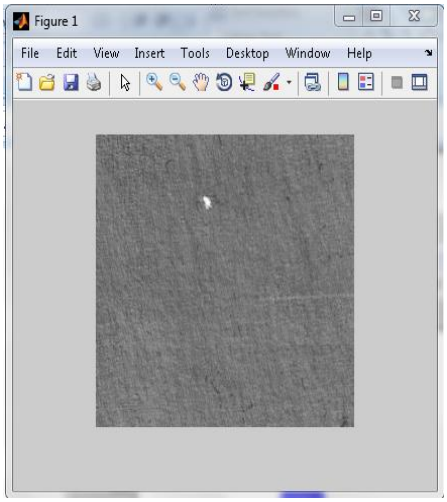
Read an images: fabric.jpg and detect.jpg.

- **Step 2: Resize Images**

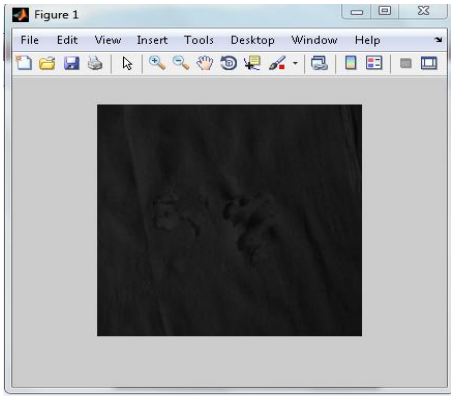
To make the image comparison easier, resize the images to have the same width & hight.

- **Step 3: Enhance Grayscale Images**

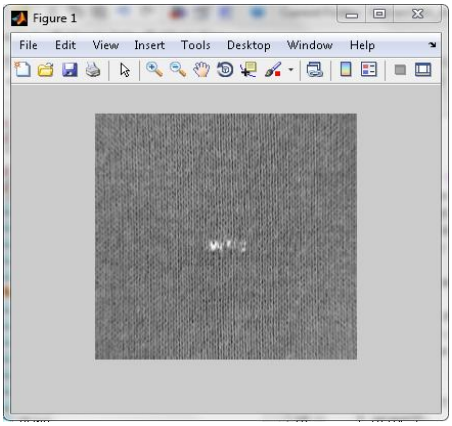
Histogram Equalization is Applied to Enhance the Contrast of Fabric Surface.



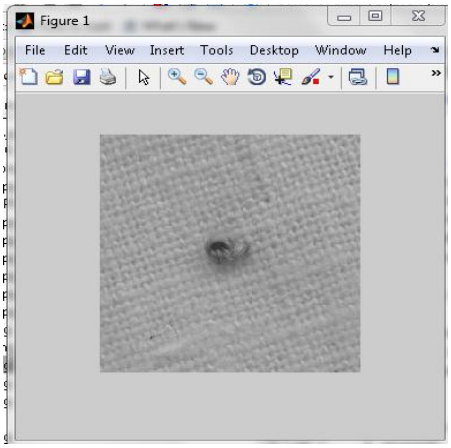
Hole



Tear



Scratch



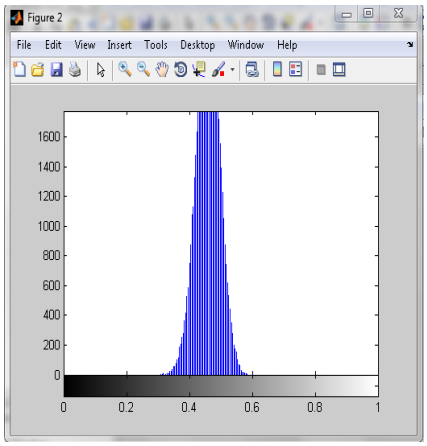
Knot

Fig.5 Color Images Converted to Gray Scale Image

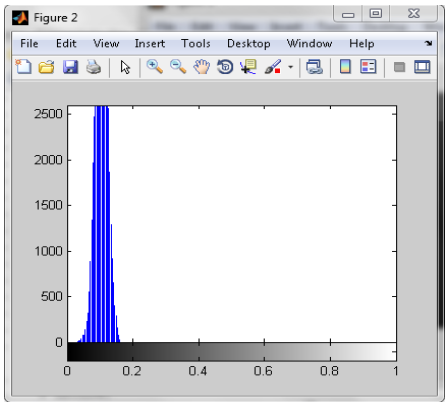
Histogram Equalization:

- Histogram is a representation of the distribution of color in an image and it represents the number of pixels that have colors in each of a fixed list of color ranges.
- Histogram equalization is a method for stretching the contrast by uniformly distribution the gray values enhances the quality of an image.
- It enhances the contrast of images by transforming the values in an intensity image.

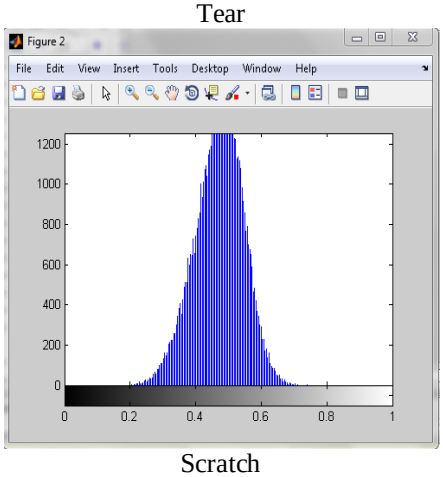
The contrast enhancement can be limited in order to avoid amplifying the noise which might be present in the image.



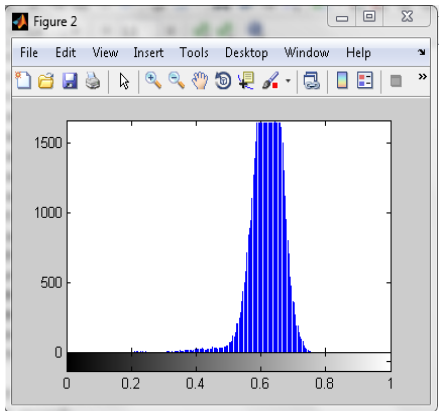
Hole



Tear



Scratch



Knot

Fig.6 Histogram Equalization of Hole,Tear,Scratch & Knot

C. Noise Removal**:**Whenever an image is converted from one form to another many types of noise can be present in the image. Noise is random variation of brightness or color information in images. The Wiener filtering method is used to filter the noise present in the image.Wiener2 low pass filters an intensity image that has been degraded by constant power additive noise.It uses pixel wise adaptive method based on statistics estimated from a local neighborhood of each pixel.

D. Image segmentation: Image segmentation is the process of partitioning a digital image into multiple segments. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image (edge detection). Each of the pixels in a region are similar with respect to some characteristic or computed property, such as color, intensity or texture.

E. As binary images are easy to operate, other storage format images are often converted into binary images are used for enhancement or edge detection. All images can be neatly segmented into foreground and background using simple thresholding. The purpose of thresholding is to extract those pixels from some image which represent an object (such as graphs, maps). This way can be determined by looking at an intensity histogram of the image.
Thresholding are two types :

- Global Thresholding
- Local Thresholding

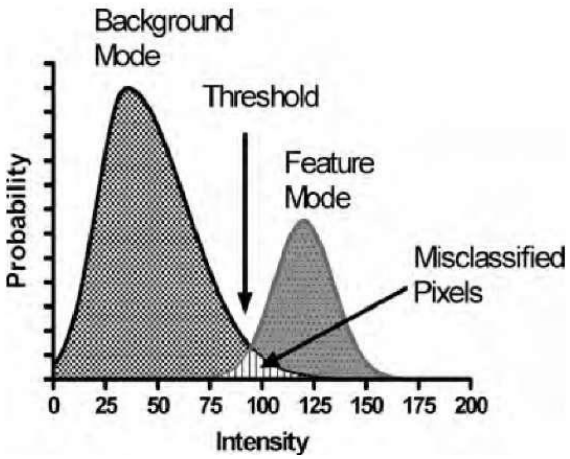


Fig.7

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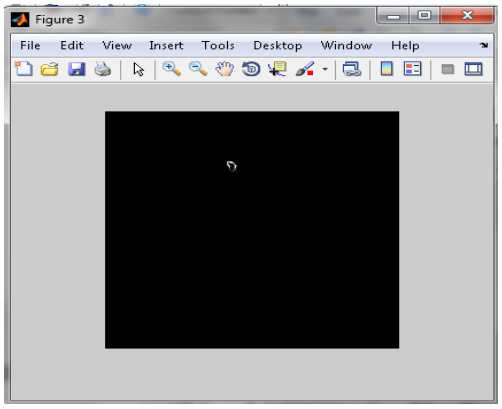
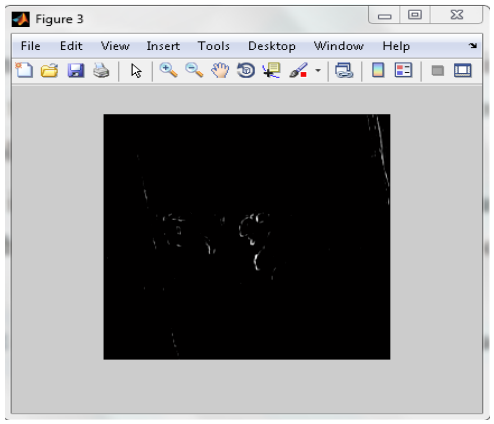
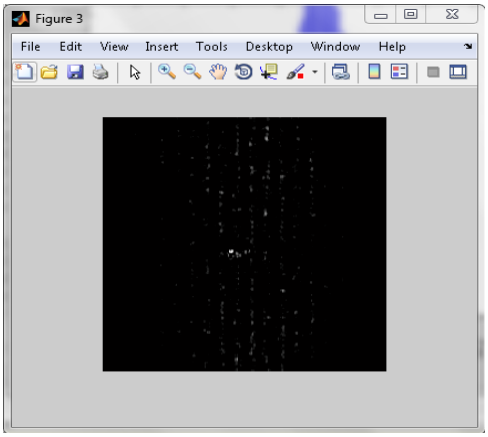


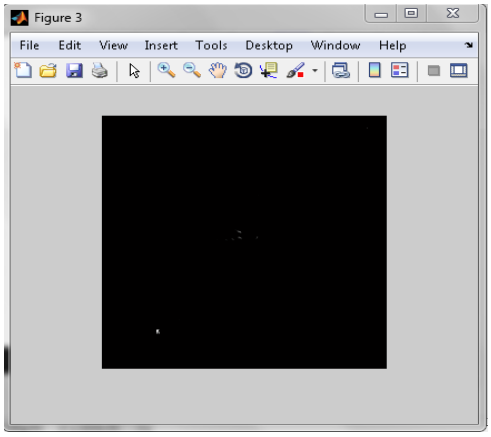
Hole



Tear



Scratch



Knot

Fig.8 Thresholding of Hole,Tear,Scratch & Knot

F. **Graph based segmentation :**The next step is to use the regions extracted by preprocessing and to extract segments that correspond to the defects. The general concept of graph based methods and measures the evidence of a boundary between two regions by computing :

(a) Intensity differences across the boundary and

(b) Intensity differences between neighboring pixels within each region.

This is mainly due to the use of the local thresholding method that performs well even when there is no uniform background in the images. The graph based segmentation returned each of the detected objects as a different segment colored randomly. The detected segments outside the image and the ones with an area greater or smaller than a minimum (50 pixels) and maximum area (3500 pixels), correspondingly.

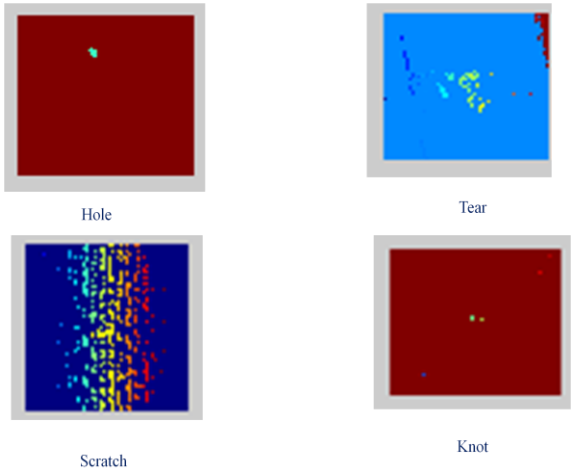


Fig.9 Graph Based Segmentation of Hole,Tear,Scratch & Knot

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G. Recognition: When the faults are detected with the help of graph based segmentation then the next step is fault location. Faults are located by the rectangle shape. That rectangle shows the postion, edge color and subplots.

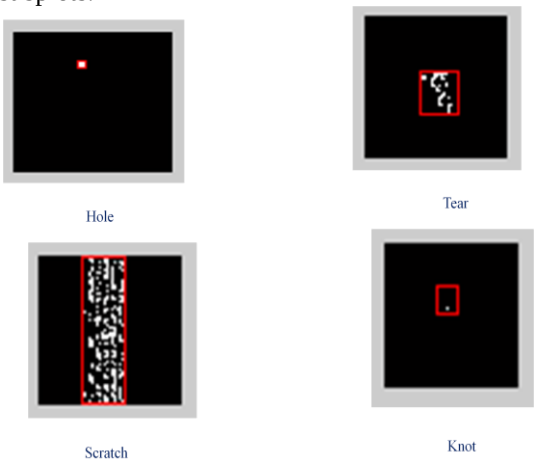
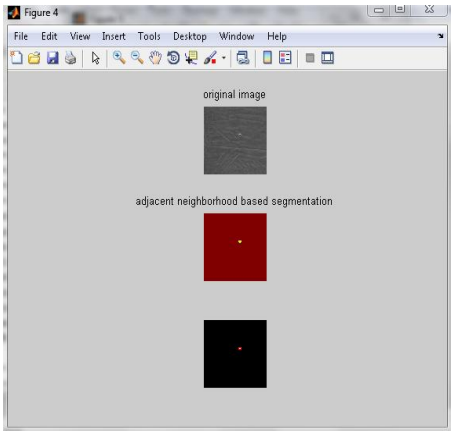
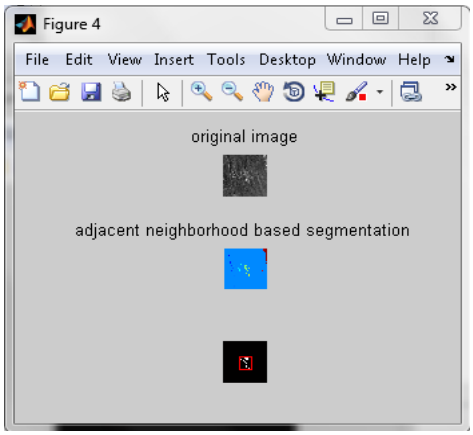


Fig.10 Recognition of Hole,Tear,Scratch & Knot

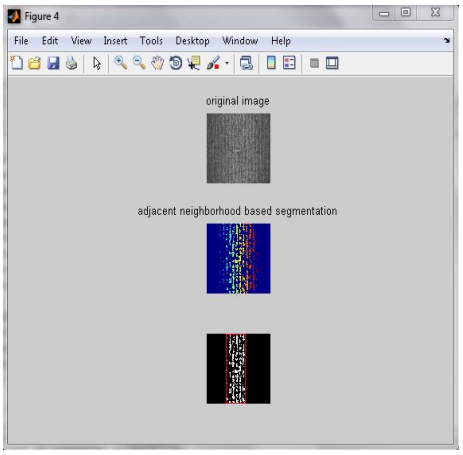
V. RESULT:



Hole



Tear



Scratch

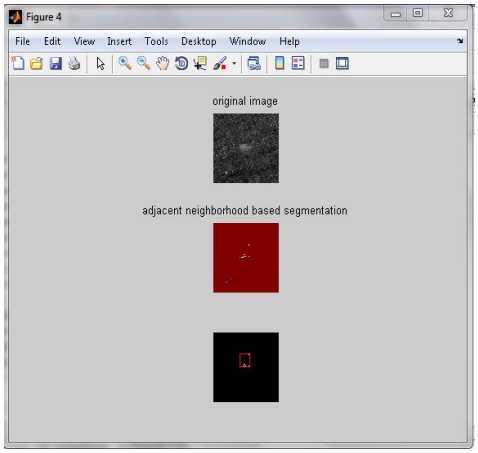


Fig. 11 Result of Hole,Tear,Scratch & Knot

Table.1 Identification Rate

Sr. No.	Types of Faults	Percentage of Correct Identification	Percentage of Incorrect Identification
1.	Hole	90.9	9.09
2.	Tear	83.3	16.6
3.	Scratch	85	15
4.	Knot	86.6	13.3
5.	Stain	96	4

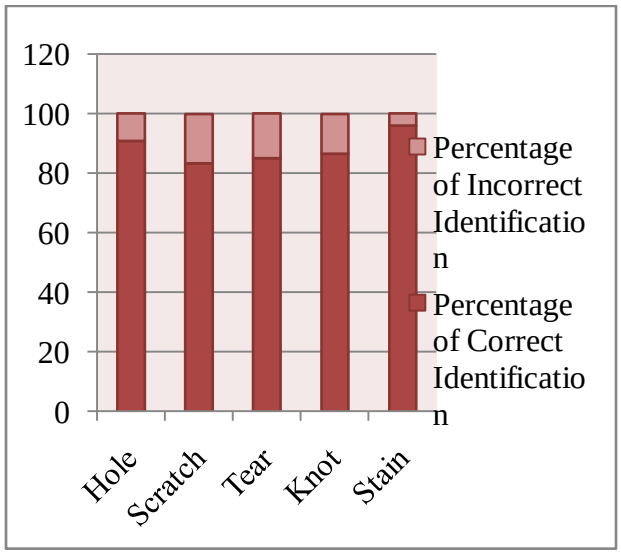


Fig. 12 Bar Chart of Identification Rate

VI. CONCLUSION:

The aim of this study is the development of efficient automated fabric inspection (defect detection) method. The Fabric Defect detection in the normal fabrics defines the faults by this graph based segmentation method. For preprocessing it used local thresholding followed by graph-based segmentation. For a given texture, the method allows to detect 89% of accuracy and obtain the perfect inspection rate.

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