

Research of Content Based Image Retrieval Technology

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Abstract—In this paper, a survey of content based image retrieval techniques is given. Image retrieval method based on shape is analyzed primarily, the description and match based on shape are discussed and compared. And relevance feedback is also introduced. At last we put forward the problems in this field and suggest the directions of future development.

Index Terms—image retrieval, shape feature, relevance feedback

I. INTRODUCTION

With the rapid development of multimedia and network technology, image information has been used more and more widely, for the large image database, how to manage it visually is an urgent problem, flexible, efficient and accurate image retrieval strategy is one of the key technologies to solve this problem.

Traditional image retrieval mainly bases on the text, using keywords, or free text to describe each image and using text-matching to search. However, the current computer vision technology is not mature, fail to extract automatically of the keywords and semantic information, manual extraction is time-consuming on the one hand, and on the other hand is subjective; at the same time, some visual informations of image such as texture and shape are difficult to describe the text accurately.

Therefore, content based image retrieval (CBIR) is proposed. This technology extracts visual image features automatically by machine such as color, texture, shape, object location and mutual relations, match the images of the database and sample images in the feature space, then search out the similar image of the sample.

II. SYSTEM STRUCTURE OF CBIR AND BASIC PRINCIPLES

The core technology of CBIR is using visual features of the image to search. In essence, it is an approximate matching technique, combining computer vision, image processing, image understanding and databases, and other fields of technological achievements. A typical CBIR system structure is shown in Figure 1.

Retrieval process and the algorithm process as follows:
① Analyze the content of the image, extract visual features of each image and then store in the feature database; ② during the image retrieval only providing fuzzy description of the image is enough, such as a sample image or a sketch, select a feature extraction method to extract features of the case diagram; ③ Select the similarity comparison, match the case diagram of the characteristics and features of the library ④ return the result to the user by similarity from large to small sequencing ⑤ When the results back to the user, he can select feature compositio through interactive feedback and adjust the weights of the various features, and finally get satisfactory results.

III. THE TECHNOLOGY OF CONTENT BASED IMAGE RETRIEVAL

Content-based description is the premise of content-based image retrieval. Image content includes both color, texture, shape and other low-level visual features, and also the high-level semantic features. The characteristic of image retrieval based on low-level feature is that its features can be obtained directly from the image, while image retrieval based on high-level semantic features are not only to solve the mathematical model, description, search algorithm and other issues, but also possess semantic features to consider ambiguity, uncertainty, and dependence on the natural language description.

A. Retrieval based on color feature

Color feature is the most intuitive and obvious characteristics of the image, generally using the histogram to describe. It has a fast speed, low storage space requirements, and is not sensitive to the scale and rotation of the image, so it receives wide attention. Now image retrieval based on color feature has become an important means of search. It is mainly divided into two categories: global color feature search and retrieval of local color feature.

Color histogram is the most used method of global color feature, Swain's main idea is using color histogram
Shape-based image retrieval is the research on shape content-based image retrieval. One important part of the target image to search, it is a very important aspect of feature extraction. Shape and the shape feature have the characteristic that it can be linked to the person's feelings; including geometry, statistics, Morphological measure so that the knowledge of people between the consolidated results, so the average color, main color, color histogram and binary local area in the color information can be expressed as segmentation, and using interactive semi-automatic segmentation based on fixed blocks, based on manual perspective of division can be divided into: Image third order of each color.

B. Retrieval based on texture feature

We often use statistical characteristics of texture or structural characteristics to describe texture feature, and the nature based on the airspace can be converted to the frequency domain, so the commonly used texture description methods can be divided into statistical method, frequency domain method and structure method, and in image retrieval they can be used together.

Statistical texture analysis methods are co-occurrence matrix analysis, Markov analysis, multiscale autoregressive MRSAR model and genetic algorithms. Tamura and so from the standpoint of human perception and psychology, the texture of the six kinds of visual features: coarse grain, contrast ratio, direction, linearity, and the roughness of the rules. The texture features that have a real visual sense, image retrieval can provide better user interaction. Due to texture rarely provide semantic information, difficult to describe. Therefore, the retrieval process is usually as an adjunct to, or combined with other features.

C. Retrieval based on shape feature

Shape-based image retrieval uses shape feature of the target image to search, it is a very important aspect of content-based image retrieval. One important part of Shape-based image retrieval is the research on shape feature extraction. shape and the shape feature have the following two characteristics: ① people perceive the shape of the retina on the real world experience and knowledge of people between the consolidated results, so the shape is still no exact mathematical definition, including geometry, statistics, Morphological measure so that it can be linked to the person's feelings; ② shape often links with the goal of human interest, together with certain semantics, it can be seen as higher than the color and texture features, it is a very complex issue for shape description, much more complex than the expression of color and texture in nature. Nevertheless, the shape is still an important visual image feature, and is also a basic feature to describe image content, and researchers pay more attention to the shape than other features.

D. Relevance Feedback in Image Retrieval

The basic idea of image retrieval based on relevance feedback is that in the retrieval process, allowing users to assess and mark the results of image retrieval, find out which results are relevant to the query image, which are not relevant, then feedback the relevant information that the users mark to the system as training samples for learning, and instruct next image retrieval so make the results more in line with the needs of users. A broader application of relevance feedback method modifies the query vector on the one hand, on the other hand, using feedback information to change the weight of each feature vector in the formula, highlighting the more important vector of the query.

The relevance feedback method based on support vector machine (SVM) is that learning the tagged cases and negative samples in the feedback process each time, establish SVM classifier as a model, and use the model to search. In each feedback process, if the user’s sample image has similar properties with the feature space, that is, as a support vector of a sample, then the sample because of distance has no effect on the SVM classifier, so although feedback from users tag images limited, but for the establishment of SVM classifier is sufficient to effectively control the generalization ability of machine learning. SVM method is the core function of the main difficulties in the selection, the selection of kernel function directly affects the classifier's generalization ability. But SVM method has a drawback is that the images must be used for feedback marking the border images and the best images to make a compromise.

The basic idea of the relevance feedback based on Bayes criterion is using the statistics of feedback to judge the information. In theory, Bayes algorithm has the smallest error rate in comparison with other classification algorithms, but in practice it is lack of reliable estimate due to the inaccuracy of assumption.

IV. THE MAIN PROBLEMS IN CURRENT STUDY AND DIRECTIONS FOR FURTHER RESEARCH

Through the analysis of the major research techniques of content-based image database and investigation of many experiments on the prototype system, the main problems of image database that supporting content-based retrieval are as following:

- Image-based color features of the main problems is the index of the color characteristics of human visual perception is still not enough consider, although the majority of image retrieval based on color features and the people using the same color perception Xiang HSV color space, but on two kind of similarity between the definition of color and visual determination of color similar to Master Cheng Yen is still a gap. From the color characteristics of that
point of view, various forms of color histogram is the most common representation, generally assigned the same color set, with tens to hundreds of high-dimensional histogram dimension. In fact one of the two images of the color image similarity few main considerations determine the main color. Different images have different color sets, which contain different color similarity between the two images still need further study determined. To further improve the color characteristics of the retrieval results, from the color of physical, visual and psychological aspects of a comprehensive in-depth

In present, the main problem in image retrieval based on texture feature is that most of texture feature set that the methods choose are depending on the specific texture image, usually, one texture feature is only useful for the expression of one texture image database, while for another is not necessarily feasible. How to switch texture feature automatically for different texture image database will need more time to study.

on the image retrieval based on shape feature, the automatic extraction of the border shape has been plagued users for many years in the field of image processing, outline manually is mostly used in many of the current retrieval systems, the shape feature extraction is a heavy workload, this problem will become more prominent for volume image data. Variety of shape feature description methods lose the information of shape seriously; only a small number of expressions independent with the shape of the geometric transform; Furthermore shape measurement method still can’t distinguish shape well, it can not express the similarity between shapes effectively. The research of image retrieval based on shape feature is still a challenging research topic.

V. CONCLUSION

In summary, we can see that image retrieval based on content is still an open research topic, the research will involve cognitive science, artificial intelligence, pattern recognition, image processing, information retrieval and other multiple areas.

For a major problem is that in a long time it is still need to improve the image feature extraction, expression, similarity measure in image processing and pattern recognition. The current image retrieval based on content mainly use visual features to distinguish image similar or not, this is also the problem in the field of pattern recognition for many years. An effective approach is to strengthen the multi-feature image retrieval method for an integrated, in order to the further improving of the image retrieval results.

In the research of Artificial intelligence, there are a lot of achievements in image semantic feature, they can be applied to content-based image retrieval to analyze the transition between visual features and semantic features of the images, making it possible that communicating between high-level concepts and low level visual characteristics, so shortening the gap of understanding similar images between user and machine. the MPEG-7 standard is developed by International Organization for Standardization of MPEG, the objective is to search images with high-level semantic feature and low-level visual characteristics of content-based, one of the focuses of future research will be high-level semantic content-based image Search. Looking for fast intelligent search algorithm and how to design user feedback mode while feedback fully is also an important research direction for the future.

REFERENCES