The main problem in Textile Industry is to increase the ratio between Quality and Productivity with high flexibility and minimization of the cost. So, it is so important to test the products to ensure quality. Most of textile testing requires a subjective evaluation by trained personnel. But this person cannot work 24 Hours with zero faults, so the mill must have a lot of trained persons for these evaluations. Also, subjective evaluation yield erratic results and costs a lot of money. So, it is important to have on-line and high-speed quality controls to enable automation to improve quality value, in addition to increase of production speeds.

Image processing technique was rapidly developed for inspection of various materials and ensures quality, and a lot of cameras manufactures offered computerized cameras with high options like: speed, accuracy, and optical zooming to make achieved success process. Image-processing techniques included operations performed by computer in order to carry out pre-programmed tasks and many people called this (machine-vision system). These techniques analyze 2-D or 3-D Dimensional scenes to extract important information (features) and take decisions as to pre-define inputs. Like human-vision system self-programming that acquired knowledge by trial and error, computer vision needs programming for each task. Image processing enhances the quality of images by mathematical functions to make easy analysis and make calculation for getting numerical results to take decision. Other approach is to divide continuous video to individual digital scenes and track objects which are different from the surroundings by separating the object from their back ground and compute its blob measurements and location.

For making a success computer vision system it is important to understand optics theory, image principles, image environment, image formation, image types, texture features and deal with image accessories like cameras. Digital image-processing means self-computer-processing of the picture or images in numerical form. Image processing needs large numbers of steps depend on the nature of the image. Some of processing steps involve: feature enhancement, image segmentation, image-smoothing, image-sharpening, image restoration, image addition, subtraction, and multiplication, image-filtering, image compression, image transformation, image classification, and finally image analysis. Enhance the quality of the image is important to make better analysis.

Simple form:

(1) Acquisition, (2) Storage,

(3) Processing, (4) Results,

(5) Decision.

1.1. Digital Images Fundamentals

1.1.1. Image

The digital form of an image is a 2-D Matrix where each element of the matrix contains a value represents the intensity of light of this pixel.

1.1.2. Image Locations

1.1.2.1. Pixel Indices

For expressing locations in an image, you may use pixel indices which are integer values range from 1 to the size of the image (discrete indices).

1.1.2.2. Spatial Coordinates

Second method to express image location (continuously coordinates), location in an image are positions on a plane, and represented by x and y (not row and column as in the pixel indexing system).

1.1.3. Image Types

1.1.3.1. Binary (Also known as a bi-level image)

Logical array containing only 0s and 1s indicates black or white, respectively. A binary image is stored as a logical array. Figure 1.1 shows a binary image with a close-up view of some of the pixels' values.

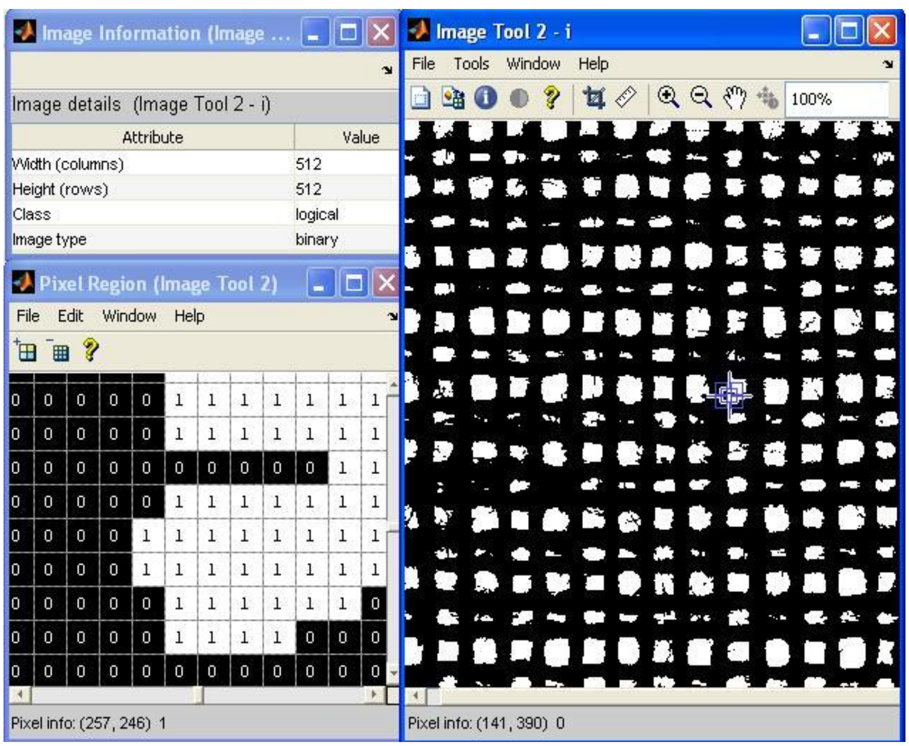

Figure 1.1: binary image.

1.1.3.2. Gray scale

Gray scale is also known as an intensity gray scale or gray level image. Each pixel indicates the intensity of light with in some range in its region. There is a color map to know the range of the pixel value. Its form is M-by-N array of class uint8, int16, uint16, single, or double. For single or double arrays storing, values range from [0, 1], For uint8 storing, values range from [0,255], For uint16 storing, values range from [0, 65535]. For int16 storing, values range from [-32768, 32767]. Figure 1.2 shows a gray scale image of class unit8.

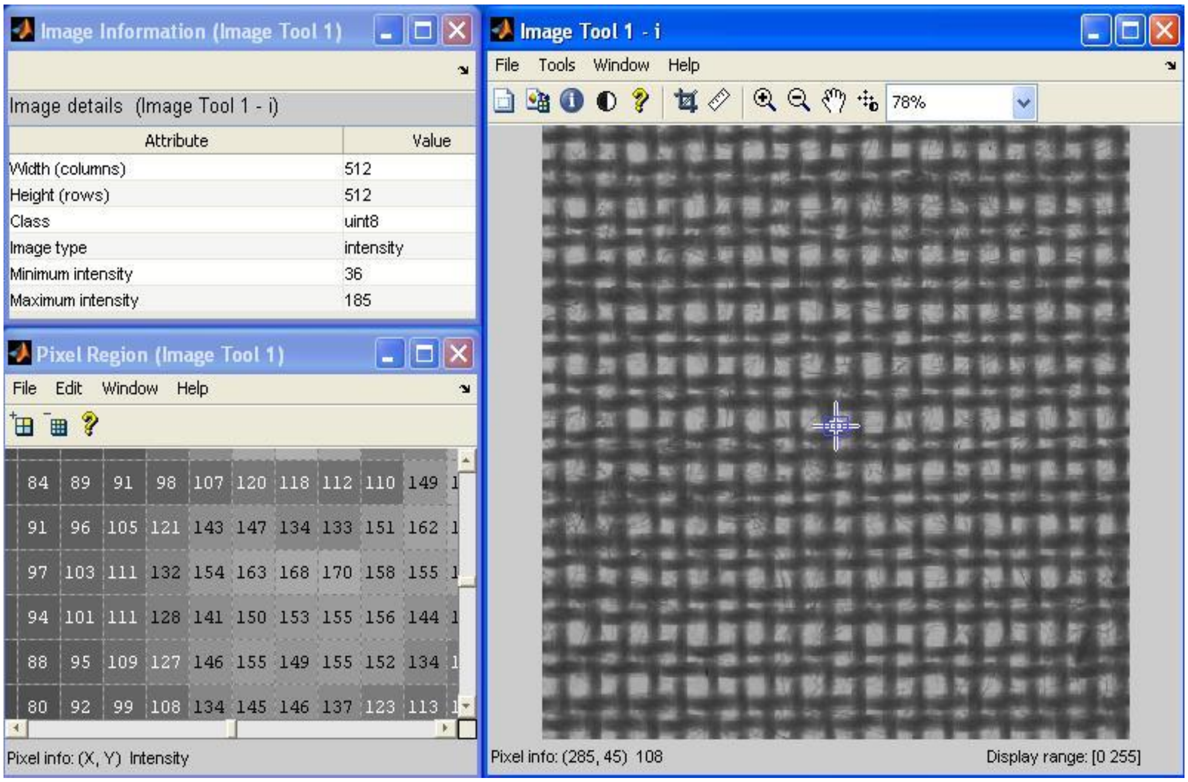

Figure 1.2: Gray scale image.

1.1.3.3. True color

Each pixel indicates the intensity of light with in some range in its region. There is no color map. Its form is M-by-N-by-3 array of class uint8, uint16, single, or double. For single or double arrays storing, values range from [0, 1]. For uint8 storing values range from [0,255]. For uint16 storing values range from [0, 65535]. Each pixel had 3 values for red, green, blue and their combination indicates its color. The three-color components for each pixel are stored along the third dimension of the data array. For example, the red, green, and blue color components of the pixel (30,15) are stored in RGB (30,15,1), RGB (30,15,2), and RGB (30,15,3), respectively. Some graphics file formats store true color images as 24-bit images, where the red, green, and blue components are 8 bits each, this yields a potential of 16 million colors. Figure 1.3 shows a True color image of class unit8.

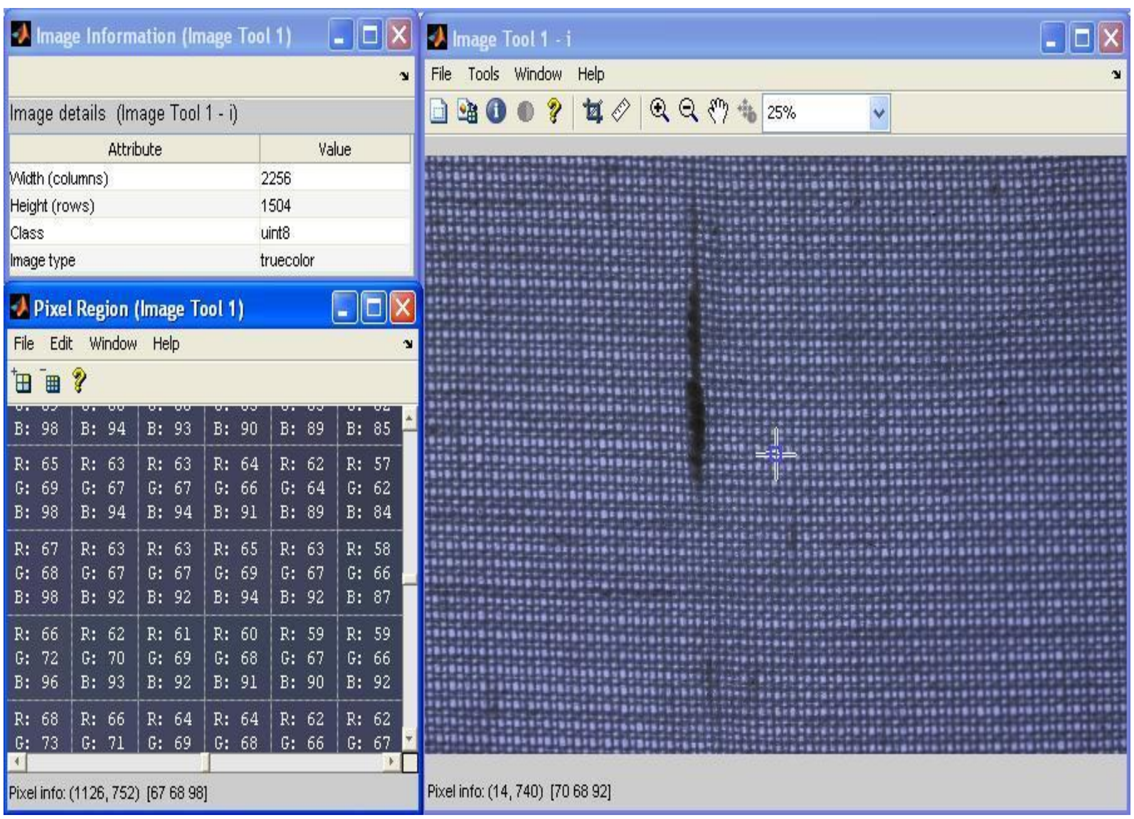

Figure 1.3: True color image.

1.1.3.4. Indexed **Images**

An indexed image consists of an array and a color map matrix. The pixel values in the array are direct indices into a color map.

1.2. Project Approach

Figure 1.4 shows a general diagrammatic sketch for an automated system using a computer for woven fabric defect detection, classification. The system also determines the sources of detected defects. Fabric images will be acquired by a digital camera.

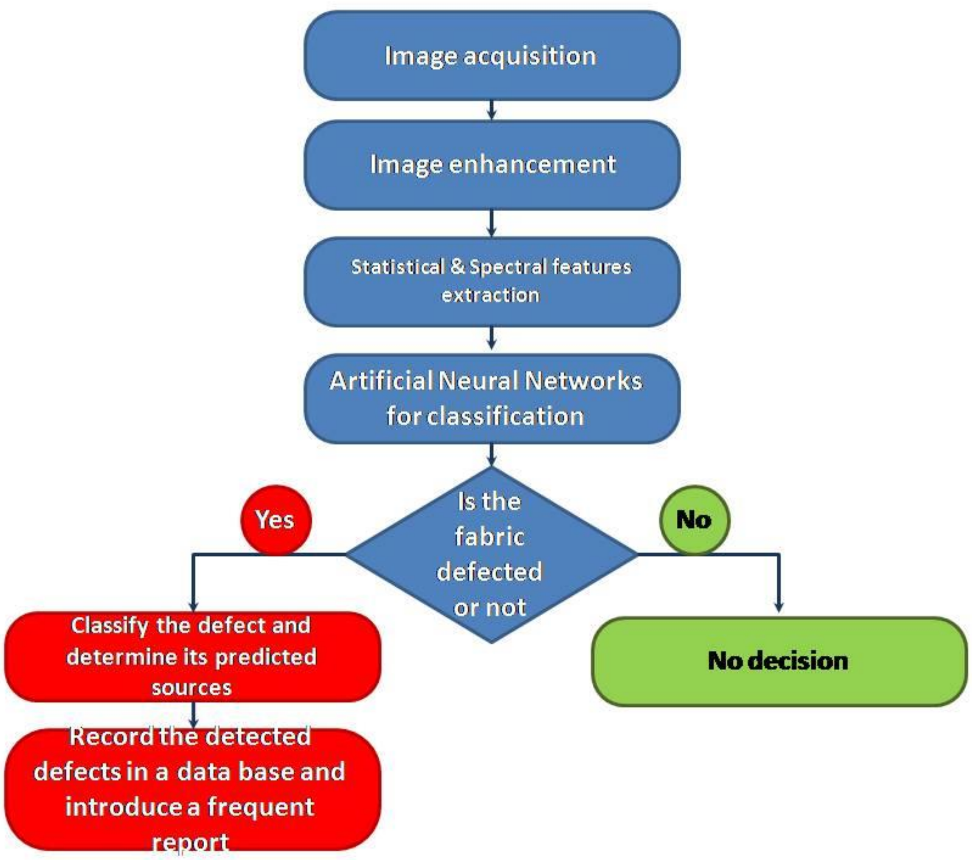

Figure 1.4: A diagrammatic sketch of the automatic system for woven fabric defects detection and classification.

The image acquisition process will utilize filters for image enhancement and standardization. Then, the image will be transmitted to a computer to extract some features. After that, these features enter an Artificial Neural Networks which is one of the most famous Artificial Intelligence Systems used as a classifier. The Artificial Neural Networks mimic the human mind and his ability to distinguish things by learning and correcting mistakes when happen. This needs a number of free defect images and some others defective for the Artificial Neural Networks supervised training after building it then, some other images were chosen for determining the efficiency of the system for faults detection and classification. After classification the system determine the predicted sources for this fault and takes a decision for correcting it and for not being repeated. The system also records the detected defects in a data base to introduce a periodic report about the most frequent defects and its effect on the quality of the produced fabrics.

A design of an automatic inspection machine is introduced for building the system of image acquisition, image enhancement, image analysis, features extraction and defects classification. This machine can work for a number of weaving machines at the same time. The design of this machine is adaptable for its function and easy for moving in small places.

This project is an automatic inspection machine using the computer for automatic fabric defects detecting. This system increases the quality of the final product by detecting small defects and providing a periodic report to repair their sources. By Appling this system, we will avoid human tiring and boring.

References:

[1] Eldeeb, Hadir & Mohy, Mahmoud & Elbagoury, Tamer & Abouseda, Khaled & Shady, Ebraheem & Eldessouki, Mohamed. (2013). An Automated Fabric Fault Detection and Classification System Based on Computer Vision and Soft Computing. ACC JOURNAL. XIX. 16-24.

[2] Shady, Ebraheem & Gowayed, Yasser & Abouiiana, Mohamed & Youssef, Safinaz & Pastore, Christopher. (2006). Detection and Classification of Defects in Knitted Fabric Structures. Textile Research Journal. 76. 295-300. 10.1177/0040517506053906.

[3] Behera, B.. (2004). Image-processing in textiles. Textile Progress. 35. 1-193.10.1080/00405160408689005.

[4] Ngan, Henry Y.T. & Pang, Grantham & Yung, Nelson. (2011). Automated fabric defect detection—A review. Image Vision Comput.. 29. 442-458. 10.1016/j.imavis.2011.02.002.