A Review: Fabric Defect Classification using Computational Intelligence Technique

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Abstract : Inspection of fabric defects plays on important role in the quality control. However, the current inspection task is primarily performed by human inspectors. Over the years significant research has been performed for automated, i.e. machine vision based fabric inspection systems in order to replace manual inspection, which is time consuming and not accurate enough. In this Purposed work extraction of fabric defect images, feature extraction, classification of different-different defect of fabric images. The main aim of the method is to develop a Computer Aided system for classification of types of fabric defect.

IndexTerm- MatLab, Nuero Solution Software, Microsoft excel, Various Transform Technique.

I. INTRODUCTION

In the manufacturing process, if the cost and just-in-time delivery represent the two lines of the right angle, the quality should be the hypotenuse that completes the right triangle of the process. It means that the quality is the most important parameter despite the increase in one or both of the other parameters (geometrical fact). Scientifically, a process quality control means conducting observations, tests and inspections and thereby making decisions which improve its performance. Because no production or manufacturing process is 100% defect-free (this applies particularly where natural materials, as textile ones, are processed), the success of a weaving mill is significantly highlighted by its success in reducing fabric defects.

For a weaving plant, in these harsh economic times, first quality fabric plays the main role to insure survival in a competitive marketplace. This puts sophisticated stress on the weaving industry to work towards a low cost first quality product as well as just-in-time delivery. First quality fabric is totally free of major defects and virtually free of minor structural or surface defects. Second quality fabric is fabric that may contain a few major defects and/or several minor structural or surface defects [1]. The non-detected fabric defects are responsible for at least 50% of the second quality in the garment industry (this figure is the result of many years of practical experience), which represents a loss in revenue for the manufacturers since the product will sell for only 45%-65% the price of first quality product, while using the same amount of production resources. Although quality levels have been greatly improved with the continuous improvement of materials and technologies, most weavers still find it necessary to perform 100% inspection because customer expectations have also increased and the risk of delivering inferior quality fabrics without inspection is not acceptable. The key issue, therefore, is how and under what conditions fabric inspection will lead to quality improvement. To address this issue, we proposed this classification system .The modern weaving Industry faces a lot of difficult challenges to create a high productivity as well as high-quality-manufacturing environment. Because production speeds are faster than ever and because of the increase in roll sizes, manufacturers must be able to identify defects, locate their sources, and make the necessary corrections in less time so as to reduce the amount of second quality fabric. This in turn places a greater strain on the inspection departments of the manufacturers. Due to factors such as tiredness, boredom and, inattentiveness, the staff performance is often unreliable. The inspector can hardly determine the level of faults that is acceptable, but comparing such a level between several inspectors is almost impossible. Therefore, the best possibility of objective and consistent evaluation is through the application of an automatic inspection system.

From the early beginning, the human dream is to improve the manufacturing techniques to achieve optimum potential benefits as quality, cost, comfort, accuracy, precision and speed. To imitate the wide variety of human functions, technology was the magic stick that advanced humanity from manual to mechanical and then from mechanical to automatic. The rare existence of automated fabric inspection may be attributed to the methodologies, which are often unable to cope with a wide variety of fabrics and defects, yet a continued reduction in processor and memory costs would suggest that automated fabric inspection has potential as a cost effective alternative. The wider application of automated fabric inspection would seem to offer a number of potential advantages, including improved safety, reduced labor costs, the elimination of human error and/or subjective judgment, and the creation of timely statistical product data. Therefore, automated visual inspection is gaining increasing importance in weaving industry.

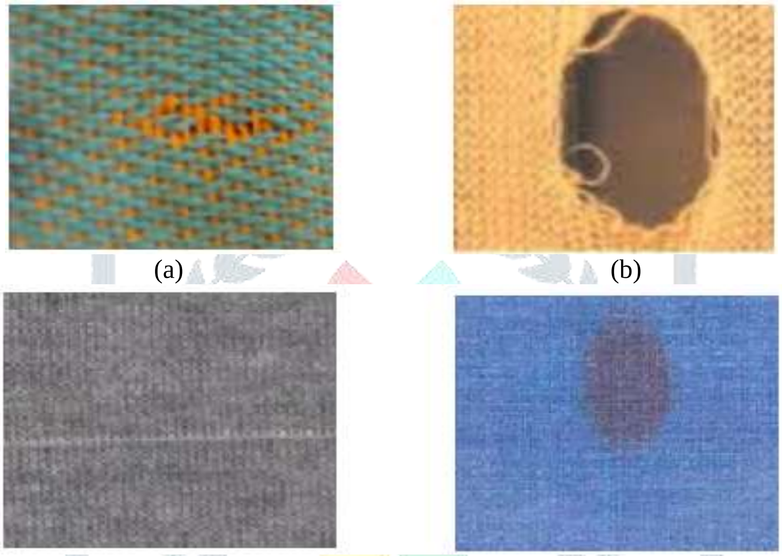
An automated inspection system usually consists of a computer-based vision system. Because they are computer-based, these systems do not suffer the drawbacks of human visual inspection. Automated systems are able to inspect fabric in a continuous manner without pause. Most of these automated systems are offline or off-loom systems. Should any defects be found that are mechanical in nature (*i.e.*, missing ends or oil spots), the lag time that exists between actual production and inspection translates into more defective fabric produced on the machine that is causing these defects. Therefore, to be more efficient, inspection systems must be implemented online or on-loom.

The Proposed method in this synopsis represents an effective and accurate approach to automatic defect detection. It is capable of identifying all five type defects. Because the defect-free fabric has a periodic regular structure, the occurrence of a defect in the fabric breaks the regular structure. Therefore, the fabric defects can be detected by monitoring fabric structure. Fourier Transform gives the possibility to monitor and describe the relationship between the regular structure of the fabric in the spatial domain and its Fourier spectrum in the frequency domain. Presence of a defect over the periodical structure of woven fabric causes changes in its Fourier spectrum. By comparing the power spectrum of an image containing a defect with that of a defect-free image, changes in the normalized intensity between one spectrum and the other means the presence of a defect.

The fabric defect could be simply defined as a change in or on the fabric construction. Only the weaving process may create a huge number of defects named as weaving defects. Most of these defects appear in the longitudinal direction of the fabric (the warp direction) or in the width-wise direction (the weft direction). The yarn represents the most important reason of these defects, where presence or absence of the yarn causes some defects such as miss-ends or picks, end outs, and broken end or picks. Other defects are due to yarn defects such as slubs, contaminations or waste, becoming trapped in the fabric structure during weaving process. Additional defects are mostly machine related, and appear as structural failures (tears or holes) or machine residue (oil spots or dirt). Because of the wide variety of defects as mentioned previously, it will be gainful to apply the study on the most major fabric defects. The chosen major defects are hole, oil stain, float, coarse-end, coarse-pick, double-end, double-pick, irregular weft density, broken end, and broken pick.

1.1 Defect Analysis

In this proposed work, we have dealt with four types of defect, which often occur in knitted fabrics in Bangladesh, namely color yarn, hole, missing yarn, and spot. All of the defects are shown in Fig. 1. All of them are discussed here below.



(a) (b) (c) (d)

Figure 1 Different types of defect occurred in knitted fabrics.
(a) Color yarn. (b) Hole. (c) Missing yarn. (d) Spot.

• Color Yarn: Fig. 1(a) shows the defect of color yarn. Color yarn appears in a shape, close to a small rectangle of one color, on a fabric of another color. A camera of high resolution and proper lighting are required in order to clearly capture the image of the defect of color yarn.

• Hole: Fig. 1(b) shows the defect of hole. Hole appears in a shape, close to a circle of the color of the background, on a fabric of another color. Its size varies from small to medium. Background color is another issue. In some cases, background color can become close to fabric color.

• Missing Yarn: Fig. 1(c) shows the defect of missing yarn. Missing yarn appears as a thin striped shade of the color of fabric. It is usually long. It is of two types, namely vertical and horizontal.

• Spot: Fig. 1(d) shows the defect of spot. Spot does not appear in any specific shape. It usually appears in a scattered form of one color on a fabric of another color. Moreover, its size varies widely. A camera of high resolution and proper lighting are required in order to clearly capture the image of the defect of spot.

II. LITERATURE REVIEW

A number of attempts have been made for automated fabric defect inspection [2]–[20]. Most of them have concentrated on defect detection, where few of them have concentrated on defect classification. A number of techniques have been deployed for defect classification. Among them, NN, support vector machine (SVM), Clustering, and statistical inference are notable. Scene analysis and feature selection are basically relevant to the works [3]–[6], [9]–[11], [18], which have dealt with multiclass problem.

Amir Reza Rezwan Talab et al.[1] in year 2018 have a proposed a new mapping technique of local binary patterns(LBPs) for texture classification , the paper title of these research is 'Fabric classification using a new mapping local binary patterns, and the accuracy of there research will be 88.25%.Implementation of proposed mapping on our patterened database shows that praposed method can be improve the classification accuracy. Kazim Hanbay et al.[2] in year 2017 have a proposed a method important texture features of the fabric image are extracting using CoHoG method. In these paper present a real time defect detection approach which compare the time performance of Mat lab, C++/ open programming language. Overall defect detection success rate of 95% is achieved for the mat lab and C++ application. Muhammad Faith Talu et al.[3] using wavelet analysis method in 2015 an online fabric defect detection system that can defect fabric defect which may occur during the features vectors through wavelet transform has reduced and successfully provided the classification of the defect by 90%. Ahmed Shayer Andalib et al .[6]have proposed a novel method to detect defect in woven fabric based on the abrupt changes in the intensity of fabric image due to the the defect and have constructed a classification model we have implemented artificial neural network(ANN) .Both are newly proposed method and improved the technique have performed the exiting method. We have implemented K-Validation to estimate the performance of our classification model of the defect by 90%.TE-LI SU et al .[7] have proposed the wavelet transform , stretch knitted fabric, neural network, Taguchi method in 2010,yhese the defect features of this image and then the back propagation neural network (BPNN) was used to carry out the defect classification of the fabric .The Taguchi based BPNN was 0.000199 and the recognition rate can reach 96.5%. In 2014 Mohamed Jmali et al.[4] have proposed the fabric defect, image analysis using neural network classification Technique . The result of these system the value 0 in the case of “thread missing”, the value 0.5 in the case of ”Hole” And the value in 1 in case of an “oil strain”. Min Li et al.[5] in 2013 have proposed a novel method for patterned fabric defect detection and classification using spectral estimation technique and rough set theory is presented in 2013. this method can successfully analyze and recognize oil warp and weft defects in patterned fabrics with nearly 96% success rate. In 2009 Liu Shuguang, et al.[8] have demonstrated fabric defect, there are a lot of image- based inspection technique: Fourier transform, Sobel algorithm of adge inspection , fast Fourier Transform(FFT) et. However Wavelet Transform is a kind of multi resolution algorithm fabric defect’s classification rate can be up to 95% with above method. F. Tajeripour et al.[9] in 2007 implemented Local binary patterns LBP, is one of the features which has been used for texture classification The proposed method is simple and gray scale invariant. Because of its simplicity, online implementation is possible as well. Accuracy is 96.8%. Mohamed Abdulhady et al.[10] have a proposed in 2005 the basic objectives are to improve the features selection used in CNeT classifier and compare the results with other neural network classifiers. The improved classification performance is achieved by employing a statistical method to select the most important features that can be used in classification. The network can be then used to test and classify new defects with 75% accuracy.

From the rigorous review of the above mentioned papers , it is observed that no method has reported accuracy of more than 98%. We need to improve the accuracy and for that a new system is required to be developed.

III. RESEARCH METHODOLOGY

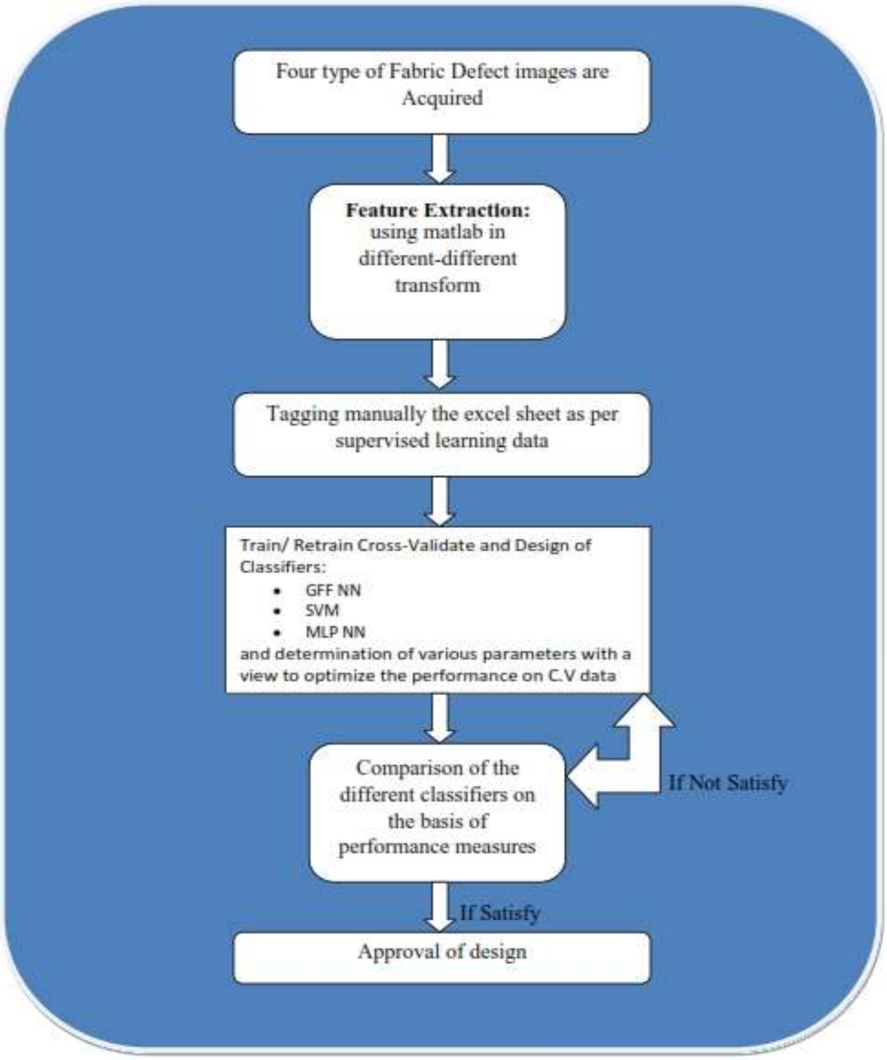


Figure 2: Flow chart

It is proposed to study the classification of four type of fabric defect images Using Neural Network Approaches.. Data acquisition for the proposed classifier designed for the Recognition of four type of fabric defect images. Image data will be Collected from the different- different textile hub .The most important un correlated features as well as coefficient from the images will be extracted .In order to extract features, statistical techniques, image processing techniques, transformed domain will be used.

Computational Intelligence techniques include the following will established techniques.

i) Statistics
ii) Image processing
iii) Learning Machines such as neural network .
iv) Transformed domain techniques such as FFT, DCT, WHT, etc.

For choice of suitable classifier following configuration will be investigated.

i) Multilayer perceptron Neural network.
ii) Support vector machine.
iii) Generalized Feed Forward Neural Network

For each of the architecture, following parameters are verified until the best performance is obtained.

i) Train-CV-Test data
ii) Variable split ratios
iii) Retraining at least five times with different random initialization of the connection weights in every training run.
iv) Possibility different learning algorithms such as Standard Back-Propagation, Conjugate gradient algorithm , Quick propagation algorithm, Delta Bar Delta algorithm, Momentum.
v) Number of hidden layers
vi) Number of processing elements of neurons in each hidden layer.

After regions training & retraining of the classifier, it is cross validated & tested on the basis of the following performance matrix.
i) Mean Square Error
ii) Normalized Mean Square Error
iii) Classification accuracy

In order to carry out the proposed research work, Platforms/Software's such as Matlab, Neuro solutions, Microsoft Excel will be used.

III.RESEARCH OBJECTIVES:

i)To maintain the correctness & accuracy in the classification of Fabric defect even though the input images are contaminated by known or unknown noise.
ii)To increase the classification accuracy for the four type of fabric defect.

iv)Conclusion

This paper demonstrated Fabric Defect Classification using of the proposed optimal classifier based on Computational Intelligence techniques will be result in more accurate and reliable. Using our system will lead to textiler, which is useful for textile developments.

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