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Techniques for Efficient Image Retrieval

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ABSTRACT

According to the large image data accumulation, image retrieval is still in an exploratory stage. Retrieval of images plays a major role in different areas including medical diagnosis, biometrics, industry inspection, satellite system, web search and so on. Compared with text based image retrieval, content based image retrieval methods ensure the quality of image retrieval. The retrieval results can be using more features or by incorporating ranking methods. This paper discusses various feature extraction techniques and re ranking techniques to get better search result.

Key words: Content based image retrieval, Feature extraction, Reranking. Text based image retrieval**.**

1. INTRODUCTION

Image retrieval (IR) has become an important research area in computer vision where digital image collections are rapidly being created and made available to multitudes of users through the World Wide Web. Tremendous increment is there in the collections of images from art museums, medical institutes, and environmental agencies and so on. In the commercial sector, companies have been formed that are making large collections of photographic images of real-world scenes available to users who want them for illustrations in books, articles, advertisements, and other media meant for the public at large. Incredibly, the indexing of these images is all being done manually–a human indexer selects and inputs a set of keywords for each image. However, the present image retrieval performance still cannot meet the requirement of expectations. Compared with text retrieval, image retrieval is still in exploratory stage.

At present, there are two main types of image retrieval: text based image retrieval (TBIR) and content-based image retrieval (CBIR). Text based image retrieval makes use of artificial marks to avoid visual analysis. Through the searching and matching for texts, text based image retrieval establishes the correlation link between images. However, with the increase in size of the image database, the limitations of the method based on artificial annotation are also shown.

Manual annotation requires two much manpower and time consumption. When the size of the image database increases to a certain extent, manual labeling for each image will become impossible. In order to overcome the shortcomings of the methods based on manual annotation, researchers put forward the content based image retrieval. Different from the text based image retrieval, content based image retrieval directly gets visual vectors of the images to find out the similar characteristics. According to the difference in the feature scale, it is divided into the method based on global features and the method based on local features. Content based image retrieval can extract the relevant visual statistical characteristics such as colors and textures. According to the distance measurement between the feature vectors, images can be matched with each other.

1.1 Text-Based Approach

Input keywords descriptions may index images using keywords. The Advantages of text – based approach are , it is easy to implement and it helps in fast retrieval of images where the disadvantages are the manual annotation is not always available, the manual annotation is impossible for a large DB and the manual annotation is not accurate.

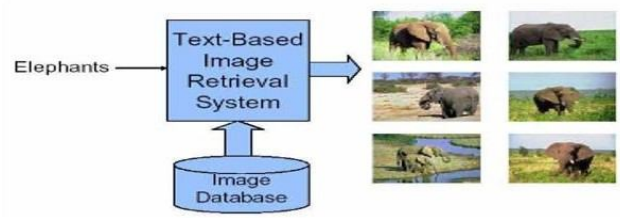

Figure 1: Text Based Image Retrieval

1.2 Content-Based Approach

Index images using images. The advantages of content based approach are, it allows Visual features, such as color, texture, and shape information, of images are extracted automatically and similarities of images are based on the distances between features.

In this paper we discuss Text-Based image retrieval techniques and Content–Based image retrieval techniques.

Our aim is to improve the retrieval performance, so here discussing various techniques to improve the retrieval performance ranking and Re-ranking techniques are among that.

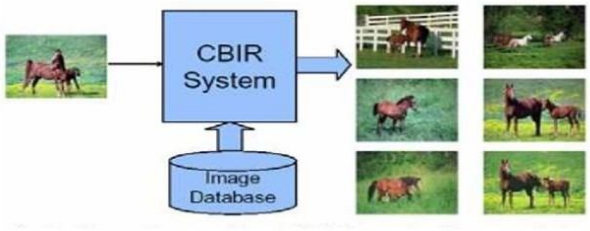

Figure 2: Content Based Image Retrieval

2. TEXT BASED IMAGE RETRIEVAL SYSTEM

The text based image retrieval utilizes the method of adding the metadata, such as keywords, captioning or descriptions to the images. The retrieval is employed over the annotation words and it makes the annotation complex and time consuming. Also it requires huge labors to manually annotate the images. The semantic content is not considered in TBIR.

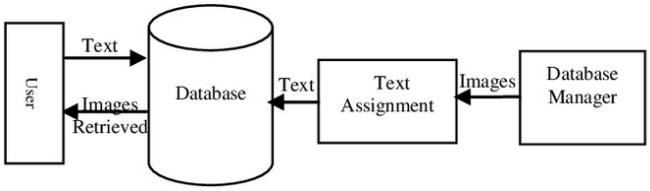

Figure 3: Flow Chart of Text -Based Image Retrieval

L. Duan [2] proposed a new approach to learn a robust classifier for text-based image retrieval (TBIR)using relevant and irrelevant training web images, in which we explicitly handle noise in the loose labels of training images. Specifically, first partition the relevant and irrelevant training web images into clusters. By treating each cluster as a “bag” and the images in each bag as “instances”, and formulate this task as a multi-instance learning problem with constrained positive bags, in which each positive bag contains at least a portion of positive instances. Here presents a new algorithm called MIL-CPB to effectively exploit such constraints on positive bags and predict the labels of test instances (images). Observing that the constraints on positive bags may not always be satisfied in our application, which additionally propose a progressive scheme (referred to as Progressive MIL-CPB, or PMIL-CPB) to further improve the retrieval performance, in which iteratively partition the top-ranked training web images from the current MIL-CPB classifier to construct more confident positive “bags” and then add these new “bags” as training data to learn the subsequent MIL-CPB classifiers.

Clough et al [1] proposed the cross language information retrieval system through which the images are captioned and the given textual query is preprocessed such as the normalization, removal of stop words and word stemming are used and a document ranking scheme used where captions containing all query terms are ranked.

3. CONTENT- BASED IMAGE RETRIEVAL SYSTEM

Content-based visual information retrieval (CBVIR) is the application of computer vision techniques to the image retrieval problem, that is, the problem of searching for digital images in large databases. Content-based means that the search analyzes the contents of the image rather than the metadata such as keywords, tags, or descriptions associated with the image. The term "content" in this context might refer to colors, shapes, textures, or any other information that can be derived from the image itself. CBIR is desirable because most web-based image search engines rely purely on metadata and this produces a lot of garbage in the results. Also having humans manually enter keywords for images in a large database can be inefficient, expensive and may not capture every keyword that describes the image. Thus a system that can filter images based on their content would provide better indexing and return more accurate results. The images are retrieved only through the Texture, Color, and shape in content based image retrieval.

The term has since been widely used to describe the process of retrieving desired images from a large collection on the basis of features (such as color, texture and shape) that can be automatically extracted from the images themselves and the features used for retrieval can be either primitive or semantic, but the extraction process must be predominantly automatic. Retrieval of images by manually-assigned keywords is definitely not CBIR as the term is generally understood even if the keywords describe image content. CBIR differs from classical information retrieval in that image databases are essentially unstructured, since digitized images consist purely of arrays of pixel intensities, with no inherent meaning. We can improve the retrieval results by adding more Features or by Ranking.

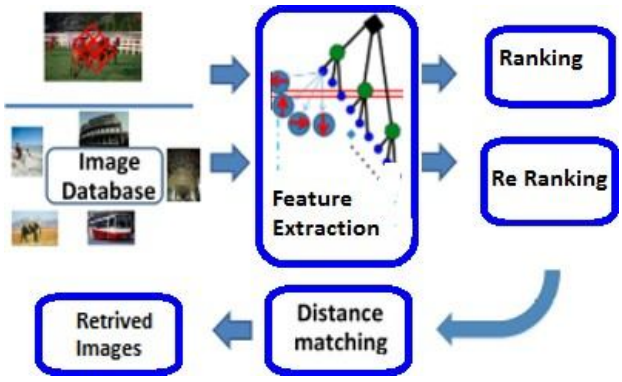

Figure 4: Flow Chart of Content- Based Image Retrieval

3.1 Retrieval by Feature: Shape

Ying Liu et al [5] pointed out of retrieval images from the large image collections. We suggest a fast image retrieval based on object shapes extracted from objects within images. Multiple shapes at lower level can be mapped into a single

shape at a higher level. Given a query shape, by searching only the relevant paths in the hierarchy, large portions of the database can thus be pruned away. An angle mapping is used to transform a shape from one level to another higher level. Angle mapping replaces some edges of shape by a smaller number of edges based on the angles between the edges thus reducing the complexity of the original shapes

Renato et al [4], is using a single color histogram for the whole image, or local color histograms for a fixed number of image cells, (named Color Shape) uses a variable number of histograms, depending only on the actual number of colors present in the image and using a large set of heterogeneous images. Pre-defined query/answer sets show that the Color Shape approach offers good retrieval quality with relatively low space overhead, outperforming previous approaches.

.3.2 Retrieval by Feature: color

Chang et al [6] proposed the image retrieval using the color distribution, mean and the standard deviation and was tested with three different databases. The other component is the relevant feedback where it helps to be more precise in searching the relevant images by taking up the feedbacks of the user.

Xue et al [7] states separate color images and color histogram moment of extraction, and then two methods of extracting color feature vector weighted to achieve similar distance, similar to the last distance based on the size of the return search results and based on the realization of the characteristics of the color image Retrieval system.

3.3 Retrieval by Feature: Texture

Zhang et al [9] proposed on image retrieval method based on Gabor filter. Texture features are found by calculating the mean and variation of the Gabor filtered image. Rotation normalization is realized by a circular shift of the feature elements so that all images have the same dominant direction. The image indexing and retrieval are conducted on textured images and natural images.Sandhu et al [8] pointed out the various methods of texture based retrieval such as the GLCM and histogram over shape and the texture properties

Visual features are very important for images, which are based on the prior knowledge of the image content. In addition, visual features are closely related with the specific application areas. Based on content-based image retrieval technology, visual features can be extracted automatically or semi automatically to improve the robustness of the system and ensure the quality of image retrieval. The characteristic information of images can be classified into two categories. Low level feature attribute contains color feature, texture feature and shape feature. Semantic feature attribute contains interpretation and identification of objects. However, due to the current development of computer vision and image understanding, the image retrieval technique is still unable to realize semantic image attribute. Key of image retrieval is still extracting low-level feature attribute information. Shape features are the most significant features for images. At the same time, it is also the most difficult to describe. For humans, it is easy to identify the objects in dominant position. For computers, they do not the ability. And shape features can help. In the field of image retrieval, methods for shape feature extraction can be divided into two directions: extraction based on edge attributes and extraction based on region shape features. The main idea of extraction for edge shape features is based on the principle of edge detection. Edge shape features are applied mainly in images whose edge is clear and separated. Perimeter, angle, eccentricity and points of interest are used as descriptors.

Color attributes are the most simple image features, which can be used in the field of image retrieval. The common retrieval methods can be divided into color histogram, color correlogram, color coherence vector, color matrix and so on. Through color channel decomposition for images, color histogram is used for calculating and comparing similarity between two images. In the content based image retrieval technology, color correlogram is more effective than the traditional color histogram. In other words, color histogram just simply reflects the proportion of different values in every color channel. However, the color correlogram not only reflects the global statistical relationship, but also expresses the spatial transformation between color and distance. In addition, color matrix mainly uses the mean, variance and skewness as the color feature information of images. Color matrix retrieval method has been proved to be representative as the distribution of color information.

Texture features are mainly extracted to describe the spatial relationship between the pixels in local area. Generally speaking, the methods for texture features extraction can be divided into the following four categories: description based on the statistical method, description based on structure method, description based on spectrum method and description based on model method. Specifically speaking, feature description based on statistical method mainly considers distribution on pixel values. The most common statistical methods often describe the texture characteristics based on the gray histogram. In order to make full use of the spatial distribution on pixel values, co-occurrence matrix was proposed to describe the texture feature. The method considers the information on distance and direction between pixels. By constructing a co-occurrence matrix, correlation information can be used as a component of image feature vectors. In addition, texture features based on human visual perception was put forward including the following attributes: contrast, likeness, roughness and so on. Description based on structure method considers regular spatial structure arrangement.

4. IMAGE RE- RANKING

Image reranking is a popular post processing method for image retrieval, which aims at enhancing the initial retrieval performance. In general, it takes either users' opinions or the relationships between images into consideration to find an optimal re ranked list based on the initial retrieved results.

As one of the applications of CBIR, image retrieval has gradually matured over the last decade. An ocean of excellent methods was proposed for IR. Some of them aim at

developing comprehensive retrieval systems using diverse technologies, while the other proposed IR methods focus on the key problems within the CBIR community. For a number of IR methods researchers have discovered, there are many techniques that can be developed to improve the performance of IR, such as enhancing the retrieval mechanism, exploring more primitive features, and adding reranking approaches. Among these techniques, reranking may be themost effective post processing method. A host of reranking algorithms has been designed to enhance retrieval performance.

4.1 Re Ranking: Co re-ranking

T. Yao [10] proposed co re-ranking based on the single random walk, a core ranking algorithm, which reinforces the information mutual exchange and propagation by two random walks, is proposed. The reranking process will not stop until a balanced state is established between two modalities. In this paper, we adopt DWT, GLCM, and the 256-D RGB color histogram (Color) to accomplish this method, which are named as CO-DG, CO-DC, and CO-GC.

4.2 Re Ranking: Multimodal Circular Reranking

C. W. Ngo [11] proposed multimodal circular reranking on the basis of the co reranking algorithm, the circular reranking method expands the mutual exchange process to at least three modalities, and the information is propagated in a circular manner. In this paper, the DWT, GLCM, and Color modalities are adopted to complete the circular reranking. They call it MMCR for convenience

4.3 Re Ranking: Multimodal Graph-Based Reranking (MMGR)

M. Wang [12] proposed multimodal graph based reranking is different from the co reranking and circular reranking, presented a reranking method using multiple modalities fusion in the framework of graph learning. The similarity metric, weights of different modalities were alternately optimized during the reranking. The three modalities produced by the DWT, GLCM, and Color features are adopted here, and we refer to it as MMGR for short.

4.4 Re Ranking: Two stage Reranking (TSR)

Xu Tang [13] proposed that the first step of our TSR is an editing scheme. A handful of informative and representative images are selected by the active learning algorithm, and their binary labels are provided by the users relative to the query image. Within the editing scheme a binary classifier is trained using the selected images and their labels to classify the rest of the neighbors. Finally, both classification results and rank information in the initial retrieval results are considered to decide which the image should be excluded. In the next step, the remaining images are re ranked by the proposed reranking scheme, i.e., multi similarity fusion reranking. Both the user's experience and image relationships are taken into account in TSR to ensure the performance of the reranking. The efficiency and the robustness of this method are validated by experiments conducted on two different types of images. Compared with the existing visual reranking approaches, TSR method achieves improved performance.

5. CONCLUSION AND FUTUREWORK

In this paper, we focuses on various methods for the Image retrieval mainly text based methods and content based image methods. Text-based image retrieval has some limitations such as task of determining image content is highly perspective. So overcomes this problem, we will discuss the CBIR system. Here also focus on various features for the image retrieval, mainly color, texture and shape. To improve image retrieval performance we can use more features and Reranking techniques. During image retrieval, we extract specific image features. The retrieval time may be increased due to the large number of features extracted. Ranking method play an important role in Image retrieval. Various Reranking techniques that enhance the retrieval performance are also discussed in this paper. We have to admit that the method could be improved by adding more features. By doing Reranking we get better result but time consumption is the major issue .We will investigate this problem in our future work.

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