A NEW TEXTURE IMAGE RETRIEVAL WAY*

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Abstract  This paper proposes a new texture image retrieval method for the considering of the population search and random information exchange merits of evolving programming which can be used to optimize image feature vector extraction. The experimental results show that this way can efficiently improve the retrieval accuracy and realize fasttips with the advantage of evolving programming algorithm.

Key words  Texture image; Image retrieval; Evolving programming

I. Introduction

Image content based retrieval is developing to a very important research area with the appearance of digital library and multimedia database management and the arrival time of information and network. The traditional way of image retrieval based on text becomes more difficult to satisfy some practical requires such as to find some images which have the similar structure of the given image. Therefore, people proposed the image content based retrieval method[1] which realize the image database management by the analysis of the image contents such as color, texture, shape or else.

The way of retrieval based on texture content is one of the efficient measures as the texture sufficiently open the surface structure of objects contented in images. At present, there are many research institutions at home and abroad that are carrying out the relevant works. For example, in the IBM QBIC (Query By Image and video Content)[2], the texture features are modifications of the coarseness, contrast, and directionality features. And recently there are the Gabor wavelet method[3] used by Alexandria digital library project of university of California, Santa Barbara and Wold decomposition way in MIT media lab's Photobook[4] retrieval system. But most texture retrieval methods are of low query accuracy in practice. Therefore, how to select the texture features to reach higher query accuracy becomes more and more necessary.

In this paper, we propose a novel method that takes advantages of population search and random information exchange of Evolving Programming (EP). It can effectively extract the texture features to get a high inquiry precision. Meanwhile, since it reflects spatial dependency relationships, the texture descriptive model used in this paper which is named gray level co-occurrences is an efficiently means to represent the texture. Experimental results show that our method based on EP can realize texture image retrieval with more exact results for the merit of strong optimization ability.

*Supported by 973 National Key Basic Research Project (G1998030413)
II. Feature of Texture Images

Texture is an internal characteristic of object surface. It can be used to show the structure of object surfaces and the relationships around. Generally, we can analyze the texture by the description way of some local patterns which appear repeatedly in a given area and the arranging rules of themselves. There are two expression ways of texture feature. One is the gray level co-occurrences matrix suggested by Haralick\[^7\] with the prominence of spatial relationships, the other is named vision feature method proposed by Tamura with the emphasizing of vision effect\[^8\].

We adopt the gray level co-occurrence matrices to depict the texture images. Such matrices as \( M(\Delta x, \Delta y) \) are built by taking account of direction and distance with coefficients corresponding to the frequency of gray level co-occurrences in terms of a given spatial relationship with the distance of \((\Delta x, \Delta y)\). There are many statistical parameters which can be extracted from these matrices such as contrast, energy, entropy, etc. For instance, the amount of contrast reflects the thickness degree of texture while the energy can be used to measure the homogenization degree of gray distribution.

There are all 11 statistical parameters in this paper, named energy, contrast, contrast partitioned matrix, sum variance, sum mean, sum entropy, entropy, difference variance, difference entropy and correlation information measurement. Their definitions\[^5\] are as follows:

Energy:  \[
f_1 = \text{ASM} = \sum \sum (p(i,j))^2
\]

Contrast:  \[
f_2 = \text{CON} = \sum_{n=0}^{N_2-1} n^2 \left\{ \sum_{i}^{N_x} \sum_{j}^{N_y} p(i,j) \right\}
\]

Contrast partitioned matrix:  \[
f_3 = \sum \sum \frac{1}{1+(i-j)^2} p(i,j)
\]

Sum mean:  \[
f_4 = \sum_{i=2}^{2N_y} ip_{x+y}(i)
\]

Sum variance:  \[
f_5 = \sum_{i=2}^{2N_y} (1-f_4)^2 p_{x+y}(i)
\]

Sum entropy:  \[
f_6 = - \sum_{i=2}^{2N_y} p_{x+y}(i) \log\{p_{x+y}(i)\}
\]

Entropy:  \[
f_7 = - \sum i \sum j p_{i,j} \log\{p(i,j)\}
\]

Difference variance:  \[
f_8 = p_{x-y}'s \ variance
\]

Difference entropy:  \[
f_9 = - \sum_{i=0}^{N_x-1} p_{x-y}(i) \log\{p_{x-y}(i)\}
\]