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Image Retrivel –A Structural (LBP) Method of Texture

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Abstract: *Many image retrieval systems were developed such as QIBC, MARS, and FIDS and so on. They are different from the traditional image retrieval systems. These systems are based on image features such as color, texture, shape of objects. The main research work of image retrieval consists of feature extracting techniques, image similarly match and image retrieval methods. Various methods are put forwarded to integrate color, texture and shape features for efficient image retrieval. Efficient indexing and searching of large-scale image data bases remain as an open problem. The automatic derivation of semantics from the content of an image is the focus of interest of the present research on image databases. Image content is the texture. Texture plays a significant role for the last few decades in various fields of image processing and pattern recognition. There is no unique definition for texture. The present research understands that texture is not only defined by the grey level value or intensity of that pixel but it is defined and measured by the surrounding or neighboring pixel grey level or with any other common property of those pixels. To address this problem the present research adopts various methods based on texture properties. It is proposed to derive new image Retrieval method by analyzing local properties of part of image based on the features of the texture.*

Keywords: *Image, LBP, Texture, Grid, Pattern*.

1. Introduction

Image retrieval is one of the main topics in the field of computer vision and pattern recognition. The process of digitization does not itself make image collections easier to manage. The need for efficient storage and retrieval of images recognized by managers of large image collections such as picture libraries and design archives for many years was reinforced by a workshop sponsored by the USA's National Science Foundation in 1992. Problems with traditional methods of image indexing have led to the rise of interest in techniques for retrieving images on the basis of automatically derived features such as color, texture and shape in a technology now generally referred to as Content Based Image Retrieval (CBIR). Image retrieval has been an active research topic in recent years due to its potentially large impact on both image understanding and Web image search. Image retrieval means retrieving or identifying the correct image from the pool of the image database. Most of the times a part of the image will be given as test image and the method should retrieve the exact image that part belongs.

Generally speaking, image content may include both visual and semantic content. Visual content can be very general or domain specific. General visual content include color, texture, shape, spatial relationship, etc. Domain specific visual content, like human faces, is application dependent and may involve domain knowledge. Semantic content is obtained either by textual annotation or by complex inference procedures based on visual content. A good visual content descriptor should be invariant to the accidental variance introduced by the imaging process the visual contents of the images in the database are extracted and described by multidimensional feature vectors. The images in the database are then calculated and retrieval is performed with the aid of an indexing scheme. The indexing scheme provides an efficient way to search for the image database. Recent retrieval systems have incorporated users' relevance feedback to modify the retrieval process in order to generate perceptually and semantically more meaningful retrieval results.

A retrieval system using combined color and shape indexing where query is cascaded by color and then shape has been developed. This combines the earlier grid-based shape representation with the dominant color-based index to provide better retrieval efficiency and effectiveness. Most of the recent approaches like advocate the method of dividing the image space into sub-blocks and use the features extracted out of each sub block to index the whole image on those features. Texture is one of the crucial primitives in human vision and texture features have been used to identify content of images.

Texture is the term used to characterize the surface of a given object or phenomenon. It is undoubtedly one of the main features used in image processing, pattern recognition and multispectral scanner images obtained from aircraft or satellite platforms for microscopic images of cell cultures or tissue samples. Texture also plays an important role in human visual perception, medical image processing, content retrieval systems and provides information for recognition and interpretation. One crucial distinction between color and texture features is that color is a point or pixel property, whereas texture is a local-neighborhood property. As a result, it does not make any sense to discuss the texture content at pixel level without considering the neighborhood. Analysis of texture requires the identification of features that differentiate the textures in the image for segmentation, classification and recognition. The texture features are one of the important features for an efficient and cost effective retrieval system. Many texture features derived from various approaches of texture analysis and classification are thus important and crucial to build an efficient retrieval system.

2. Proposed Method of LBP

The present paper uses an LBP based approach for efficient image retrieval. LBP approach captures the local features of the image efficiently, accurately and significantly. LBP is proved as an extremely versatile and significant descriptor. LBP based models often shows promising performances in texture analysis and have been widely used in related applications, such as texture segmentation, facial expression recognition, shape localization, texture classification, face recognition, dynamic texture recognition, and object recognition. Based on LBP new operators are derived such as Local Ternary Patterns (LTP), Local Quinary Patterns (LQP), and Centralized Binary Patterns (CBP) etc.

LBP is a gray-scale invariant texture measure computed from the analysis of a 3×3 local neighborhood over a central pixel. The LBP is based on a binary code describing the local texture pattern. LBP is a local texture operator with low computational complexity and low sensitivity to changes in illumination. LBP has the following advantages i) the local texture character can be described efficiently ii) it is easy to understand and compute iii) the whole image character description can be easily extended.LBP also suffers with following disadvantages i) in the course of analysis, its window size is fixed ii) It neglects the effect of the central pixel in local region iii) LBP code is rotationally variant. LBP code is formed by multiplying corresponding LBP weights with the corresponding LBP pixel value. LBP code = 1*20+ 1*21+ 0*22+0*23+1*24+0*25+0*26+1*27 =147

The eight neighbors are labeled using a binary code {0, 1} obtained by comparing their values to the central pixel value. If the tested gray value is below the gray value of the central pixel, then it is labeled 0, otherwise it is assigned the value 1 as described by the Equation 5.

Pattern numbers in LBP can be evaluated even on a 5 x 5 neighborhood. This refers to the third order neighborhood.

LBP= $\sum_{p=0}^{p-1} S_{P,R}(gp - gc)2^p$

S(t)= $\begin{cases} 1 & t \geq 0 \\ 0 & otherwise \end{cases}$

As each element of LBP has one of the two possible values, the combination of all the eight elements results in 28 = 256 possible local binary patterns ranging from 0 to 255. There is no unique way to label and order the 255 LBP on a 3×3 neighborhood

The value of the LBP changes by the representation of the weights. The LBP can be calculated in 8 different ways for a 3×3 neighborhood. That is for any 3×3 neighborhood one can generate eight LBP values. The LBP value for all eight directions is given as 227, 242, 121, 188, 94, 47, 151, and 203 respectively. To overcome the rotational variant disadvantage of LBP the proposed method measures the number of transitions from 0 to 1 or 1 to 0 in a circular manner and replaces the central pixel with the number of transitions. That is the above LBP 10100111 of contains four transitions from 0 to 1 or

1to 0. The central pixel is replaced by the obtained number of transitions value 4. In this way the second step derives a new LBP image by replacing each central pixel value of a 3x3 neighborhood with its circular transition number that occur from 0 to 1 or 1 to 0.

The above extensions of LBP [3, 31] increase the number of patterns to be considered from 58 to a large extent. This leads to lot of complexity especially in texture classification and retrieval domains. After the above study the present paper found that one should consider both uniform and non uniform patterns for an effective image retrieval, classification, recognition etc….The problem in considering both the uniform and non uniform LBP’s is they generate a total number of 256 patterns. Even if one considers only the ULBP then it leads to 58 different patterns. This increases the dimensionality and also by missing the 77% of pattern information. Evaluating the frequency occurrences of 58 or 256 pattern leads a complex and tedious work especially for image retrieval. For each retrieval, on the test image 58 or 256 feature patterns are to be evaluated if we consider ULBP or all patterns respectively. Then these huge numbers of features i.e 58 or 256 are to be compared each of the database images and the nearest one should be picked as a matching image.

Illustration of the texton detection process (a) Original texture image (b) Transitioned texture image (c) textons names identification (d) Final texton image. The four pixels of a 2×2 grid are denoted as V1, V2, V3 and V4. Texton is detected is if three or more pixels contains the same grey level value. Once the texton T1, T2, T3, T4 and T5 is detected the the proposed texton representation remains the 2 x 2 grid as it is without any change. If there are no textons then the 2 x 2 grid will be made as zeros. The working mechanism of texton detection is illustrated. The Texton based transitioned LBP texture image is formed by remaining the 2 x 2 grid as it is whenever a texton is found otherwise the 2 x 2 grid pixels are assigned to zero. This process is repeated starting from top left corner by shifting one column right till it reaches the last column and then shifting bottom by one position till it reaches the last row and last column in a convolution manner.

3. Conclusion

The present paper derived a simple method of image retrieval based on LBP. The main advantage of the present method is, it considered all the 256 LBP features by reducing them into 5 features based on the number of transitions. The proposed LBP code is rotational variant because LBP weights can be represented in 8-different ways. The present method reduced lot of complexity in representing number of texture features. The results indicate a good image retrieval rate by the present method.

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