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Local Binary Pattern Technique For Soil Texture Classification

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***Abstract*:**

In Image processing programs texture classification is one of the giant and beneficial challenge. Many texture models were implemented over the last few years and Local Binary Pattern (LBP) approach is one of the easy and dynamic method amongst them. A quantity of references to the LBP technique have been additionally supplied, but the problem stays difficult in feature vector generation and evaluation. Parameters like gray-scale variation, rotation variant, illumination version and noise effectively handled by way of texture version. We proposed a revolutionary model (ERLBP) that allows classifying and characterizing texture in digital images. The outcomes are in comparison with other extensively used texture models by applying classification tests to various texture images. Experimental consequences shows that the proposed texture model (ERLBP) is robust to gray-scale variation which improves its discriminative functionality and decreases the noise.

Keywords

Classification,ERLBP,Image processing,LBP,Texture analysis

Introduction

Image analysis is a method that derives beneficial facts from the digital images. Image segmentation, image classification, image correspondence, image compression are a number of the areas where image analysis is used. Feature extraction is one of the critical step in every image analysis methods.Feature extraction is a sub-procedure in image analysis in which it derives some of the critical functions like colour, texture and shape from a digital image. Among all the functions, texture performs a vital role in many image analysis tasks. Image analysis is primarily based on texture characteristic is called texture analysis. Texture analysis is a method of extracting data from the texture images, which defines the spatial variations of the image by using mathematical strategies and examples.

1.1.Literature review and Related work

In the digital images, the textural features are determined by the spatial distribution of gray values therefore, the spatial distribution of pixel values in the digital image can be analyzed with the aid of statistical techniques.Statistical methods can be classified into three types first-order ,second order and higher-order statistical methods [1,2] based totally at the range of pixels defining the local characteristic. Many statistical texture techniques were proposed, which might be varied from first order facts to higher order statistics. As first order statistical methods cannot model the texture perfectly, higher order methods are widely used for texture analysis(3). Grey level cooccurrence matrices (four), grey level variations (five) and Local Binary Patterns (6) are some of the famous second order statistical texture techniques for texture analysis.

Fu (7) proposed a concept in which the texture image can be found as texture primitives.In this texture premitives are arranged according with the placement rule.The technique of identifying the primitives of the placement rule is known as texture analysis. In model-based procedures, mathematical models are used to represent the textures in an image consisting of fractals (8), random field models(nine) and so on. Texture feature may be extracted in signal processing methods by way of considering the frequency domain of the digital images. Coggins and Jain (10) proved multichannel filtering technique with the use of frequency and orientation selective filters for the texture analysis.Usage of Gabor filters (eleven) and pyramids (12) have been effectively investigated under signal processing methods.

Geometrical methods are based at the concept of texture that would be considered as a spatial organization of texture primitives

2.Local Binary Patterns

In former instances, local binary patterns (LBPs)[13] have aroused growing and are summarizes effictively by means of comparing each pixel with its adjacent pixels. Tolerance to monotonic illumination modifications and computational simplicity are the principle properties of LBP.

By the use of of decimal numbers the original LBP operator labels the pixels of an image, which are called LBP codes.These codes encode the local structure for each pixel. It represents as illustrated in Fig. 1.Each pixel is compared with its eight acquaintances in a 3 × three community by subtracting the middle pixel value; the received terrible values are encoded with zero and the fantastic values with 1. For each given pixel, a binary range is fashioned by means of combining some of these binary values in a clockwise path, beginning from the pinnacle-left neighbor.Now the decimal price of the

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received binary range is used for labeling the given pixel. The derived binary numbers are referred to as LBPs or LBP codes.

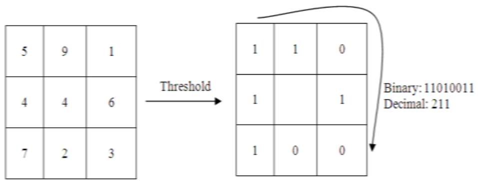

Fig.1. Basic LBP operator example.

2.1.Recent Variations of LBP

Later LBP approach has been advanced with huge range of versions to enhance performance in special programs of image processing. These variations target is to enhance the discriminative capability of it. The ELBP [15] is an approach to improve the discriminative functionality of LBP. The ELBP operator performs binary comparison among the center pixel and its neighbours. By the use of a few extra binary units it encodes their exact grey-value differences (GDs).

Especially, the ELBP characteristic includes some LBP codes at multiple layers, which encodes the gray value difference between the center pixel and its neighbouring pixels.An example of ELBP operator is illustrated in the following figure.As a result, while describing similar local textures ,even though the first layer LBP isn't discriminative enough, the information encoded in the additional layers can be applied to differentiate them. In general,ELBP increases feature dimensionality to a large extent.

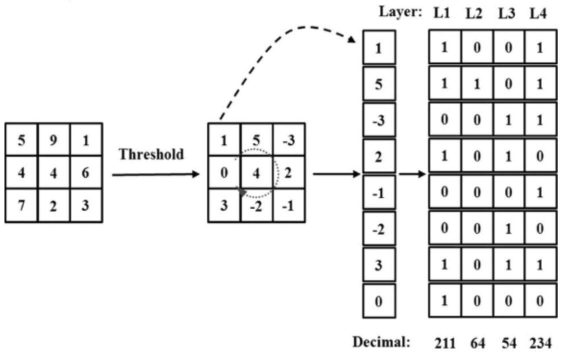

Fig. 2. Example of the ELBP operator

3.Proposed Method (ERLBP) :

In general,Rule based local binary patterns are characterized as discrete dynamic systems These systems are completely described by a set of rules in a nearer neighbourhood. The state of a system is expressed as a regular grid, on this regular grid the rules are applied to produce a new state. Now consider a sample matrix S_{3X3} and compare the each element with significant centers of the considered sample matrix.The following rules have been applied on the image to remove the uncertainty in classifying the texture.

3.1. Algorithm

1. Compute Ri value with Xc & Xi where Xc is center of the sample and Xi is neighbourhood value.

$$R_i=S(Xc-Xi)$$

2. Replace sample values with corresponding Ri values.

$$S1(Xi)=Ri \text{ for all } i;$$

3. Compute mean value of S1 and convert sample values into binary values based on mean value as a Threshold value.
4. Column wise count on sample space $S1_{3X3}$ can be calculated as follows.

$$X_i=\sum_{i=1}^{3} S1\,(s_i, n)\ ;\ \text{where } n=1, 2,3$$

If X_i >=2 then
Ci=1
Else
Ci=0

5. Row wise count on sample space S_{3X3}
Can be calculated as follows.

$$Y_i=\sum_{i=1}^{3} S1\,(s_i, m) \quad \text{where } m=1, 2,3$$

If Yiion>=2 then
Ri=1;
Else
Ri=0;

6. Now Calculate the left diagonal D1 and right diagonal D2 count on sample space S_{3x3}.
7. Therefore the new sample matrix thus formed is represented as follows.

R1 D1 C1
R2 C2
R3 D2 C3

8.Now construct a matrix M of size 3x3.
by converting each value into its corresponding binary value
9. Compute the LBP operator on each column and calculate the mean of all 3 LBP codes.Now the centre pixel is replaced with the obtained value.
10.Repeat all the above steps on each image and form the new unambiguous image by analyzing the texture classification

5.Experimental Results

To verify the classification of soil texture using the proposed method, a group of various images have been tested. The overall performance of two methods has been described based on tables of values and graphs shown in the paper. Three texture images of sandpebbels, crack and

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beach of different soil images have been shown in Fig 3, Fig 4 & Fig 5 of size 256X256 were considered in this experiment. Each individual texture image is considered as a model sample and there are 3 model samples in total. Each test sample is compared using ELBP and proposed method(ERLBP) and classified. Table1 & Table2 show the classification performance of the proposed texture model and ELBP. From the Table2, it is observed that the classification results are excellent with high classification accuracy. The result of the comparison is given in the form of graphs shown in Fig 6 & Fig 7. In the case of ELBP texture model it does not classify three categories clearly.So Proposed method is considered as an excellent texture classifier, it clearly classifies all three types of images. Among the two texture methods under consideration, the proposed texture method provides superior classification.

Fig.3.Sandpebbel images

Fig. 4.Beach images

Fig .5. Crack images

Table1: ELBP

IMAGE	SPELBP	CELBP	BELBP
I1	0.039	0.041	0.026
I2	0.0431	0.044	0.031
I3	0.044	0.045	0.041
I4	0.048	0.048	0.042
I5	0.048	0.059	0.045
I6	0.05	0.066	0.048
I7	0.054	0.07	0.063
I8	0.054	0.076	0.063
I9	0.06	0.081	0.066
I10	0.065	0.113	0.067

Table 2: ERLBP

IMAGE	SPERLBP	CERLBP	BERLBP
I1	0.221	0.231	0.235
I2	0.226	0.242	0.247
I3	0.228	0.244	0.236
I4	0.231	0.244	0.244
I5	0.236	0.245	0.252
I6	0.243	0.246	0.262
I7	0.245	0.25	0.263
I8	0.245	0.25	0.266
I9	0.247	0.253	0.289
I10	0.254	0.257	0.318

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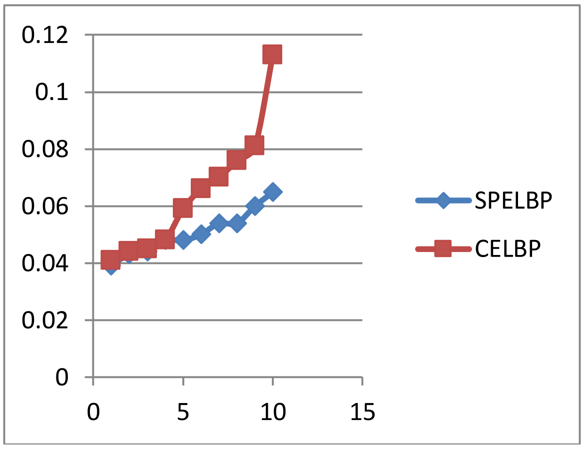

Fig.6 ELBP on sandpebbels and crack images

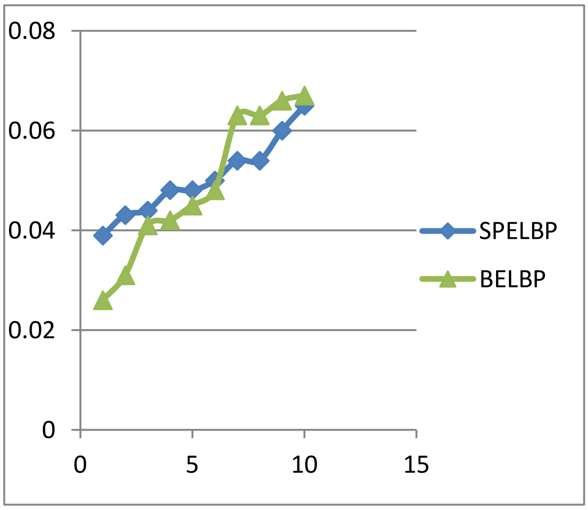

Fig.7 ELBP on sandpebbels and beach images

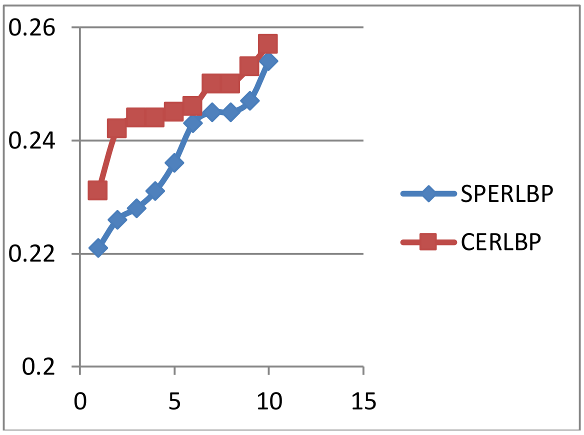

Fig.8 ERLBP on sandpebbels and crack images

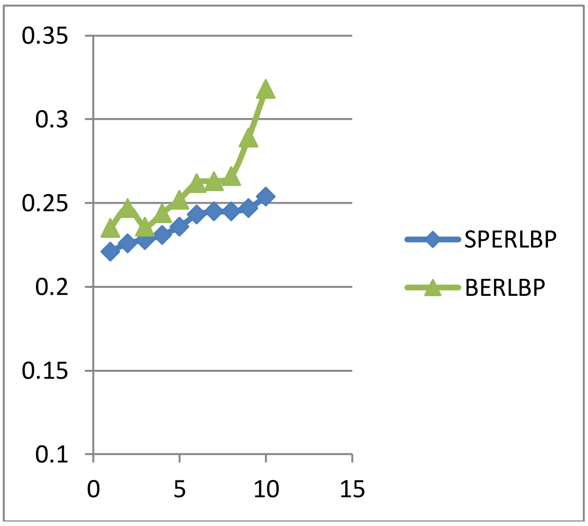

Fig.9 ERLBP on sandpebbels and beach images

6.CONCLUSION

The LBP operator has been theoretically simple yet a powerful approach of studying and analyzing textures. Through the extension advanced during this paper, the ERLBP operator became a powerful measure of image texture showing outstanding results in terms of accuracy and computational complexity in many empirical research. In this paper, we analyzed ELBP and therefore a new scheme, namely ERLBP is proposed. Two operators, ELBP and ERLBP are defined to classify the texture of images. Finally, ERLBP operator gives efficient texture classification with more accuracy than ELBP operator which obtained.

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