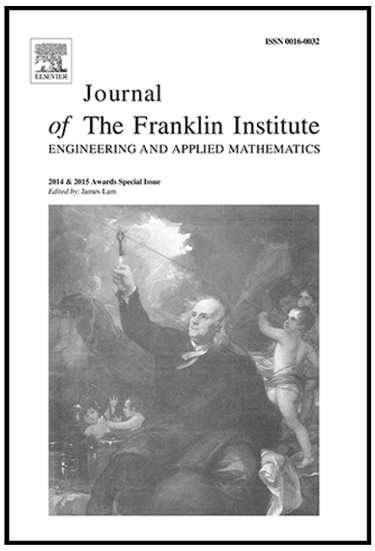

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Fabric Defect Inspection Based on Lattice Segmentation and Lattice Templates

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Abstract

Automated fabric inspection is a challenging task due to the unpredictable visual forms of the fabric defects and their scarcity compared with the tremendous amount of defect-free fabric products. This paper proposes a novel method based on lattice segmentation and lattice templates which automatically identifies the defects of fabric images. With the proposed method, a fabric image is segmented to lattices by inferring the placement rule of the texture primitives categorized to distinct texture classes. Each texture class is modeled by multiple templates inferred from the defect-free samples based on some metrics determined a priori according to their inspection efficiencies. For a lattice segmented from a given image, the most similar template is identified through a template matching process which compensates the local deformations around the lattice, and the distances between the lattice and the identified template are estimated based on the selected metrics. The lattices of distances exceeding the learnt distance range are identified as defective. The performance of the proposed method is evaluated based on two databases respectively providing pixel-level and image-level evaluations. For both databases, the receiver operating characteristic curves are plotted and the average areas under curves are 0.86 and 0.95 respectively for pixel-level and image-level databases. The proposed method is further tested on the blurred and noisy version of images from pixel-level database and the resulting area is 0.81 on average. The proposed method outperforms the state-of-the-art methods by comparing corresponding areas.

Keywords: Fabric defect inspection; Lattice segmentation; Image Decomposition; Patterned texture

1. Introduction

As an industrial product possessing the most diverse two-dimensional surfaces, fabric (textile) serves many fields of human civilization and is inseparable from our daily lives. The number of fabric products is tremendous and the quality control thus plays an important role in saving cost [1]. A critical aspect of quality control is inspecting fabric defects of unpredictable visual forms which randomly occur in the automatic manufacturing process. Consequently, it is difficult to collect lots of defective fabric samples. Hence, Automated Fabric Inspection (AFI) which identifies defects of unpredictable visual forms is always developed in absence of defective samples, which makes AFI as a challenging task. As a result, there are numerous AFI methods developed for various fabrics. These methods may be categorized from different perspectives such as the texture representations and the fabric types.