

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 4, April 2019

Neural Network Based Defect Inspection for Texture Images

Jackson Johnson¹, Jinesh K J²

P.G. Student, Department of Electronics and Communication, Jyothi Engineering College, Cheruthuruthy,
Kerala, India¹

Associate Professor, Department of Electronics and Communication, Jyothi Engineering College, Cheruthuruthy,
Kerala, India²

ABSTRACT: In textile manufacturing units, the quality of stuffs is an important factor of competitiveness. Given that defects have a negative effect on the market value of the product. For this reason, it is necessary to have good quality stuff rolls from the looms. Typically, the stuff inspection is performed by a human controller that uses a display system that relies on personal knowledge. The objective of our work is to develop a system for the detection and classification of defects in a simple and efficient way using techniques of image feature processing. All information about the weaving defects may be stored in a database dedicated to the quality management of stuffs. Industry is a significant problem. In the manual fault detection systems with trained inspectors, less percentage of the defects are being detected while a real time automated system can increase this to a maximum number. This fact opens the possibility of applying the image featuring in textile industry to facilitate and improve fault detection in different ways. For the detection of these defects, we first decompose the image feature into its bit planes data. The lower order bit planes are found to carry important information of the location and shape of defects. Then we find the exact location by means of mathematical morphology procedures.

KEYWORDS: TILDA - The Irish Longitudinal Study on Ageing, MM - Mathematical Morphology, NN - Neural Network.

I. INTRODUCTION

The textile industry is very concerned with quality. It is increasingly imperative to produce goods of the highest quality in the shortest time possible [1; 2; 3]. Among the new methods used to reduce the cost of poor quality, we find digital image processing of fabrics. To recognize a sequence of forms, it is often necessary to automatically segment the sequence before proceeding to the examination of each form separately. In some researches [4], we find that the researchers used the contribution of fuzzy logic to benefit from the ability of the computer and human expertise. Fabric defects are responsible for the majority of problems found in the garment industry. It is therefore imperative to detect and identify defects to prevent them from reproducing [6].

Currently, much of the fabric inspection is performed manually. With the most qualified inspectors, only some defects are detected. In this context, there is a need for making an automatic inspection of fabrics in the textile industry that can detect and identify the characteristics of the fabric in real time. In this case, the system will alert maintenance personnel once the machine needs an intervention to prevent the production of defects or when it is necessary to modify the process parameters to improve the quality of products. An automated system for detection and identification of defects increases the quality and the performance of the product to meet customer needs and reduce the cost of non-quality. This system also allows providing a robust method for detecting defects of weaving. A new method of classifying fabrics defects has been designed and implemented to meet the needs of manufacturers. To identify the most harmful and expensive defects in fabrics, a survey was conducted in the industrial environment.

This survey showed that the most frequently detected defects are missing weft or warp threads, oil stains and holes. Image processing system usually uses a scanner or a digital camera with high resolution linear scanning. The extracted

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 4, April 2019

data are provided as input to a neural network [7]. The neural network we used is a multilayer based on the retro-propagation algorithm and contains three layers: an input layer, a hidden layer and an output layer. Since it has the ability to cope with non-linear regression property, this method can enhance the capacity of image identification significantly.

In [8], Xianghua Xie has shown that the surface defects are loosely separated into two types. One is local textural irregularities which is the main concern for most visual surface in section applications. The other is global deviation of color and/or texture, where local pattern or texture does not exhibit abnormalities. In his work [9], Ajay Kumar attempts to present the first survey on fabric defect detection techniques presented in about 160 references.

II. RELATED WORK

In the manufacture of fabrics, many problems can affect the textile. Among these anomalies, we find missing warp or weft threads, oil stains and holes. As shown in figure 1, our study will focus on these three defects because they are the most frequently encountered. To detect and identify numerically these defects, they should be treated case by case. To do this, we tried to find the characteristics that permit us to assign each type of defect to its appropriate category.

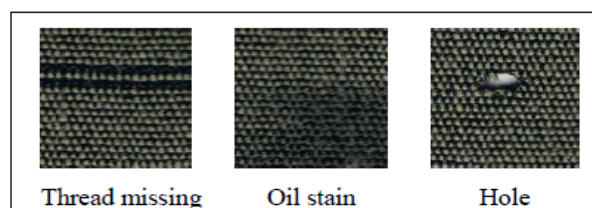


Fig 1: Examples of defects.

The work aims to extract measurable parameters that can give us an idea of the texture of the processed image in each case of defect. In the following, we present some examples of each defect with a presentation of digital images and we end up by determining a parameter that characterizes this type of defect. It consists of passing a weft yarn in a space formed by two layers, called crowd. Figure 2 shows a schematic representation of a cross-over between the yarns (weft and warp). During the weaving process, the insertion of weft yarn may encounter some technical problems that will cause the absence of some yarns in the fabric produced. Similarly, we can sometimes find warp threads missing. The "missing thread in weft or warp" default is very common in the weaving industry. In that case, the character of the texture is not respected in some parts of the fabric. Figure 3 shows some examples of this defect.

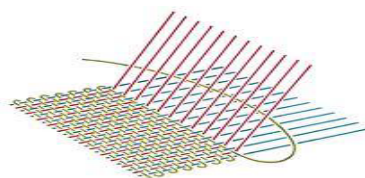


Figure 2: A schematic representation of a cross between the yarns.

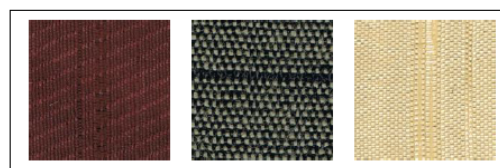


Figure 3: Examples of the defect "missing thread in weft or warp".

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 4, April 2019

Presence of an oil stain is the second example, during the operation of weaving, we have to lubricate mechanical parts of the machine. Therefore, the fabric may undergo some oil stains accidentally. Figure 4 shows some examples of this defect.



Figure 4: Examples of the defect oil stain.

Presence of a hole in the fabric is another one, during its displacement, the roll of fabric may undergo some frictions which can cause more or less large holes. Figure 5 shows some examples of this defect.

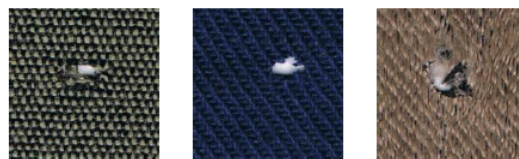


Figure 5: Examples of the defect hole in the fabric.

III. BLOCK DIAGRAM AND WORKING

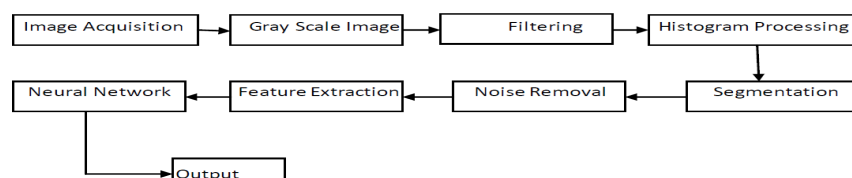


Figure 3.1: Block Diagram

The first stage of any vision system is the image acquisition stage. Different types of camera can be used for this application such as CCD (Charged Coupled Device) camera, CMOS (Complementary Metal Oxide Semiconductor) camera, Digital camera, etc. The pixel value of these cameras is around 320X420 pixels. After the image has been obtained, various methods of processing can be applied to the image to perform different tasks. If the image has not been acquired satisfactorily then the intended tasks may not be achievable. The following are the various methods for image acquisition. Laser Ranging Systems, Structured Light Methods, Moire Fringe Methods, Shape from Shading Methods, Active and Passive Stereoscopic Methods

The acquired image must be converted into gray scale to eliminate the hue and saturation information while retaining the luminance. A filter is defined by a kernel, which is a small array applied to each pixel and its neighbors within an image. In most applications, the center of the kernel is aligned with the current pixel, and is a square with an odd number of elements in each dimension. The process used to apply filters to an image is known as convolution, and may be applied in either the spatial or frequency domain. The CONVOL function performs this convolution process for an entire image. The histogram of a digital image with intensity levels in the $h(r_k) = nk$ where $r_k = kth$ intensity value nk = Number of pixels in the image with intensity r_k Histograms are frequently normalized by the total number of pixels in the image. Assuming a $M \times N$ image, a normalized histogram $p(r_k) = \frac{nk}{MN}$, $K = 0, 1, 2, \dots, n-1$ is related to probability of occurrence of r_k in the image. The histogram provides a convenient summary of the intensities in an image.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 4, April 2019

Segmentation involves partitioning an image into groups of pixels which are homogeneous with respect to some criterion. Different groups must not intersect each other and adjacent groups must be heterogeneous. The groups are called segments. Most digital images exist on a rectangular grid. This is primarily due to the arrangement of image sensors on camera and scanning equipment. Digital images consist of many types of noise. Noise is the result of errors in the image acquisition process. There are several ways that noise can be introduced into an image, depending on how the image is created. If the image is scanned from a photograph made on film, the film grain is a source of noise. Noise can also be the result of damage to the film, or be introduced by the scanner itself. If the image is acquired directly in a digital format, the mechanism for gathering the data (such as a CCD detector) can introduce noise. Electronic transmission of image data can introduce noise.

Feature Extraction is a method of capturing visual content of images for indexing retrieval it will the following details. Feature construction, Feature subset generation, Evaluation criterion definition, Evaluation criterion estimation. Textures can be rough or smooth, vertical or horizontal etc generally they capture patterns in the image data. Texture features are Statistical measures, Entropy, Homogeneity, Contrast, Wavelets and Fractals.

Artificial 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. A neural network consists of a group of simple elements called neurons (as shown in the figure) which process the input information. These neurons are connected to each other with links carrying the signals between them. Bias terms can be presented to solve specific problem with obvious result-tendencies. Using neural networks using neural networks as a classifier requires two phases training phase and a testing phase. In the training phase, the neural network makes the proper adjustment for its weights (W) to produce the desired response. When the actual output response is the same as the desired one, the network has completed the training phase (i.e. it has acquired knowledge). In the testing phase the neural network is asked to classify a new set of images and its success is evaluated. In this work the neural networks were trained by the back propagation algorithm to detect and classify the weaves fabric defects. The feature vectors were used as the input vectors to the Neural Network.

IV. SOFTWARE IMPLEMENTATION AND RESULTS

This project is being implemented in MATLAB 2013a. MATLAB (matrix laboratory) is a multi-paradigm numerical computing environment. A proprietary programming language developed by MathWorks, MATLAB allows matrix manipulations, plotting of functions and data, implementation of algorithms, creation of user interfaces, and interfacing with programs written in other languages, including C;C++;C]; Java, Fortran and Python. Although MATLAB is intended primarily for numerical computing, an optional toolbox uses the MuPAD symbolic engine, allowing access to symbolic computing abilities. An additional package, Simulink, adds graphical multi-domain simulation and model-based design for dynamic and embedded systems. The MATLAB application is built around the MATLAB scripting language. Common usage of the MATLAB application involves using the Command Window as an interactive mathematical shell or executing text files containing MATLAB code. Variables are defined using the assignment operator, =. MATLAB is a weakly typed programming language because types are implicitly converted. It is an inferred typed language because variables can be assigned without declaring their type, except if they are to be treated as symbolic objects,[13] and that their type can change. Values can come from constants, from computation involving values of other variables, or from the output of a function. Image Processing Toolbox provides a comprehensive set of reference-standard algorithms and workflow apps for image processing, analysis, visualization, and algorithm development. Results analysis is shown in figure 6 with a simplified block diagram of the overall texture defect detection:-

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 4, April 2019

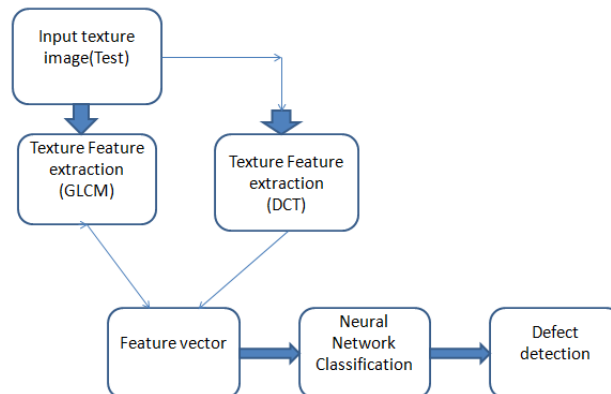


Figure 6: Block Diagram

Different steps in the defect detection techniques are shown below:- Figure 7 shows the dialogue box when the program executed. There will be space showing the defects in the texture as graph. Then we have a table consisting of different features of the texture. There will also be a sample table for showing the features of whole dataset. The feature of whole dataset is taken for the easy analysis of the results. Next the dialogue box we will have the different steps for process which is able to select for the process. Separate sections are there for single and bulk testing of the defect.

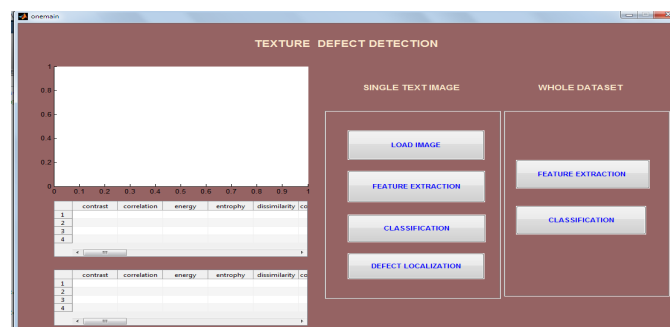


Figure 7: Texture defect detecting dialog box appeared when program executed

Next figure 8 shows the selection of data set. By clicking load image icon from the dialogue box we can get the samples. The samples images will appear in the data set. Select a sample defect texture image from the source. Thus the selection of data set is finished.

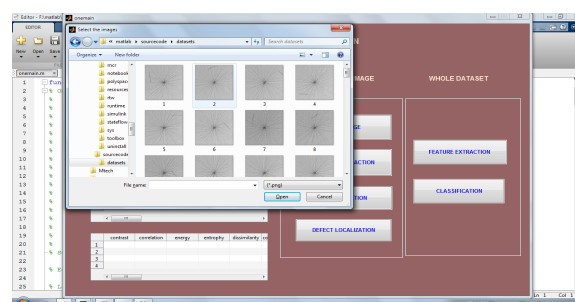


Figure 8: Selecting dataset

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 4, April 2019

Figure 9 shows the sample defected texture image on the dialogue box. By applying feature extraction the feature of the respective image is arranged in a tabular column.

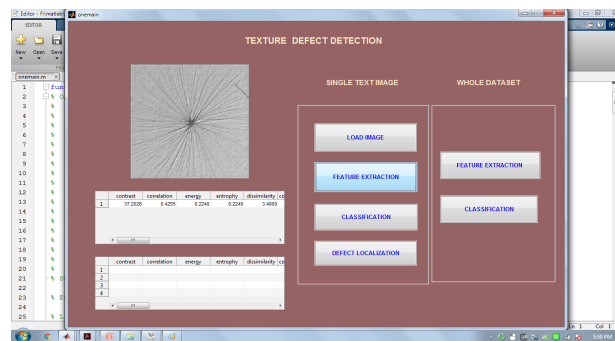


Figure 9: Program executed and the characteristic features of the dataset appear.

Next we need to find the defect amount in the texture data given. For this purpose defect analysis is done. This is shown in figure 10. The test will say whether the image have defect region or not. Here we have given a defected image there appears as “defect image “in the dialogue box.

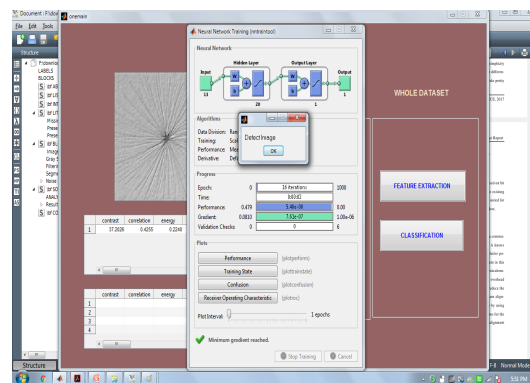


Figure 10: checking defect of the image and analyzing the result

Figure 11 shows that the whole data set is processed for taking feature. Then the resultant feature and the sample given feature is represented.

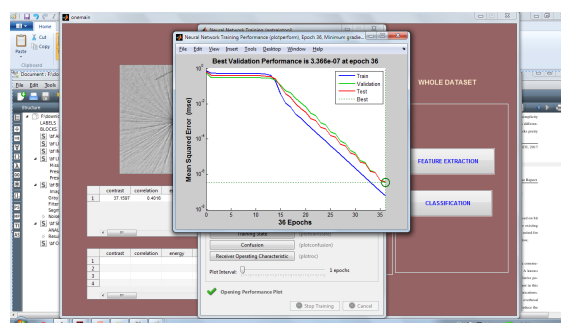


Figure 11: Graphical representation of test result.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 4, April 2019

Finally we can represent the defect figured out in the sample data given. Different scale units are used here for showing the defect region in the sample texture data. It is shown in figure12.

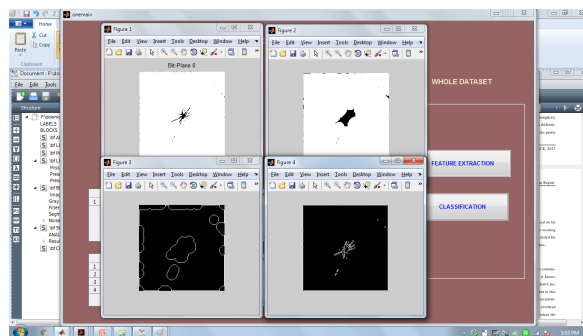


Figure 12: Defect analysis done by using different scaling techniques.

V. CONCLUSION

Quality is a very important factor in textile industry. In our work, we tried to implement a system based on image processing and neural networks to detect and identify three fabric defects (missing threads, oil stains and holes). Our system works according to four steps. We begin by capturing the image, and then we eliminate parasite information and increase the sharpness of the image by image analysis. After that, we determine three parameters which characterize the mentioned defects (the rate of straight lines, the rate of dark areas and the rate of voids). Finally we apply a neural network to recognize the category of defect present on the fabric. Our system can be improved to recognize other types of defects in real time and treat fabrics which contain more than one defect.

REFERENCES

- [1] Jmali, Mohamed, Baghdadi Zitouni, and Faouzi Sakli. "Fabrics defects detecting using image processing and neural networks." Information and Communication Technologies Innovation and Application (ICTIA). IEEE, 2014.
- [2] Banumathi, P., and G. M. Nasira. "Fabric inspection system using artificial neural networks." Inter. J. Computer Eng. Sci 2 20-27, (2012).
- [3] Priya, S., T. Ashok Kumar, and Varghese Paul. "Fabric Defect Detection using Bitplane Decomposition and Mathematical Morphology." European Journal of Scientific Research ISSN, 322-330 (2012).
- [4] X. Chen, Z. Xu, T. Chen, J.Wang and L. Li , "Detecting Pills in Fabric Images Based on Multi-scale Matched Filtering", Textile Research Journal, 79(15), pp. 1389-1395, 2009.
- [5] A. Kumar. "Computer Vision-based Fabric Defect Detection: A Survey", IEEE Transactions on Industrial Electronics, 55, pp. 348-363, 2008.
- [6] X. Xie. "A Review of Recent Advances in Surface Defect Detection using texture analysis Techniques", Electronic Letters on Computer Vision and Image Analysis, 7(3), pp. 1-22, 2008.
- [7] T. E Mursalin, F. Z Eishita and A.R Islam, "Fabric defect inspection using Neural network and Microcontroller," Journal of Theoretical and Applied Information Technology, ,pp 560- 570 2008.
- [8] S. Priya ,T. Ashok kumar and Varghese Paul, "A novel approach to fabric defect detection using digital image processing," Proc. of IEEE Int .Conf. on ICSCCN ,pp228-232, July 2011.
- [9] T. Ashok kumar ,S. Priya and M.G. Mini "Optic disc localization in ocular fundus images," IJCA Proc. of ICVCI (5) International Conference, India ,pp. 20-22. 2011.
- [10] R K Rao Ananthavaram , O.Srinivasa Rao , MHM Krishna Prasad, " Automatic Defect Detection of Patterned Fabric by using RB Method and Independent Component Analysis", International Journal of Computer Applications (0975 -987) Volume 39 ,S No.18, February 2012.