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RESEARCH ARTICLE

FRACTAL TEXTURE BASED IMAGE CLASSIFICATION

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Abstract— ***In recent years, Fractal Geometry is used or applied in image processing. Fractal geometry is accurate to displaying a modelling of nature texture in a digital image. This paper presents texture feature extraction method ie) Segmentation Based Fractal Texture Analysis or SFTA.A SFTA analysis is used to extracting or classify different textures images. The Extraction algorithm is mainly used to decompose the input image into set of binary images since fractal dimensions resulting regions are computed to describe segmented texture patterns. The classification is performed by agglomerative hierarchical cluster tree with Inner squared distance method.***

Keywords: Fractal Geometry, Texture, Texture extraction, Segmentation Based Fractal Texture Analysis or SFTA, Agglomerative hierarchical cluster.

I. INTRODUCTION

Segmentation plays a vital role in all kinds of image analysis. Segmentation means splitting the images into meaningful regions .Texture segmentation[1] is a process to segregate an image into homogenous regions and to identify interested regions of object .There are two types, supervised or unsupervised. Supervised texture segmentation is the system has models of textures to be encountered in the images to be segmented. Unsupervised texture segmentation is dividing an image into regions of similar texture without a priori information about the different textures.

Mainly Texture characterization is used for fractal dimension. There are two separate methods. First it is estimated based on the average intensity difference of the pixels within the region of interest. In second method, the fractal dimension is determined from the Fourier power spectrum of the image data. Fractal dimension looks as good in describing many natural textures.

Texture plays an important role such as surface inspection, scene classification, and surface orientation and shape determination.

Texture classification can be divided into 3 phases

- Extracting texture features
- Training a classifier
- Classification of an unlabelled texture image

Texture analysis is important in many applications of computer image analysis for classification or segmentation of images. Segmentation needed an efficient description of image texture. Industrial and biomedical surface inspection is a applications of texture analysis.

For example for defects and disease, ground classification and segmentation of textured regions in document analysis segmentation of satellite or aerial imagery, and content-based access to image databases.

There are main four issues in texture
Analysis[2]:

- **Feature Extraction**
- **Texture Discrimination**
- **Texture Classification**
- **Shape From Texture**

The first stage of image texture analysis is Feature Extraction. Next stage is results obtained used for texture discrimination, texture classification or object shape determination.

II. LITERATURE SURVEY

AzmiTawfik Alrawi, Ali makki Sagheer and Dheyaa Ahmed Ibrahim,[1]has proposed multitexture segmentation. The author describes to implement a novel supervised algorithm for multitexture segmentation and this algorithm based on blocking procedure where each image divide into block (16×16 pixels) and extract vector feature for each block to classification these block based on these feature. These feature extract using Box Counting Method (BCM). BCM generate single feature for each block and this feature not enough to characterize each block ,therefore, must be implement algorithm provide more than one slide for the image based on new method produce multithresolding, after this use BCM to generate single feature for each slide.

Alceu Ferraz Costa, Gabriel Humpire-Mamani, Agma Juci Machado Traina[3] has proposed we propose a Segmentation-based Fractal Texture Analysis, or SFTA.

The author describes Segmentation-based Fractal Texture Analysis, or SFTA.The extraction algorithm consists in decomposing the input image into a set of binary images from which the fractal dimensions of the resulting regions are computed in order to describe segmented texture patterns. The decomposition of the input image is achieved by the Two- Threshold Binary Decomposition (TTBD) algorithm. We evaluated SFTA for the tasks of content-based image retrieval (CBIR) and image classification, comparing its performance to that of other widely employed feature extraction methods such as Haralick and Gabor filter banks. SFTA achieved higher precision and accuracy for CBIR and image classification. Additionally, SFTA was at least 3.7 times faster than Gabor and 1.6 times faster than Haralick with respect to feature extraction time.

III. TEXTURE ANALYSIS METHODS

It can be categorised into four types

Structural Method

It represents texture by well-defined primitives and a hierarchy of spatial arrangements of those primitives. It provides a good symbolic description of the image but this feature is more useful for synthesis than analysis tasks. This is the advantage of structural approach. A powerful tool is provided by mathematical morphology. It also useful for bone image analysis, e.g. for the detection of changes in bone microstructure.

Statistical Method

Statistical approaches[2] is contrast to structural methods, do not attempt to understand explicitly the hierarchical structure of the texture. It is mostly used in bio medical images

Model-Based Method

Model based texture analysis using stochastic and fractal models. The parameters of the model are estimated and then used for image analysis. The fractal model is useful for modelling some natural textures. And also used for texture analysis and discrimination.

Transform Method

Fourier , Gabor and wavelet transforms are the transform methods .It represents an image in a space whose co-ordinate system has an interpretation that is closely related to the characteristics of a texture (such as frequency or size).

IV. RELATED WORKS

A segmentation-based fractal texture analysis is used to classify different image textures[3]. The Extraction algorithm is mainly used to decompose the input image into set of binary images since fractal dimensions resulting regions are computed to describe segmented texture patterns. The classification is performed by agglomerative hierarchical cluster tree with Inner squared distance method.

Symbol	***Definition***
I	Grayscale image.
Ib	Binary image.
Δ	Border image.
nl	Grey level range.
T	Set of threshold values.
Nt	Number of thresholds.
D	Fractal dimension.
*D*0	Haussdorf fractal dimension.
_ Box	size in the box counting Algorithm.
*V*SFTA	SFTA Feature vector.

TABLE OF SYMBOLS

Table 1

SFTA Extraction Algorithm

Needed: Grayscale image I and number of thresholds nt.

Ensure: Feature vector VSFTA.

1: $T \leftarrow$ MultiLevelOtsu(I,nt)

2: $TA \leftarrow \{\{ti, ti+1\} : ti, ti+1 \in T, i \in [1..|T| - 1]\}$

3: $TB \leftarrow \{\{ti, nl\} : ti \in T, i \in [1..|T|]\}$

4: $i \leftarrow 0$

5: for $\{\{t\_, tu\} : \{t\_, tu\} \in TA \cup TB\}$ do

6: $Ib \leftarrow$ TwoThresholdSegmentation(I, $t\_$, tu)

7: $\Delta(x, y) \leftarrow$ FindBorders(Ib)

8: VSFTA[i] $\leftarrow$ BoxCounting(Δ)

9: VSFTA[i + 1] $\leftarrow$ MeanGrayLevel(I, Ib)

10: VSFTA[i + 2] $\leftarrow$ PixelCount(Ib)

11: $i \leftarrow i$ + 3

12: end for

13: return VSFTA

V. **RESULTS AND DISCUSSION**

Step: 1 First we create a database with any images (Both natural and medical images). It is collection of 13 different images. These were 512×512 pixels images with 256 grey levels per pixel, followed by a histogram equalization process[4]. The image is a 512×512 image with 8-bits (256 grey levels) per pixel.

Step: 2 Next it is implementing in matlab.

Step: 3 The process is extracting the images one by one. They take seconds for extracting the images.

Step:4 Then clustering will be done. The Agglomerative hierarchical cluster tree with Inner squared distance method are used in the research

```
vclust( Files, Xn, C );
```

Files - The Files that features extracted from them

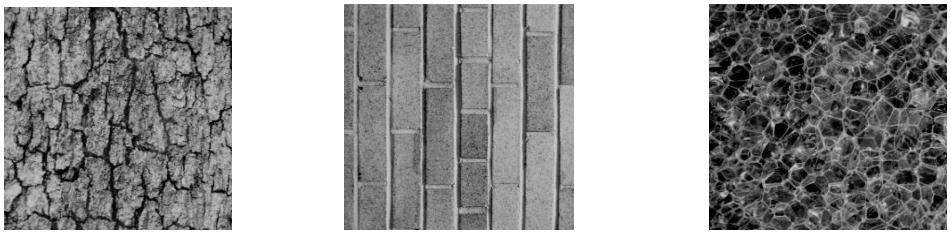
Xn - Feature Matrix

C - Maximum number of Clusters

***Step* :5** Finally, the image is classified.

Sample Images

A)Natural Images:



a b c

1A a)bark b)brick c)bubbles

B)Medical Images:

a b c

1B a)brain b)chest c)spinal

Figure 1 (A) (B)Sample images from the SFTA dataset.

The segmentation-based fractal texture analysis is used to classify different image textures.

Conclusion

In this paper, we proposed a feature extraction algorithm; the Segmentation based Fractal Texture Analysis (SFTA).In these algorithms there are 13 textures are used. First we can clustering 13 textures. So it can reduce the processing time. The SFTA is used both at medical imaging and general domain texture feature extraction.

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