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Artificial Neural Network Based Defect Identifier

KEYWORDS: Artificial Neural Network (ANN), Back Propagation Algorithm, Fabric Defect Detection, Feature Extraction, Image Processing.

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ABSTRACT *The purpose of this paper is to automate the detection of weaving defects in plain-woven fabric by computerized software. The fabric defects identification system requires efficient and robust defect detection algorithms. Due to large number of fabric defect classes, the automatic fabric defects identification system is very challenging. When we consider reduction of labor cost and its benefits, the automatic fabric defects identification system is very economical. Various techniques have been developed to detect fabric defects. Based on the features of fabric, the defect detection techniques have been characterized into three categories. They are statistical, structural and model based techniques. This paper presents an statistical based approach to the fabric defect identification from the images of textile industry. Textile industry needs to produce less defective textiles for minimizing production cost and time consumption and increase the accuracy. The images are acquired, preprocessed, statistical feature is extracted. The Artificial Neural Network is used as identification model. The extracted feature is given as input to the artificial neural network, it identifies the defect. The proposed method shows a better performance when compared with the existing methods.*

1. INTRODUCTION

This paper describes the development of ANN based identifier for woven fabric images based on Image processing and ANN techniques. Image processing is one of the most important techniques in identifying defects out of which image acquisition and image preprocessing are used in our proposed system to enhance image features for further processing and analysis. Statistical features measures the spatial distribution of pixels, it is assumed that the defect free regions are stationary and these regions extend over a significant portion of defected images. Therefore, the statistical feature method is chosen to calculate statistical values in woven fabric images.

A fabric is a flat structure, among the available fabrics woven fabrics produced by weaving, which is the textile art in which two distinct sets of yarns or threads – called the warp and weft – are interlaced with each other at right angles to form a fabric. The warp represents the threads placed in the fabric longitudinal direction, while the weft represents the threads placed in the width wise direction. The weave pattern periodically repeated throughout the whole fabric area with the exception of edges. The quality of the fabric is determined based on the non-defects. The operation of an ANN based identifier system can be broken down into a sequence of processing stages. The stages are image acquisition and Preprocessing, feature extraction, training and testing.

2. LITERATURE REVIEW:

Celik H.I., Dulger et al.[1][3] proposed a machine vision system for fabric inspection based on wavelet transform, double thresholding binarization and morphological operations where they detected the defective and defect free regions of an accuracy of 93.4 % and the defects are classified with 96.3 % accuracy rate. Zhou, J., Semenovich, et al. [2] proposed a dictionary-learning framework for fabric defect detection by simply measuring the similarity between the original and its approximation. Their results show that the proposed algorithm can control both false alarm rate and missing detection rate within 5%. Kang, Z., Yuan, C., et al [4] proposed a fabric defect detection technology based on wavelet transform and neural network. G.M.Nasira and P.Banumathi [5] proposed the defect identification system based on structural and statistical features. They identified the accuracy of defect detection is 98%. Raheja, J.L., Kumar, S., et al [6] described a new scheme for automated fabric defect detection system implementation using gray level cooccurence matrix (GLCM) and compare it with gabor filter approach. Their findings includes that the GLCM produces higher defect detection accuracies than gabor filter approach and computationally efficient. Anitha, S., and Radha, V [7] explained about evaluation of defect detection in textile images using gabor wavelet based independent componenet analysis and vector quantized principal componenet analysis. P.Banumathi, and G.M.Nasira [8] discussed the defect detection based on histogram processing. YH Zhang and WK Wong [9] briefly discussed about the classification and detection of color-textured fabric defects using genetic algorithm and elman neural network. Jayanta K. Chandra, Pradipta K. Banerjee, et al [11] briefed the morphological processing used for the detection of defects in woven fabric . The literature survey illustrates though a variety of algorithms were implemented with different approaches. The results reflects on little less accuracy and more time consumption. This motivated us to create a fabric defect detection system with more accuracy and less time consumption which is very much useful for textile industries globally.

3. PROPOSED SYSTEM

In this paper, we focus only on plain woven fabric imag-

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es with defect and defect free. Since human vision is approximately 300 dpi at maximum contrast The images were captures using digital camera ranges from 300 dpi to 1200 dpi resolution. We have identified that images of 512x512 size with 1000 dpi resolution are most suitable for our identifier which is evident from figure 2.1.

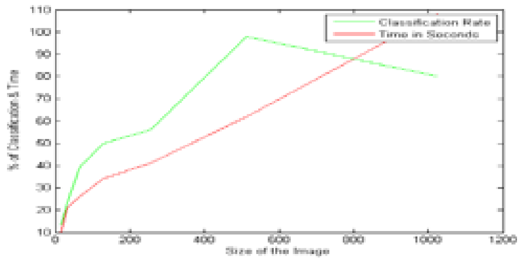

Fig. 3.1 Detection rate and CPU time of 512x512 image

4.0 IMAGE PROCESSING TECHNIQUES

The image processing techniques which were used for our proposed system includes interpolation techniques, adaptive median filtering and feature extraction. These techniques are frequently used for plain woven fabrics which is evident from the various literature survey conducted by us.

4.1 Interpolation Technique

Interpolation technique is the process of estimating an image value at a location in between image pixels. Interpolation methods determine the value for an interpolated pixel by finding the point in the input image that corresponds to a pixel in the output image and then calculating the value of the output pixel by computing a weighted average of some set of pixels at that point. In our investigation the captured image resized into 512x512 image, by using bicubic interpolation technique which produces better results compared with the linear and cosine interpolation techniques,

4.2 Adaptive Median Filtering

A large number of methods have been proposed to remove impulse noise from digital images. The best-known order-statistics filter is the median filter, which replaces the value of a pixel by the median of the gray levels in the neighborhood of that pixel. In the present system we have used improved adaptive median filtering technique to remove noise which preserves edges and fine pixels

Algorithm

Implement a minimum filter using 3*3 window, Implement a maximum filter using 3*3 window and Implement a median filter using 3*3 window. Here we need to calculate the threshod value for an image, then, if the median value is lesser than the threshold value replace the each element in the window with the maximum of its north, east, south, west neighbours. If the median of the 3*3 window is in between the local min and max the algorithm moves into the second phase. If not the size of the window is increased by one pixel in each direction an dthe min, max and medians are calculated again. This process continues until the max window size is reached which then forces the program into the second stage. When the second is reached, the pixel being operated on is not equal to the local min or max values, the resulting pixel values remain the same. If the pixel being operated on is equal to the local min or max values, the resulting pixel values is replaced with the local median.

4.4 Feature Extraction

A statistical feature of an image represents different properties, which are classified based on the number of pixels. In our system six statistical values such as mean, standard deviation, energy, entropy, skewness and kurtosis are calculated to train our ANN that produces high detection rate with minimum time. The formulas for the above-mentioned statistical values are

$$mean\ (\mu_1) = \frac{\sum_{i=1}^{M}\sum_{j=1}^{N} I(i,j)}{M\ x\ N} \qquad ---(1)$$

$$standard\ deviation\ (\sigma_1) = \sqrt{\frac{\sum_{i=1}^{M}\sum_{j=1}^{N}(I(i,j)-\mu)^2}{M\ x\ N}} \qquad --(2)$$

$$energy(e_1) = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N} I^2(i,j) \qquad ---(3)$$

$$entropy = \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N} I(i,j) - \ln\left(I(i,j)\right) \qquad ---(4)$$

$$skewness = \frac{\sum_{i=1}^{M}\sum_{j=1}^{N}(I(i,j)-\mu)^3}{M\ x\ N\ x\ \sigma^2} \qquad ---(5)$$

$$kurtosis = \frac{\sum_{i=1}^{M}\sum_{j=1}^{N} I(i,j)-\mu)^4}{M\ x\ N\ x\ \sigma^4} \qquad ---(6)$$

5. ARTIFICIAL NEURAL NETWORKS

In this paper, multilayer feed forward network is used in which the processing elements are arranged in three layers called input layer, hidden layer and output layer. During the training phase, the training data is fed into to the input layer. The data is propagated to the hidden layer and then to the output layer. This is called the forward pass of the back propagation algorithm. In forward pass**,** each node in hidden layer gets input from all the nodes from input layer, which are multiplied with appropriate weights and then summed. The output of the hidden node is the nonlinear transformation of the resulting sum. Similarly each node in output layer gets input from all the nodes from hidden layer, which are multiplied with appropriate weights and then summed. The output of this node is the non-linear transformation of the resulting sum.

6. RESULTS AND DISCUSSIONS

The inspection system captures fabric images by acquisi-

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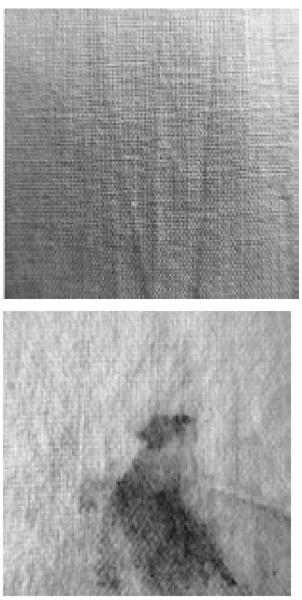
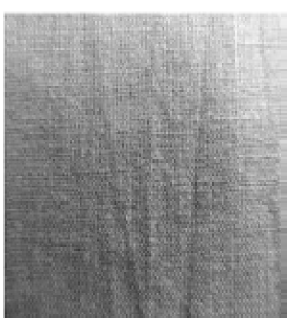
tion device (digital camera) and passes the image to the computer. Initially the inspection system normalizes the image using interpolation methods. The normalized image is filtered with adaptive median filtering. The number of connected components and their region property area with boundingbox is calculated. Taking the value of area as threshold the image is converted into binary image.

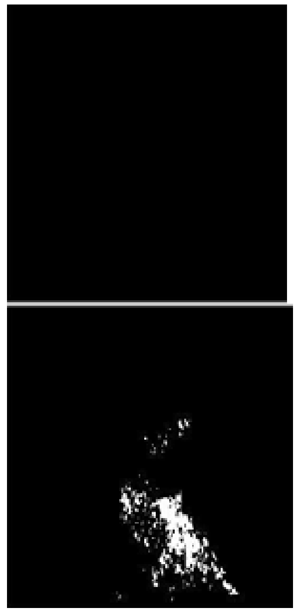
Fig(1)Original (a) defect free image (b) defect image



Fig(2) Normalized(a) defect free image (b) defect image



Fig(3) Filtered (a) defect free image (b) defect image



Fig(4) Binary (a) defect free image (b) defect image

Fig(5) Result of (a) defect free image (b) defect image

From the simulation of the experiment results, we can draw to the conclusion that instead of taking all the first order statistical, if we take only one feature entropy produces high accuracy system for fabric defect identification in textile industry.

1. CONCLUSION

In this paper an Artificial Neural Network based fabric defect identification system was demonstrated. We achieved success rate of fabric identification is 94.6%. The results

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obtained by our proposed system indicate that a reliable fabric inspection system for textile industries can be created.

REFERENCE

Çelik, H.I., Dülger, L.C., Topalbekiroğlu, M. Development of a machine vision system: Real-time fabric defect detection and classification with neural Networks (2014) Journal of the Textile Institute, 105 (6), pp. 575-585. | [2] Zhou, J., Semenovich, D., Sowmya, A., Wang, J. Dictionary learning framework for fabric defect detection (2014) Journal of the Textile Institute, 105 (3), pp. 223-234. | [3] Çelik, H.İ., Dülger, L.C., Topalbekiroglu, M. Fabric defect detection using linear filtering and morphological operations (2014) Indian Journal of Fibre and Textile Research, 39 (3), pp. 254-259. | [4] Dr.G.M.Nasira, P.Banumathi,"An Intelligent System for Automatic Fabric Inspection", Asian Journal of Information Technology ,Vol.13,issue 6,2014, pp.308-312. | [5] Kang, Z., Yuan, C., Yang, Q. The fabric defect detection technology based on wavelet transform and neural network convergence (2013) 2013 IEEE International Conference on Information and Automation, ICIA 2013, art. no. 6720367, pp. 597-601. | [6] Raheja, J.L., Kumar, S., Chaudhary, A. Fabric defect detection based on GLCM and Gabor filter: A comparison (2013) Optik, 124 (23), pp. 6469-6474. | [7] Anitha, S., Radha, V. Evaluation of defect detection in textile images using Gabor wavelet based independent component analysis and vector quantized principal component analysis (2013) Lecture Notes in Electrical Engineering, 222 LNEE (VOL. 2), pp. 433-442. | [8] P.Banumathi, Dr.G.M.Nasira, "Fabric Inspection System using Artificial Neural Networks", in the International Journal of Computer Engineering Science in the month of May 2012, ISSN 2250 – 3349. | [9] YH Zhang, WK Wong (2011), "An Intelligent model for detecting and classifying color-textured fabric defects using genetic algorithms and the Elman neural network", Textile Research Journal October 2011 vol. 81 no. 17 1772-1787. | [10] Dr.G.M.Nasira, P.Banumathi, "Fabric Defect Detection using Neural Networks", in the Journal of Research in Recent Trends in the month of December 2011, ISSN 2250 – 3951. | [11] Jayanta K. Chandra, Pradipta K. Banerjee & Asit K. Datta, "Neural network trained morphological processing for the detection of defects in woven fabric", Journal of the Textile Institute ,Volume 101, Issue 8, 2010,pages 699-706. |