

Texture Classification Based On Empirical Wavelet Transform Using LBP Features

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Abstract

Automatic inspection systems become more importance for industries with high productive plans especially in texture industry. A novel approach to Local Binary Pattern (LBP) feature for texture classification is proposed in this system. At the first, the proposed Empirical Wavelet Transform (EWT) based texture classification is tested on gray scale and color images by using Brodatz texture images. The gray scale and color image is decomposed by EWT at 2 and 3 level of decomposition. LBP features are calculated for each empirical transformed image. Extracted features are given as input to the classification stage. K-NN classifier is used for classification stage. The result of the proposed system gives satisfactory classification accuracy of over 98% for all types of images.

Keywords: Texture classification, EWT, LBP, K-NN.

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1. Introduction

The review of literature given in this section is centered upon various techniques for texture classification. Intensive research work has been undertaken in the development of automated image analysis methods to classify texture images. Curvelet statistical and co-occurrence features for texture classification is explained in [1]. The texture classification issue using curvelet transform is analyzed. Curvelet arithmetic and co-occurrence features are subsequent from the sub bands of the curvelet decomposition and are used for classification.

Wavelet Transforms based on gaussian markov random field based texture classification is discussed in [2]. GMRF model on linear wavelets is used for feature extraction for the purpose of texture classification in this paper. Least square error estimation method is used for extraction the seven features on third order markov neighborhood.

Texture classification based on wavelet features is presented in [3]. Feature extraction algorithm using wavelet decomposed images of an image and its complementary image for texture classification is presented in this paper. Euclidean distance measure and the minimum distance classifier to classify the texture are used.

Linear regression model based on wavelet transform for texture classification is approached in [4]. Features are extracted from the linear regression model and correlation too that characterize the samples. Pyramid structured wavelet transform and tree structured wavelet transform is used. Gabor filters and co-occurrence probabilities based design for texture feature fusion is discussed in [5] [8]. The fused feature set used Gabor filters probable of accurately capturing lesser and center-frequency texture detail. K-means, principal component analysis is used.

Multimodal invariant local binary pattern based texture classification is presented in [6]. How this system descriptor can be built efficiently is described in this paper. Also demonstrate empirically that compared to all the state of the art LBP-based descriptors. Curvelet transform based texture classification is approached in [7]. One group feature vector can be developed by the mean and variance of the curvelet statistical features, which are resulting from the sub-bands of the curvelet decomposition and are used for classification purpose. Wavelet transform and neural network based color texture classification is described in [9]. Feature extractor using wavelet domain and neural networks ensembles classifier are used in this scheme. Feature extractor using wavelet domain includes entropy and energy features.

2. Proposed System

This section concentrates on classification of gray images based on EWT and KNN. In common, a typical classification system generally consists of two phases; first is feature extraction and second is classification phase. All the stages are explained in fact in the following sub sections. Proposed gray texture classification system using empirical band signature is shown in Figure 1. Tables and Figures are presented center, as shown below and cited in the manuscript.

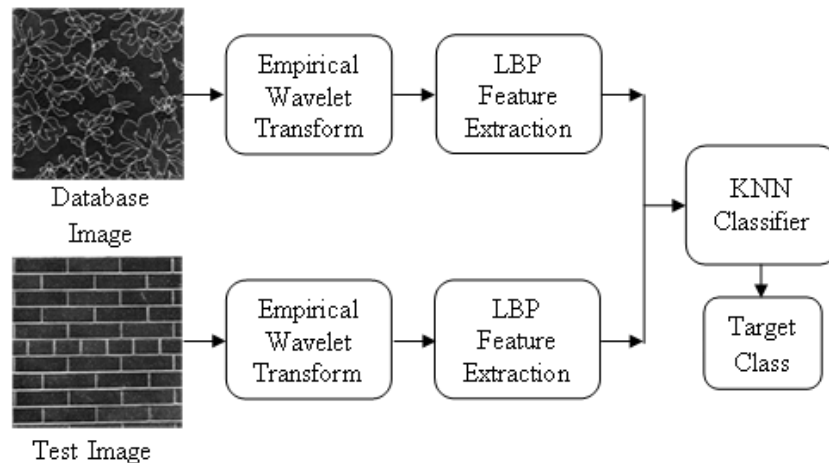


Figure 1. Proposed gray texture classification system based on DST and KNN

2.1. EWT & LBP

The aim of the EWT is to decay an image or signal on wavelet rigid frames which are built efficiently. Finding the chains of some "modes" in the Fourier spectrum using these supports to construct Littlewood-Paley type wavelets in 1D is the procedure. A Curvelet transform, Littlewood-Paley transform, and the Ridgelet transform. To keep mutually some details is the advantage of this empirical advance that or else would be split in the container of dyadic filters.

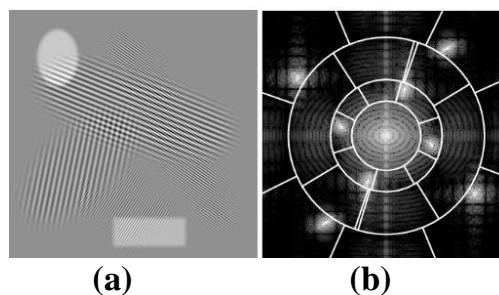


Figure 2. (a) Input Image (b) Detected Fourier Supports

Background of the pixels are explained in binary patterns in the regions is defined as LBP features. The obtained features from the regions are included into an exacting feature histogram. Images can be compared by measuring the comparison between their histograms.

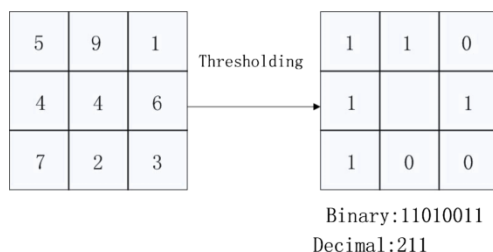


Figure 3. LBP Operator

2.2. K-NN Classifier

The concluding stage of the proposed approach is classification or validation stage. In the classification stage, the type of the unknown texture image is mentioned to a known type by using the features extracted. The classifier used to assign a target class to an unknown texture image is KNN classifier. The proposed empirical band features are extracted for the unknown texture image at first. By using the feature reference list along with the features of unknown texture image, KNN classifier assigns the reference texture image class to the unknown texture image.

3. Experimental Results

In this chapter, the experimental results and their implication are discussed. Also, the performance of the proposed classification systems for gray texture images and color texture images based on the proposed EWT and LBP features using KNN classifier is explained. Table 1 shows the proposed system comparative analysis with other methods in the literature in terms of classification accuracy. Also, the proposed system outperforms all forms of wavelet transforms including TSWT, PSWT and Gabor transforms.

Table 1 Comparative analysis

Techniques	Classifier Accuracy (%)
Gabor with GLCM [7]	48.995
Curvelet Transform [2]	87.1
CLBP [8]	89.4
Linear Regression Model [6]	97.151
Proposed method	98

4. Conclusion

In this scheme, an efficient and novel texture classification system is proposed for both gray and color images. At the first, the proposed DST based texture classification is tested on gray scale images by using 40 Brodatz texture images. The gray scale image is decomposed using EWT method. Classification part is done using the features from LBP. K-NN classifier is used for classification purpose. Experimental results show that the proposed empirical based gray texture classification system outperforms the existing texture classification techniques such as wavelet and Gabor transform.

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