Textile Fabric Defects Detection and Sorting Using Image Processing

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ABSTRACT

Quality inspection is an important aspect of modern industrial manufacturing. In textile industry production, automate fabric inspection is important for maintain the fabric quality. For a long time the fabric defects inspection process is still carried out with human visual inspection, and thus, insufficient and costly.Therefore, automatic fabric defect inspection is required to reduce the cost and time waste caused by defects. The development of fully automated web inspection system requires robust and efficient fabric defect detection algorithms. The detection of local fabric defects is one of the most intriguing problems incomputer vision. Texture analysis plays an important role in the automated visual inspection of texture images to detect their defects. Variousapproaches for fabric defect detection have been proposed in pastand the purpose of this paper is to categorize and describe these algorithms. This paper attempts to present the survey on fabric defect detection techniques, with a comprehensive list of references to some recent.

Index Terms: Fabric Defect, Defect Classification, SVM(support vector machine),MATLAB

1. INTRODUCTION

Quality assurance of product is considered as one of the most important focuses in the industrial production. So is textile industry too. Textile product quality is seriously degraded by defects. So, early and accurate fabric defect detection is an important phase of quality control. Manual inspection is time consuming and the level of accuracy is not satisfactory enough to meet the present demand of the highly competitive international market. Hence, expected quality cannot be maintained with manual inspection. Automated, i.e. computer vision based fabric defect inspection system is the solution to the problems caused by manual inspection. Automated fabric defect inspection system has been attracting extensive attention of the researchers of many countries for years. The high cost, along with other disadvantages of human visual inspection has led to the development of automated defect inspection systems that are capable of performing inspection tasks automatically. The global economic pressures have gradually led business to ask more of itself in order to become more competitive. As a result, intelligent visual inspection systems to ensure high quality of products in production lines are in increasing demand of printed textures (*e.g.* printed fabrics, printed currency, wall paper) requires evaluation of color uniformity and consistency of printed patterns, in addition to any discrepancy in the background texture, but has attracted little attention of researchers. Human inspection is the traditional means to assure the quality of fabric. It helps instant correction of small defects, but human error occurs due to fatigue and fine defects are often undetected. Therefore, automated inspection of fabric defect becomes a natural way to improve fabric quality and reduce labor costs.

1.1 Fabric defects

Fabric faults or defects are responsible for nearly 85% of the defects found in the garment industry[6]. Manufactures recover only 45-65% of their profit from second or off quality goods [7]. It is imperative therefore to detect, to identify and to prevent these defects from reoccurring. There are many kinds of fabric defects. Much of them are caused by machine malfunctions and have the orientation along pick direction (broken pick yarns or missing pick yarns), they tend to be long and narrow. Other defects are caused by faulty yarns or machine spoils. Slubs are often appeared as point defects; machine oil spoils are often along with the direction along the warp direction and they are wide and irregular. An automated defect detection and identification system enhances the product quality and results in improved productivity to meet both customer needs and to reduce the costs associated with off- quality. Recently, the fault detection is done manually after a sufficient amount of fabric has been produced, removed from the production machine and then batched into larger rolls and then sent to the inspection frame. An optimal solution for this would be to automatically inspect from the fabric as it is being produced and to alert the maintenance personnel when the machine needs attention to prevent production of defects or to change process parameters to prevent automatically to prove product quality. This is done by identifying the faults in fabric using the image processing techniques and then based on the dimension of the faults; the fabric is classified and accordingly then graded.

2. LITERATURE REVIEW

To make the defect detection inspection more effective following points should be considered reduction of wastage, higher price of fabrics due to the presence of fewer defects, requirement of less labor.An automated defect detection and identification system enhances the product quality and results in improved productivity to meet both customer needs and to reduce the costs associated with off-quality.The inspection of real textile defects is particularly challenging due to the large number of textile defect classes, which are characterized by their vagueness and ambiguity. Recent method involves man power which reduces the efficiency and optimum solution. For this would be Automatic inspection from fabric as it is being produced and to alert the maintenance personnel when the machine needs attention to prevent production of

defects or to change process parameters to prevent

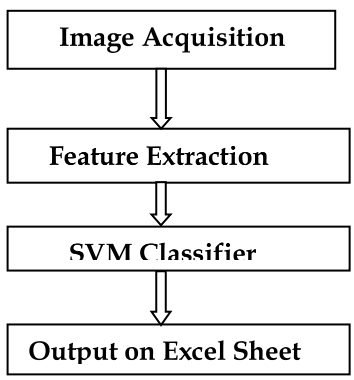
automatically to improve product quality.

have been deployment of mainly three defect detection techniques , namely, statistical, spectral, and model based. A number of techniques have been deployed There for classification. Among them, neural network, support vector machine (SVM), clustering,and statistical inference are notable. Different techniques have been applied in classification. Amongthem - ANNs, support vector machines (SVMs),clustering and statistical inference are the prominent ones.The development of automated system involves number of steps as shown in figure 1.Each step has effect on the performances of its preceding step. Each step has lot of importance in machine vision system. The task of Scene analysis and feature extraction is challenging issue. The complexity of the subsequent steps increases and the classification task becomes hard by selecting an inappropriate feature set. In the beginning of automated textile inspection system,various scene of different colored defective and defect free fabric should be analyzed. Then each defect

occurred should be analyzed properly. This will facilitate selection of the features for classification. Each of the features should be properly justified in terms of their discriminatory qualities and complexities to extract them, which is also very challenging. This results in an appropriate feature set, which will make the system's performance good.

3. METHODOLOGY

3.1 Software Description



3.1.1.Image Acquisition:

The first stage of any vision system is the image acquisition. In this process, first we take the image of the background where the towel is kept for processing and saved. The image of the background is captured when the towel is placed on the conveyor belt. Here the further processing is done in the form of do-while loop i.e. First the process is undertaken and then the conditions are checked. Thus, the image of the background when the towel was placed is substracted from the background image saved previously. A threshold is set to select the proper image of the towel. And if the threshold level of the image captured is equal or greater than the threshold level set before, than only the image of the towel is processed further. Thus on substraction if we do not get the proper image the image is recaptured followed by the further process.

3.1.2 . Feature Extraction:

In this process, the following features are extracted.

I. Colour:

First,the image obtained is in the RGB format. Further it is converted into gray level by the instruction “rgb2gray(image name)”.Now,the parameters such as homogeinity, contrast and correlation of the 3 colurs i.e. red, green and blue are checked separately .

II. Oil spot:

The image obtained is in rgb format .this rgb format is converted into his.now the mean of this image is calculated followed by calculation of mean of hue and mean of saturation.further standard deviation of hsi, hue and saturation is calculated lastly the parameter like correlation and homogeinity of the image is calculated.

III. Threading:

Here the RGB image is converted into gray image further morphological opening with structuring element used as line is applied on the image.

Next step is noise removal filtering which is done in matlab by the instruction wiener(i,(m,n)). Next is median filtering to reduce salt and pepper noise.

Last step is averaging filter which is done by the instruction h=fspecial(‘avg’,[m,n])

3.1.3 . SVM Classifier:

SVMs are based on the statistical learning technique and can be used for pattern classification and inference of nonlinear relationships between variables. This method has been successfully applied to the detection, verification and recognition of faces, objects, handwritten characters and digits, text, speech and speakers and the retrieval of information and images. An SVM classifier, which is trained with the features length and height of all sides and diameter of the hole.

SVM provides several salient properties, such as maximization of margin nonlinear transformation of the input space to the feature space using kernel methods. A binary (two) classification problem can be described as follows: given a set of labelled points (xi; yi), $1 \le i \le l$, where $xi \in Xp$a p dimensional input space containing vectors of features and $yi \in \{-1, +1\}$ are class labels, construct a rule that correctly assigns a new point x to one of the classes. The vectors xi in this formulation corresponds to objects, and the dimensions of the features or characteristics of these objects. Using labels $\{0,\ldots, K-1\}$ instead of $\{-1, +1\}$ we can describe a multiclass problem with K classes. A classification method or algorithm is a particular way of constructing a rule, also called classifier, from the labelled data and applying it to the new data. SVMs can be thought of as a method for constructing a special kind of rule called a linear classifier, in a way that produces classifiers with theoretical guarantees of good predictive performance.

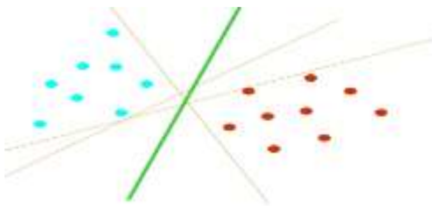


Fig-1.Optimal Separating hyperplane

Here there are many possible linear classifiers that can separate the data, but there is only one that maximises the margin (maximises the distance between it and the nearest data point of each class). This linear classifier is termed the optimal separating hyperplane.Consider the problem of separating the set of training vectors belonging to two separate classes

$$D = \{(x1, y1), \ldots, (x1, y1)\}, x \in Rn, y \in \{-1,1\}$$

with a hyperplane,

$$(w, x) + b = 0$$

The set of vectors is said to be optimally separated by the hyperplane if it is separated without error and the distance between the closest vector to the hyperplane is maximal.

Linear classifiers

Consider SVM I its simplest form, a linear SVM. A linear SVM is a hyperplane that separates a set of positive data from a set of negative data with maximum margin in the feature space. It is defined by the normal vector *w* and the offset *b*.

$$\text{Hyperplane} = \{x \mid \langle w, x \rangle + b = 0\}$$

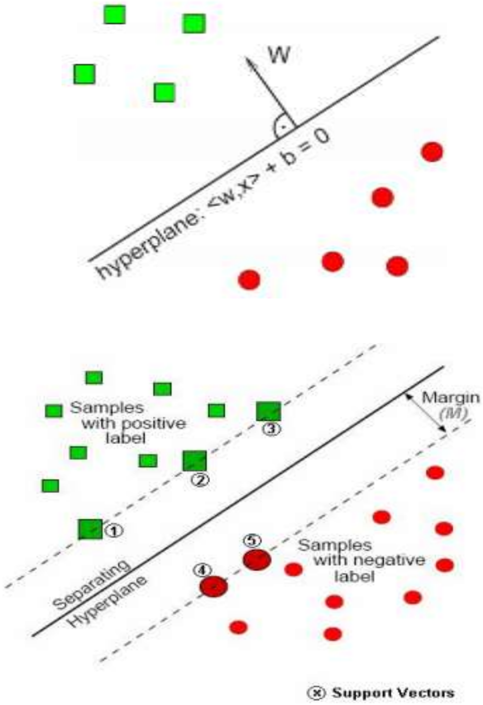


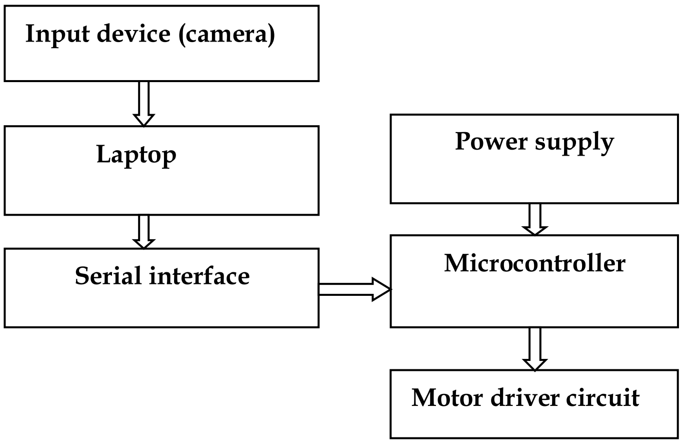
Fig-2. SVM linear classifiers

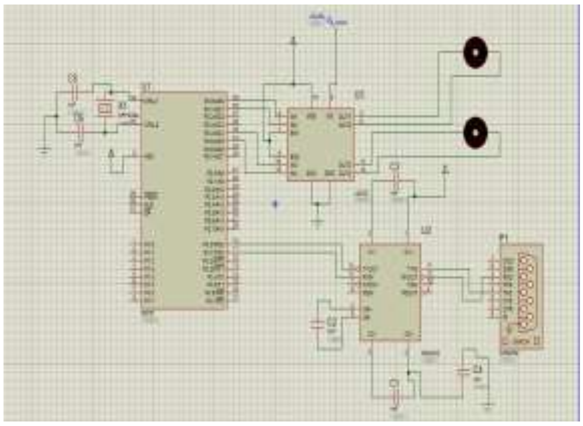
First fig shows a separating hyperplane with a normal vector *w*.second fig. shows an example of a simple two dimensional problem that is linearly separable. Each feature corresponds to one dimension in the feature space. The distance from the hyperplane to a data point is determined by the strength of each feature of the data. The SVM computes the hyperplane that maximizes the distances to support vectors for a given parameter setting

3.1.4.Output on Excel Sheet:

Excel sheet on the PC is used for displaying the result.The towels are separated on the basis of the quality level and the number of towels in the respective quality is displayed on the excel sheet.

3.2 Hardware Description:





The hardware block diagram consist of camera(webcam),laptop(for image processing),serial interface(max232),microcontroller(8051),motor driver(L239D)

3.2.1.Input Device :

The first stage of this project is image acquisition. So thus the block diagram first consists of a camera which may be a CCD (Charged Coupled Device) camera, CMOS (Complementary Metal Oxide Semiconductor) camera, Digital camera, etc. The pixel value of these cameras is around 320 × 420 pixels. Further a laptop is used for image processing.

3.2.2.Serial Interface:

Serial interface circuit (RS 232) for serial communication between the input device and microcontroller. In other words, RS-232 is a long established standard that describes the physical interface and protocol for relatively low-speed serial data communication between computers and related devices. RS-232 is the interface that your computer uses to talk to and exchange data with your modem and other serial devices.

To transfer the data from db9 connector to controller we are using max232 IC. The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. The controller operates at TTL logic level (0-5V) whereas the serial communication in PC works on RS232 standards (-25 V to + 25V). This makes it difficult to establish a direct link between them to communicate with each other.

The intermediate link is provided through MAX232. It is a dual driver/receiver that includes a capacitive voltage generator to supply RS232 voltage levels from a single 5V supply. Each receiver converts RS232 inputs to 5V TTL/CMOS levels. These receivers (R_1 & R_2) can accept ±30V inputs. The drivers (T_1 & T_2), also called transmitters, convert the TTL/CMOS input level into RS232 level.

3.2.3.Microcontroller:

We are using 8051 microcontroller, which is used to control motor drive circuit.

3.2.4. Motor drive circuit:

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

4.EXPERIMENTAL RESULT

Fig-3(a):threading defect image

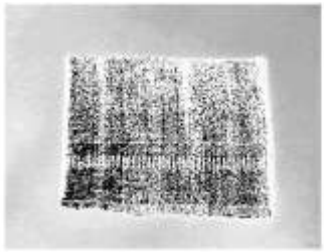


Fig.-3(b):RGB to HIS(hue)

Fig.-3(c): RGB to HIS (Saturation)

Fig.-3(d):RGB to HIS (intensity)

5. CONCLUSION

In this paper, a proposed method was developed. different types of defect were identified and classified based on geometric features. in this paper a svm approach for defects identification in textile has been proposed. the svm classifier is trained by the acquired defect samples. and , penalty factor and kernel parameter are searched by the genetic algorithm for acquired the optimal SVM classifier in the condition of limited samples information. Thus, this svm classifier is used here for classification of the defects.

we have presented a possibly appropriate feature set in order to identify the defects and classify . and we have found that the geometric features are sufficient to successfully classify the defects by svm. this method detects and classifies 90% of defect in fabric. this work is in progress to use a subset or all of the features combined with texture statistical features in order to successfully detect and classify the defects for a sample of a very large number of high-quality images.

we hope that this paper would be useful for newcomer in the area of textile fabric defect.

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