Detection and Location of Defects Fabrics Using Feature Extraction Technique

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Abstract- *This paper presents an approach to automatic detection of fabric defects using digital image processing. In Textile industry automatic fabric inspection is important to maintain the quality of fabric. Fabric defect detection is carried out manually with human visual inspection for a long time. This paper proposes an approach to recognize fabric defects in textile industry for minimizing production cost and time. 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 that image into binary image by restoration and threshold techniques. This paper introduces a method which reduces the manual work. This image processing technique is done using MATLAB 7.10. This research thus implements a textile defect detector with system vision methodology in image processing.*

Key words: Image acquisition, MATLAB, enhancement, feature extraction technique.

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. In this paper a fabric faulty part is taken for analysis from textiles. It is imperative, therefore, to detect, to identify, and to prevent these defects from reoccurring. There is a growing realization and need for an automated woven fabric inspection system in the textile industry. All faults present on fabrics such as hole, scratch, dirt spot, fly, crack point, color bleeding etc. In this paper we analyze the faults using image processing technique. Hence the efficiency is also reduced in this process. Image processing techniques will help to production increase in fabric industry; it will also increase the quality of product. They have to detect small detail that can be located in wide area that is moving through their visual field. For this process we have use MATLAB in image processing toolbox. The high cost, along with other disadvantages of human visual inspection has led to the development of on-line machine vision systems that are capable of performing inspection tasks automatically.

DEFECTS CLASSIFICATION

In textile industries, some defects are arising in the production process. The various types of defects detected during quality control are classified: Critical defects, Major defects and Minor defects. Some of the commonly occurring fabric defects are:

- Yarn defects- The defects originating from the spinning stage or winding stage.
- Weaving defects-The defects which originate during the process of weaving.

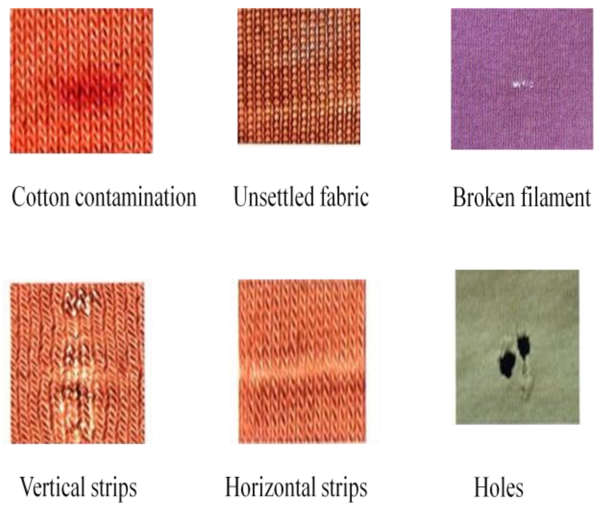


Fig.1 Yarn Defects & Weaving Defects

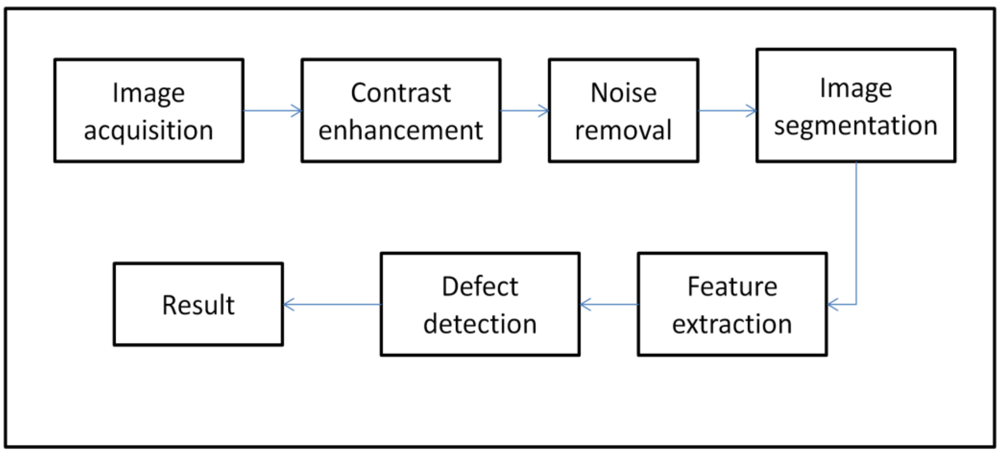
BRIEF LITERATURE REVIEW: Fabric defect detection using digital image processing has received considerable attention during the past two decades and numerous approaches have been proposed in the literature. Navneet Kaur [1] proposed a Gabor filter scheme. A Gabor filter was chosen as a suitable representative 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 Xie Xianghua [2]the techniques used to inspect textural abnormalities are discussed in four categories, statistical approaches, structural approaches, filter based methods, and model based approaches. This paper focuses on the recent developments in vision based surface inspection using image processing techniques, particularly those that are based on texture analysis methods. Due to rising demand and practice of color texture analysis in application to visual inspection, those works that are dealing with color texture analysis are discussed separately. 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 here. Dr.M.Mohammed Sathik [3] Bit-Plane slicing method is used to extract the details of a Colored X-Ray Image. This method produces different bit level images. In this paper Bit Level 6 is evaluated for RGB colors of the Original image and it is evaluated with the Bit level 6 of the original image. The result shows that the colored X-Ray image Bit level6 yield more details than the Bit level6 of gray scale X-Ray image. In view of the high degree of periodicity for textile fabrics. Most of the algorithms used today for fabric defect localization or detection are computationally intensive and less accurate, particularly in the presence of a number of patterns and print. In this paper the algorithm used is simple and more efficient for implementation. There is a significant improvement in computational time also.

Manual Inspection Versus Automated Inspection

Inspection Types	Manual Inspection	Automated Inspection
Defect detection	70 %	85 %
Statistics ability	0%	90 %
Response type	50%	80 %
Inspection speed	30m/min	120m/min
Reproducibility	50%	90 %
Information exchange	20%	87 %

Table -1

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 MATLAB with image processing toolbox. MATLA is a high-level language and interactive environment for numerical computation, visualization, and programming.MATLAB analyze data, develop algorithms, and create models and application. HDF, JPEG, PCX, TIFF, BMP,XWB are the image format that use in MATLAB.

A. Image Acquisition: The first stage of any vision system is the image acquisition stage. After the image has been obtained, various methods of processing can be applied to the image to perform the many different vision tasks required today. However, if the image has not been acquired satisfactorily then the intended tasks may not be achievable, **even** with the aid of some form of image enhancement. 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. That acquire Input color fabric image to the MATLAB in image processing system.

B. Contrast Enhancement: Three functions are particularly suitable for contrast enhancement: imadjust, histeq, and adapthisteq.

- **Imadjust:** To increases the contrast of the image by mapping the values of the input intensity image to new values such that, by default, 1% of the data is saturated at low and high intensities of the input data.
- **Histeq:** To performs histogram equalization. It enhances the contrast of images by transforming the values in an intensity image so that the histogram of the output image approximately matches a specified histogram (uniform distribution by default).
- **Adapthisteq:** To performs contrast-limited adaptive histogram equalization. Unlike histeq, it operates on small data regions (tiles) rather than the entire image. Each tile's contrast is enhanced so that the histogram of each output region approximately matches the specified histogram (uniform distribution by default). The contrast enhancement can be limited in order to avoid amplifying the noise which might be present in the image.

C. Noise Removal: Whenever an image is converted from one form to another many types of noise can be present in the image. Here we use the Adaptive filtering to reduce stationary noise. It filters an intensity image that has been degraded by constant power additive noise. It uses pixel wise adaptive wiener method based on statistics estimated from a local neighborhood of each pixel. Explore noise reduction in images using linear and nonlinear filtering techniques is applied.WIENER2 Performs 2-D adaptive noise-removal filtering [6].WIENER2 low pass filters an intensity image that has been degraded by constant power additive noise. WIENER2 (Adaptive filtering**)** uses a pixel-wise adaptive Wiener method based on statistics estimated from a local neighborhood of each pixel.

D. Image Segmentation: Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. Image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. Several methods can be used to segment the defect, i.e., detect the defect on the image, ranging from simple segmentation methods (e.g., thresholding) to more advanced methods that combine background subtraction. Background subtraction methods construct a reference defect-free image and subtract it from the original image to detect defects. Defect detection was done in two sequential steps: (1) Sauvola local thresholding and (2) a graph-based segmentation method. The formula of the threshold T that is compared with the gray value of the pixel centered in a N _ N window is:

$T = M\,[1+K(s/R-1)]$

Where M and s are the mean and standard deviation in the window,R is the maximum standard deviation of gray level in all windows in the image and K is a parameter defined by the user. N should be sufficiently small to preserve the local details but it must be large enough to remove the noise. After local thresholding, a morphological filtering has to be used to remove a number of single dots in the resulted threshold image and get a smoothed binary image. This image contains suspicious objects in ‘‘white”, while other areas belong to the black background. The other method is graph based segmentation; this method is able to capture perceptually distinct regions, even though their interior is characterized by large variability, by considering global image characteristics. This is a very desirable feature, since such cases are very common in fabric defect images.

E. **Feature Extraction:** In pattern recognition in image processing. **Feature extraction** is a special form of reduction. Feature extraction has many techniques. We chose to use a newly developed multi-class SVM instead of using a binary SVM and adopting techniques for incorporating it in a multi-class problem, e.g., one versus all or all versus all. The optimization problem is solved using an efficient cutting plane algorithm that exploits sparseness and structural decomposition.

Multiclass SVM

Multiclass SVM aims to assign labels to instances by using support vector machines, where the labels are drawn from a finite set of several elements. The dominant approach for doing so is to reduce the single multiclass problem into multiple binary classification problems. Common methods for such reduction include

- Building binary classifiers which distinguish between (i) one of the labels and the rest (*one-versus-all*) or (ii) between every pair of classes (*one-versus-one*). Classification of new instances for the one-versus-all case is done by a winner-takes-all strategy, in which the classifier with the highest output function assigns the class (it is important that the output functions be calibrated to produce comparable scores). For the one-versus-one approach, classification is done by a max-wins voting strategy, in which every classifier assigns the instance to one of the two classes, then the vote for the assigned class is increased by one vote, and finally the class with the most votes determines the instance classification.
- Directed Acyclic Graph SVM (DAGSVM)
- error-correcting output codes

  Crammer and Singer proposed a multiclass SVM method which casts the multiclass classification problem into a single optimization problem, rather than decomposing it into multiple binary classification problems.

F. **Defect Detection:** The defect detection step in textile provides a set of objects that correspond to one of the following classes: non-defect, holes, broken filament, cuts, lack of fusion and cracks. In order to classify each of the obtained objects, a set of geometrical and texture-based features is extracted which is then used as input to a multi-class classifier.

- **Feature Definition:** The experienced users use both geometrical and intensity based attributes to evaluate a segment in fabric images. A system that would try to identify defects should exploit both information sources as well.

- **Feature Selection:** It is clear that the features that we mentioned in the previous section require a lot of computational power, especially the texture- based ones. There is a need for a trade-off between efficiency and effectiveness that becomes clearer for images. We need to use only those features that provide useful information and reject the rest, since we expect a great amount of redundancy in the information carried by the features. For this purpose we employed a feature selection method. Feature selection refers to a method that selects a subset of original features based on an evaluation criterion. For a data set with N features, there exist 2N candidate subsets. Even for a moderate N, the search space increases exponentially and very soon becomes prohibitive for exhaustive search. To avoid the computationally intractable exhaustive feature selection we have used a Sequential Backward Selection (SBS) method, which is employed along with a classifier, as described in next subsection. It selects from an initial set of input variables those variables that are mostly related to the output and contain the causality to the output.

CONCLUSIONS: The Fabric Defect detection and location identification in the normal fabrics defines the faults by this method. This method classifies 85% of defect in fabric and locates the defect in the normal fabric at an acceptable rate and provides 80% classification accuracy. We have present promising results for a novel system for multi-class defect detection and classification in fabrics using both geometric and texture features to capture the visual properties. For preprocessing we have used local thresholding followed by graph-based segmentation. The defects were classified using the state of the art multi-class SVM**.** We have also investigated the effect of feature selection and showed that it is possible to reduce computation time significantly without seriously affecting overall accuracy. As feature definition and classification techniques evolve the proposed overall strategy is expected to provide better results as well. In the future, we aim to investigate the method in many more images and eventually create a public dataset which will be able to be used for algorithm evaluation.

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