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Fabric Defect Classification Based on LBP and GLCM ⋆

Lei Zhang*, Junfeng Jing, Hongwei Zhang

School of Electronic and Information, Xi'an Polytechnic University, Xi'an 710048, China

Abstract

Inevitably there will be various types of fabric defect exists in textile production line. In order to distinguish and classify the types of defects more efficiently and accurately, an algorithm which combines Local Binary Patterns (LBP) and Gray-level Co-occurrence Matrix (GLCM) is proposed in this paper for fabric defect classification. The most pivotal step of the algorithm is to extract the local and global feature values of defect images. Firstly the local feature information of the image is extracted by adopting LBP algorithm. And then the overall texture information of the image is described via GLCM algorithm. In this way, the fabric image can be fully described from global and local. Finally, the two-part feature information are structured as a whole as the input of BP Neural Network. Thus the trained BP Neural Network can be used to classify the different types of defects. Experimental results show that the algorithm has higher classification accuracy.

Keywords: LBP; Gray-level Co-occurrence Matrix (GLCM); BP Neural Network; Defect Classification

1 Introduction

With the rapid development of textile industry, quality monitoring of textile manufactories is promoted more rigorous. As one of the key factors of the quality of textile, fabric defects impact the worth of textile immensely. Statistics information represents that fabric defects induce the worth of the textile falling by roughly 45%-60% [1, 2]. Thus effective classification of existing fabric defects becomes a pivotal step in textile production control, which facilitates the fabric repairing of various types of defects on production line, enhances work efficiency immensely, and improves the quality and worth of textile. And if different fabric defects can be correctly distinguished, producers can make improvements in production process which can product more superior quality fabric.

Nowadays automatic defects classification method has been replaced the traditional artificial operation, the accuracy and effective are remarkable increased because of the artificial classi-

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*Corresponding author.
Email address: 11795503@qq.com (Lei Zhang).

fication method based on subjective recognition is substituted by computer version technique based on digital image processing. The difficulty of increase the classification accuracy lies in the multiple types of fabric defects and generated new types of defects in production process. Additionally, the same kinds of defects may have thorough different appearance while different kinds of defects may have the same appearance which is caused by kinds of textile materials and fabric constructions [3].

In recent years, abundant research has been carried out by scholars domestic and overseas. In [4, 5], fabric defect classification is based on geometrical characteristic of textile image. The characteristics of defect area and the length of its boundary line is extracted and fuzzed, defect classification is then made on the basis of fuzzy logical [4]. Similarly, Stojanovic et al. process the classification of fabric defects through neural network, whose input are defect area, center coordinate, horizontal and vertical projection, and co-occurrence matrix [5]. But these kinds of classifications' accuracy cannot reach a high level. In [6], a defect detection and classification method is proposed by Chan et al. Firstly Fourier transform is processed on the textile image, and then seven characteristics values including the peak values of magnitude in spectrogram in horizon and vertical are extracted as the basis of classification. While in this method, some detailed information of the image spatial domain and local variations may be lost. In [7], Yang et al. adopt the average energy of coefficients of wavelet transformation as characteristic parameter to classify the fabric defects. Kuo et al. propose a classification method by computing the correlation of GLCM features between detected sequence and sample [8, 9]. But these two methods are not applicable for the classification of local defect.

In this paper, a defect classification method that combines LBP and GLCM is proposed. Firstly, the textile image information is depicted locally and integrally respectively. And then the feature values are extracted by LBP and GLCM from locally and globally, respectively. Through this combination of global and local information extractions, the fabric defect image can be fully described and used as input of a BP Neural Network. In this research, the training function of BP Neural Network is selected as trainlm function based on LM (Levenberg-Marquard) algorithm. Finally, the trained BP Neural Network can be used to distinguish different types of defects. Experimental results with samples from TILDA Textile Texture Database show that compared with the existing classification methods the proposed classification algorithm has higher classification accuracy.

2 Local Binary Patterns

Local Binary Patterns (LBP) is firstly proposed by Ojala in 1999, which is an effective texture operator to depict the local texture characteristic of an image.

The main idea of LBP is based on comparisons of pixel gray values, the relative grayscale between a pixel and its adjacent pixel is used as a response result. Such that LBP is invariant for monotonous gray value change. Basic LBP operator is shown in Fig. 1. In this model, a 3×3 window is used as an operating unit and gray value of the center pixel is taken as a threshold for achieving relative grayscale compared with 8 local pixels. If a local pixel gray value is bigger than that of the center pixel, it is labeled as 1. On the contrary, it is labeled as 0. After labeling all the 8 local pixels, the binary value is taken out clockwise from top left. Then a response result can be got through transforming the binary string into decimal number.