Texture Image Classification using Wavelet Completed Local Binary Pattern descriptor (WCLBP)

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Abstract—In this paper, a new texture descriptor inspired from completed local binary pattern (CLBP) is proposed and investigated for texture image classification task. A wavelet-CLBP (WCLBP) is proposed by integrating the CLBP with the redundant discrete wavelet transform (RDWT). Firstly, the images are decomposed using RDWT into four sub-bands. Then, the CLBP are extracted from the LL sub-bands coefficients of the image. The RDWT is selected due to its advantages. Unlike the other wavelet transform, the RDWT decompose the images into the same size sub-bands. So, the important textures in the image will be at the same spatial location in each sub-band. As a result, more accurate capturing of the local texture within RDWT domain can be done and the exact measure of local texture can be used. The proposed WCLBP is evaluated for rotation invariant texture classification task. The experimental results using CURTex and OuTex texture databases show that the proposed WCLBP outperformed the CLBP and CLBC descriptors and achieved an impressive classification accuracy.

I. Introduction

Texture descriptors one of the global descriptors that can be used to describe image contents. It is important element for object identification and region distinction. Because of that, texture descriptors can be used in many of computer vision tasks, such as object and scene recognition [1], [2], image retrieval [3], and face recognition [4], [5].

An example of a texture descriptor is the shape context descriptor [6], a 36-bin histogram of edge distribution in a region. The location and orientation of each edge point are used to construct the shape context histogram. Each location is represented using a log-polar grid with a certain radius and then quantised into nine bins while the orientation is quantised into four bins, namely, horizontal, vertical, and two diagonals. Another important example of texture descriptors is the Local Binary Pattern (LBP) [7]. The LBP histogram is computed over user-defined patterns (grid of cells). The first step is the thresholding step where the centre of pattern is compared with its pixel neighbourhood to convert their values to binary values (0 or 1). This step aims to find the binary differences. The next step is the encoding step, which encodes the binary number of each pattern and converts it to the equivalent decimal

number that characterises a structural pattern. The LBP is one distribution-based descriptors because all the patterns' decimal values are then represented as a histogram. In addition to that, the LBP is computationally simple, showing good performance and excellent results in texture classification. Moreover, the LBP descriptor and some of its variants are used for different

Examples of LBP variants are Local Ternary Pattern (LTP) [8], center-symmetric local Binary Pattern (CS-LBP) [9], Dominant LBP (DLBP) [10], Completed LBP (CLBP) [11], and Completed Local Binary Count (CLBC) [12]. In this paper, we are enhancing the CLBP texture descriptor to increase its discriminating property by extracting it in the wavelet domain instead of the spatial domain. Redundant Discreet Wavelet Transform (RDWT) is selected due to its characteristics. The proposed wavelet CLBP (WCLBP) is evaluated for invariant rotation texture classification using two benchmark texture databases. The experimental results illustrate that WCLBP performed well and achieved higher texture classification rates than CLBP and CLBC.

The rest of this paper is organized as follows. Section II briefly reviews the LBP, CLBP and CLBC. Section III presents the proposed WCLBP descriptor. Then in Section IV, the experimental results are reported and discussed. Finally, Section V concludes the paper.

II. Related Work

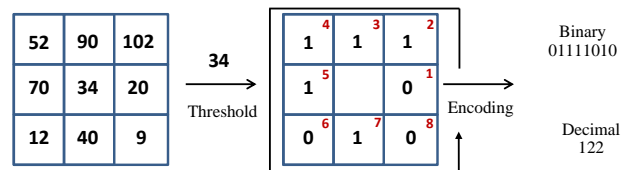This section provides brief review of the LBP, CLBP, and CLBC.

Fig. 1. LBP operator.

proposed WCLBP is evaluated and investigated in this paper. As shown in the experimental results, the proposed WCLBP showed higher classification accuracy the new existing texture operators, i.e., CLBP and CLBC.

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