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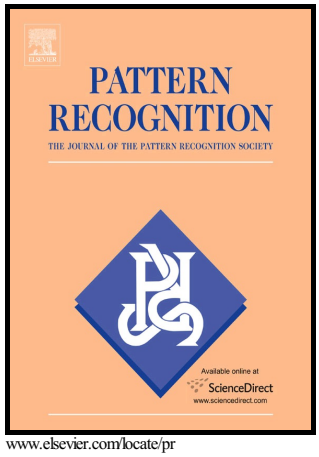

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Local Binary Features for Texture Classification: Taxonomy and Experimental Study

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Abstract

Local Binary Patterns (LBP) have emerged as one of the most prominent and widely studied local texture descriptors. Truly a large number of LBP variants has been proposed, to the point that it can become overwhelming to grasp their respective strengths and weaknesses, and there is a need for a comprehensive study regarding the prominent LBP-related strategies. New types of descriptors based on multistage convolutional networks and deep learning have also emerged. In different papers the performance comparison of the proposed methods to earlier approaches is mainly done with some well-known texture datasets, with differing classifiers and testing protocols, and often not using the best sets of parameter values and multiple scales for the comparative methods. Very important aspects such as computational complexity and effects of poor image quality are often neglected.

In this paper, we provide a systematic review of current LBP variants and propose a taxonomy to more clearly group the prominent alternatives. Merits and demerits of the various LBP features and their underlying connections are also analyzed. We perform a large scale performance evaluation for texture classification, empirically assessing forty texture features including thirty two recent most promising LBP variants and eight non-LBP descriptors based on deep convolutional networks on thirteen widely-used texture datasets. The experiments are designed to measure their robustness against different classification challenges, including changes in rotation, scale, illumination, viewpoint, number of classes, different types of image degradation, and computational complexity. The best overall performance is obtained for the Median Robust Extended Local Binary Pattern (MRELBP) feature. For textures with very large appearance variations, Fisher vector pooling of deep Convolutional Neural Networks is clearly the best, but at the cost of very high computational complexity. The sensitivity to image degradations and computational complexity are among the key problems for most of the methods considered.

Keywords: Texture classification, local binary pattern, rotation invariance, noise robustness, deep learning

1. Introduction

1.1. Motivations and Scope

Texture is a fundamental characteristic of the appearance of virtually all natural surfaces, is ubiquitous in natural images, and is a key component of many computer vision systems. Texture classification, as one of the major problems

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