Fabrics Fault Processing Using Image Processing Technique in MATLAB

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Abstract

The main objective of this paper is the processing of the defective fabric parts. In Textile industry automatic fabric inspection is important to maintain the quality of fabric. This paper proposes an approach to recognize fabric defects in textile industry for minimizing production cost and time since the work of inspectors is very tedious and consumes time and cost. Waste reduction through accurate and early stage detection of defects in fabrics is also an important aspect of quality improvement. The recognizer acquires digital fabric images by image acquisition device and converts that image into binary image by restoration and threshold techniques.

Keywords

Image Processing, Gray Image, Histogram, Thresholding

I. Introduction

Quality is an important aspect in the production of textile fabrics. Fabric quality is consisting of two components, i.e., fabric properties and fabric defects. Fabric property depends on the raw material, construction parameters and processing methods. Whereas a fabric defect can occur right from raw material selection to finishing stage, because of improper input parameters with respect to material, machine and man. Any variation to the knitting process needs to be investigated and corrected [11]. Defects fall into the category. Since when they appear, repair is needed, this is time consuming and sometimes results in fabric rejection. Fabric defect detection has been a long – felt need in the textile and apparel industry. Surveys carried out in the early 1975 shows that inadequate or inaccurate inspection of fabrics has led to fabric defects being missed out, which in turn had great effects on the quality and subsequent costs of the fabric finishing and garment manufacturing processes [22].

Digital image processing is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing [1].

Since images are defined over two dimensions (perhaps more) digital image processing may be modeled in the form of multidimensional systems. Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it [3]. It is a type of signal dispersion in which input is image, like video frame or photograph and output may be image or characteristics associated with that image [5].

Usually Image Processing system includes treating images as two dimensional signals while applying already set signal processing methods to them.

Image processing basically includes the following three steps.

1. Importing the image with optical scanner or by digital photography.
2. Analyzing and manipulating the image which includes data compression and image enhancement and spotting patterns that are not to human eyes like satellite photographs.
3. Output is the last stage in which result can be altered image or report that is based on image analysis.

II. Existing Solution

The only solution to our problem is that the fabrics have been inspected through the laboratories. That is the solution is the manual inspection of the fabric, which can be done in any circumstances. The solution to this problem is not favourite since there are large numbers of textile industries all over the world; also it is not possible for each and every labour to carefully look in to each and every part of the fabric very carefully [15].

The weakness of this type of the solution is that

• Huge number of staff is to be recruited in large scale industries
• Efficient staff should be appointed without having any disability
• Favourable conditions should be available for the work that is uninterrupted power supply and other favourable conditions
• Human errors is one most important criteria

III. Expectation from the Proposed System

The proposed system should be able to scan and show an image that shall be able to clearly view each and every part of the fabric very leniently that not a single fault should be out of reach. The system developed should pass through each and every stage of the built system and clearly pass through each and every technical aspects so that the fabric passed will be fault free and if there is the fault it should be generated and intimated to the concerned person in the department [16]. The system should be able to take the input as the faulty fabric image and then convert that image into the gray scale image. Proper noise removal of the image should be done and it should be converted to the corresponding binary image. The result should be displayed in the form of the histogram and depending upon the prescribed properties of the histogram the output is displayed. In addition to the histogram properties the thresholding function that is being defined is also being considered for the output.

IV. Background

This paper describes about fault detection, positioning and classification of the faults occur in the weaving machine during weaving by using the principle of image processing, an automatic fabric evaluation system, which enable computerized defect detection – analysis of weaved fabrics. This method involves the process of analyzing the fabric image capture by a digital camera. The advantage for the manufacturer here is to get a warning when a certain amount of defect or imperfection occurs during the production of the fabric so that precautionary measures can be taken before the product hits the market. Wastage reduction through accurate and early stage detection of defects in fabrics is an important aspect of quality improvement [19]. The problem of web inspection, particularly, is very important and complex and the...
research in this field is widely open. Natural fabric and synthetic fabric are the two classifications of textile fabric. Synthetic fabrics are fairly new and have evolved with the continuous growth in textile industry. According to the need and constant innovation in textile industry water proof, oil resistant, UV resistant and abrasive resistant fabrics are also available. Natural fabrics use animal’s skin, the cocoons of silkworms, plants seeds, leaves and stems. It is soft and durable. It does not change color due to UV light and there is no warming effect to the user until the material loses its tensile strength. The various types of natural fabrics are cotton fabric, silk fabric, wool fabric, leather fabric, hemp fabric, coir fabric and linen fabric [18]. Fabric texture refers to the feel of the fabric. It is smooth, rough, soft, velvety, silky, lustrous, and so on. The different textures of the fabric depend upon the types of weaves used. Textures are given to all types of fabrics, cotton, silk, wool, leather etc., In textile, different types of faults are available i.e. hole, scratch, stretch, fly yarn, dirty spot, slab, cracked point, colour bleeding etc; if not detected properly these faults can affect the production process massively[18]. The objective of the proposed work is to identify whether the fabric is defective or not. If it is defective then identify the location and the type of the defect.

V. Related work
Advanced and automated neural network based textile defect detector:- The proposed textile defect recognizer is viewed as a real-time control agent that transforms the captured digital image into adjusted resultant output and operates the automated machine i.e. combination of two laser beams and production machine through the microcontroller.

Fabric defect detection using neural network:- Neural networks have been developed as generalization of mathematical models of human cognition and showed promise for solving difficult problems in areas such as pattern recognition and classification [21].

Automated Fabric Defect Recognition System using Image Processing and Artificial Neural Networks with the Support of Microcontroller:-

Fabric Inspection System using Artificial Neural Networks:- The performance of the proposed fabric defect detection scheme is evaluated by using a set of fabric images chosen from the Manual of Standard Fabric Defects in the textile Industry. These images are captured by a digital camera.

VI. Analysis
The system as a whole can be overviewed as shown in the fig. 1. The brief description and the detailed working of each and every block is summarized as follows:

A. Input of the Fault Image
This is basically the image acquisition block of the system. Here the faulty fabric image is taken by the different types of camera such as CCD (Charged Coupled Device) camera, CMOS (Complementary Metal Oxide Semiconductor) camera, or any basic Digital camera, etc. The pixel value of these cameras is around 320 × 420 pixels. The acquired image may or may not contain noise signal, if it consists of the noise signal it is required some pre-processing techniques in the image. Noise must be removed from the image by using noise removal techniques [4].

B. Conversion of Color Image to Gray Image
This is basically converting the original image that is being forwarded by the previous block in to the gray scale image. The gray scale image conversion is really very important since the further processing of the system is to be done on the gray image only. Explore noise reduction in images using linear and nonlinear filtering techniques is applied [3].

C. Noise Removal and Filtering from the Image
The image that is converted to the gray scale image is being given as an input to the noise removal part of the system. In this part of the system the removal of the noise signal is done in order to analyse the image for the defects in the image that is the fabric. The noise removal is one of the crucial part of the system since the noise in the image acts as the impurities in the image that can cause the degraded output of any system. Here in our system the noise can affect the level of the intimation of the faults that the system is going to predict at the end [4].

D. Conversion to the Binary Image
The noise of the image is being totally removed in the noise removal part of the system. The next step after the noise removal from the fabric image is the conversion of the noise removed image to the binary image of the original image. Here the conversion of the binary image is the important task since the original image is in the image format of the various formats. This conversion of the image to the binary image is necessary since the image is to be converted in to the machine readable format for the processing and that is done only with the help of the binary image. Various operations on the images is also done only on the binary images [3].

E. Histogram
A histogram is basically the graphical representation showing a visual impression of the distribution of data. It is an estimate of the probability distribution of a variable [9]. In this system the collected frame of the image is analysed for its appearance, the every pixel of the frame which is obtained from the output of the image enhancement process is measured and their appearance value is given between the standards 0 – 256 and their resultant values are marked in the histogram graph. Histogram here basically is used to classify the defects ts of the fabric. With the use of the output of the histogram the faults are being guessed [10].

F. Thresholding
Thresholding is the simplest method of image segmentation. From a gray scale image, thresholding can be used to create images in thresholding, the color-image or gray-scale image is reduced to a binary image. Thresholding is a process of converting a gray scale input image to a bi-level image by using an optimal threshold. The purpose of thresholding is to extract those pixels from some
image which represent an object (either text or other line image data such as graphs, maps). Though the information is binary the pixels represent a range of intensities. For a thresholding algorithm to be really effective, it should preserve logical and semantic content [8].

There are two basic types of thresholding algorithms:
- Global thresholding algorithms
- Local or adaptive thresholding algorithms

VII. Implementation

A. MATLAB

Matlab has been developed as generalization of mathematical models of human cognition and showed promise for solving difficult problems in areas such as pattern recognition and classification. Matlab has proved a great success in the various matrix operations and the various image processing operations such as matrix multiplication and so on [5].

This paper is basically implemented using the Matlab for the reason that the efficient behaviour with the types of images and the ease of the operations to be performed on the various images and at the various level.

The efficient flow of the paper can be summarised as follows

![Flow of the System](image)

The fault classifier here basically is dependent on the output of the histogram. The output of the histogram classifies the type of the defect contained in the fabric. With the use of the and the study of the various histogram curve seen in the output in the system the various faults of the fabric can be summarised. the types of the defects are that discussed in the paper.

VIII. Evaluation

In fabric field there are different types of faults such as scratch, hole, dirty spots, color bleeding etc; if these faults are not detected properly it will affect the production system massively.

The various defects in the process of fabric weaving can be seen as follows:
1. Broken Ends-This defect is caused by a bunch of broken ends woven in the fabric.
2. Broken Picks

In plain woven fabrics, this defect materializes by the presence of two picks in the same shed for a part of the width of the fabric. The main cause of weft breaks are rough surfaces of shuttle, shuttle box, rough or incorrect placement of shuttle eye, loose fitting of pin in the shuttle, incorrect alignment of pin with shuttle eye and low yarn strength.
3. Float-A float is the improper interlacement of warp and weft threads in the fabric over a certain area.
4. Gout-A gout is a foreign matter usually lint or waste accidentally woven into the fabric.
5. Hole, Cut or Tear-The occurrence of hole, cut or tear which is self explanatory.

IX. Results

![Graphical User Interface of the System](image)

![Image of the Defected Fabric Given as Input to the System](image)
X. Limitations and Future Scope

Every coin has two sides likewise if there are advantages there are certain disadvantage. In this system there are some limitations like the input to the system is the image of the fabric and not the fabric itself. This may give sometimes the less efficient results because the nature of the fabric is not recognised by the system as the input is the image instead of the actual fabrics.

In future this work may be extended such that the output is given to neural network and the Microcontrollers of any type can be utilized and programmed such that it can detect the faulty fabric part. If the microcontroller is connected with motors of any type then it will be operated under normal fabric condition and can stop the motor if there is any fault on fabrics.

XI. Conclusion

It is easy to identify faults on fabric images and process by using this method. Thus the MATLAB Implementation is done for fault identification such as hole, scratch, fading and other faults on fabrics can be identified and processed. Thus the overall
efficiency is 85% by using this process compared to other methods of fault identification. Hence a different approach wherein various thresholding algorithms can be successively applied on the input image can yield better results. The manual textile quality control usually goes over the human eye inspection. Notoriously, human visual inspection is tedious, tiring and fatiguing task, involving observation, attention and experience to detect correctly the fault occurrence. The accuracy of human visual inspection declines with dull jobs and endless routines. Sometimes slow, expensive and erratic inspection is the result. Therefore, the automatic visual inspection protects both: the man and the quality. Here, it has been demonstrated that Textile Defect Recognition System is capable of detecting fabrics’ defects with more accuracy and efficiency. Thereby applying Matlab9 version to the color faulty fabrics it is processed and finally the Histogram is obtained for the same image and thresholding is done to obtain the intensity of the image. In future this can be extended to any number of fault identifications on fabrics and can be processed.

References
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