Chapter 14
Defect Detection of Fabrics by Grey-Level Co-Occurrence Matrix and Artificial Neural Network

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ABSTRACT

The class of Textiles produced from terephthalic acid and ethylene glycol by condensation polymerization has many end-uses for example these are used as filter fabric in railway track to prevent soil erosion, in cement industry these are used in boiler department as filter fabric to prevent the fly-ash from mixing in the atmosphere. Presently, the quality checking is done by the human in the naked eye. The automation of quality check of the non-Newtonian fabric can be termed as Image Analysis or texture analysis problem. A Simulation study was carried out by the process of Image Analysis which consists of two steps the former is feature extraction and the later part is recognition. Various techniques or tools that are presently studied in research for texture feature extraction are Grey level co-occurrence matrix(GLCM), Markov Random Field, Gabor filter. A GLCM matrix with 28 Haralick features were taken as input for this chapter.

INTRODUCTION

The class of Textiles produced from terephthalic acid and ethylene glycol by condensation polymerization has many end-uses for example these are used as filter fabric in railway track to prevent soil erosion, in cement industry these are used in boiler department as filter fabric to prevent the fly-ash from mixing in the atmosphere. Presently, the quality checking is done by the human in naked eye. The automation of quality check of the non-Newtonian fabric can be termed as Image Analysis or texture analysis problem

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.We have done a Simulation study by the process of Image Analysis which consists of two steps the former is feature extraction and the second part is recognition. Various techniques or tools that are presently in research for texture feature extraction are GLCM (Brad, 2007), Markov Random Field (Dorrity, Vachtsevanos & Jasper, 1995), and Gabor filter (Dorrity, Vachtsevanos & Jasper, 1996). We have used here GLCM with 20 Haralick features.

The authors had done a simulation Study for defect detection and estimation by taking 25 nice sample and 25 defective still image samples and then extracted 28 Haralick features. Also, 20 polynomial entropy features were taken .When combined it has given 48 features. The pattern recognition problem for fault detection problem of Non-Newtonian fluid is done by Back propagation neural network, recurrent neural network, and Radial basis function neural network and Learning Vector Quantization neural network.

LITERATURE SURVEY

A comprehensive review on the automated fabric defect detection can be found in (Conci & Proenca, 2000; Schiffaueroval & Thomson, 2006). A segmentation of fabric image based on multi-scale Markov random field (MRF) of a fabric image is presented (Nickolay, Schicktanz & Schamlfuss, 1993). Multi-scale MRF is applied to segment the fabric images combined with the edge information obtained using the modulus maximum of Wavelet Transform. Experimental results show that the segmentation algorithm associated with edge information can reduce both the computing time and misclassification. Cohen et al. (1986) have used a MRF model for the detection of defects in fabrics. Sylla (2002) has implemented an MRF based method on TMS320C40 parallel processing system for the real time inspection of defects in a fabric. Ozdemir and Ercil (1996) have used Gauss MRF to detect the common defects in the textile fabrics. Arivazhagan et al. (2006) have applied the Gabor-wavelet transform for the detection of defects in fabrics. The defects in the regular texture can be found easily by the transform. Proper thresholding ensures the elimination of the defects from the texture background. The results obtained using this method vindicates its effectiveness. Krueger and Sommer (2000) have used an imaginary part of a Gabor function as the transfer function of the hidden layer in a wavelet network, and introduced the concept of Gabor- wavelet network for solving 2D problems in the pattern recognition (Dorrity, Vachtsevanos & Jasper, 1996). (Bodnarova et al., 2002) uses an optimal Gabor filters for the detection of flaws in textiles. When applied on the non- defective texture, the filter response maximizes a Fisher cost function. A pixel of potentially flawed texture is classified as an defective or non- defective based on the Gabor filter response. Yuan Shu et. al. (2004) have presented a flaw detection system in fabrics based on Gabor filter. It is based on the energy response from the convolution of Gabor filter bank in different frequencies and orientations. Using the image fusion to combine all response feature images and finally thresholding this fused images produces a simple binary image consisting of defects. The simulation results on fabric samples show the effectiveness of this method. Bu, Wang & Huang (2009) have developed a fabric defect detection system based on multiple fractal features to overcome the inability of the single fractal feature in dealing with flaw detection in fabrics. Multiple fractal features are needed to mitigate the problems of the box-counting method as well as the inherent characteristics.

Conci et al. (1998) have used the estimate of fractal dimension for the inspection of fabrics to detect defects. The approach used for decision in (Conci et al. 1998) though computationally is simple but the experimental results of 90% are validated on a small database involving eight types of defects. The localization accuracy of these detected defects is very poor raising high false alarm. Escofet et al. (1998)