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Recent Trends in Image Retrieval Techniques for the Big Data Platform: A Survey

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Abstract: As the tremendous growth in the volume of images as well as the widespread application in multiple fields, the requirement for development of image retrieval techniques have enhanced. The ability to handle very large amounts of image data is important for image analysis and retrieval applications. Image Retrieval is an interesting and rapidly growing developing methodology in all fields. It is an effective and well organized approach for retrieving the image. Digital explosion of image databases over internet pose a challenge to retrieve images that are relevant to user query, efficiently and accurately. It becomes increasingly important to develop new CBIR(Content Based Image Retrieval) techniques that are effective and scalable for real time processing of very large image collections. Content based image retrieval system based on Hadoop, proposed a solution for a large database of images which provides secure, efficient and effective search and retrieve the similar images of Query image from the database. In this paper we provide an overview of the fundamental theories and emerging techniques for Image Retrieval, different types of image retrieval and Hadoop framework, as well as several extended work in these areas.

Keywords: Image retrieval, Image features, Extraction, Hadoop frame work, Feature extraction.

I. INTRODUCTION

As computer technologies become worldwide, besides numerical and categorical data, various digitalized images, sounds, voices, and videos have become part of daily life. Plenty of knowledge can be hidden in these data, it is since1970th people devoted themselves into image retrieval research, and then text based image retrieval technology and context web retrieval technology were proposed, which in a certain extent solved some image retrieval and resource discovery problems. However, people are not satisfied with only being able to access information, because through image retrieval people can only find out the relative information they want, they cannot dig out valuable knowledge hidden in large sets of image data [1].Thus, image mining was introduced, Image mining concerns the extraction of implicit knowledge, image data relationship, or other patterns not explicitly stored in the images. It is more than just an extension of data mining to image domain. Image mining is an interdisciplinary endeavour which draws upon expertise in computer vision, image understanding, data mining, machine learning, database, and artificial intelligence. Some methods allow image mining to have two different approaches. First method extracts images from image databases or collection of images. Second method mines a combination of associated alphanumeric data and collection of images. Image retrieval systems attempt to search through a database to find images that are perceptually similar to a query image. Content based image retrieval (CBIR) is an important alternative and complement to traditional text-based image searching and can greatly enhance the accuracy of the information being returned. It aims to develop an efficient visual-Content-based technique to search, browse and retrieve relevant images from large-scale digital image collections. Most proposed CBIR techniques automatically extract low-level features (e.g. color, texture, shapes and layout of objects) to measure the similarities among images by comparing the feature differences.In early era of this emerging filed the image was retrieved by text description called as Text Based Image Retrieval [TBIR].Complete surveys of this technique can be viewed in Chang S.K. and Hsu A [2]. All text based image retrieval systems require the text description with images in large scale data bases and manually this task is not feasible. As a result, text based image retrieval systems were not applicable for task dependent queries [3].

II. IMAGE RETRIEVAL AND RELATED WORKS

Popular knowledge claims that an image is worth 1000 words. Unfortunately, these 1000 words may differ from one individual to another depending on their perspective and/or knowledge of the image context. Thus, even if a 1000 word image description were available, it is not certain that the image could be retrieved by a user with a different description.The image retrieval is an interesting and fastest developing methodology in all fields. It is an effective and well organized approach for retrieving the image.

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Image retrieval techniques are splitted into two categories text and content-based categories. The text-based algorithm comprises some special words like keywords. Keywords and annotations should be dispenses to each image, when the images are stored in a database. The annotation operation is time consuming and tedious. In addition, it is subjective. Furthermore, the annotations are sometimes incomplete and it is possible that some image features may not be mentioned in annotations [4]. In a CBIR system, images are automatically indexed by their visual contents through extracted low-level features, such as shape, texture, colour, size and so on [4, 5]. However, extracting all visual features of an image is a difficult task and there is a problem namely semantic gap in the semantic gap, presenting high-level visual concepts using low-level visual concept is very hard. In order to alleviate these limitations, some researchers use both techniques together using different features. This combination improves the performance compared to each technique separately [6, 7]. Many image retrieval systems, both commercial and research, have been built.

Most image retrieval systems support one or more of the following options:

- random browsing
- search by example
- search by sketch
- search by text (including key word or speech)
- navigation with customized image categories

We have seen the provision of a rich set of search options today, but systematic studies involving actual users in practical applications still need to be done to explore the trade-offs among the different options mentioned above. Content-based image retrieval (CBIR) was originated in 1992, by scientist T.Kato. He was found it during the time when he is doing the experiments about the retrieval of images from a small database by using their visual content. Pattern recognition, signal processing, linear systems and machine vision areas are used to create the techniques, tools and algorithms that are used in CBIR.

The more recent works in the area of content based image retrieval consists of Relevance feedback, Radial basis function networks and fuzzy approaches. These three help to add more human interaction with the CBIR systems, thus significantly reduces the time for retrieving the output. Relevance feedback is a technique to overcome the semantic gap, where users provide feedback on the relevance of the retrieved images by the system, and this information is given back to the system for learning the user information needs. Important relevance feedback algorithms includes query refinement, re-weighting, Bayesian learning, optimal learning over heuristic-based feature weighting, artificial neural networks,discriminant-EM algorithm, and kernel-based learning etc., these have been adopted in CBIR systems and demonstrated considerable performance improvement. Fuzzy logic is a logic that deals with reasoning which is approximate rather than fixed and exact. Compared to traditional binary sets fuzzy logic variables may have a truth value that ranges in degree between 0 and 1. Fuzzy logic has been expected to handle the partial truth information concept, where the truth value may range between true and false that is partial information needs. Fuzzy deals with concepts that cannot be expressed as relevant or irrelevant but rather as partially relevant. The other approaches such as genetic algorithms and neural networks can perform as equal to fuzzy logic in many cases, fuzzy logic has the advantage that the problem solution can be cast in terms that human users can understand. Therefore fuzzy logic can be able to include more human interaction in the retrieval process. Fuzzy Radial Basis function networks are neural networks which perform the process in sessions. If the CBIR system is in real time, then RBF networks are the best. Moreover they have fast learning speed, simple network structure and global generalization power. Fuzzy logic for the interpretation of the texture queries for content-based image retrieval is latest and effective technique.

Some extended works in this area are,a new technique called Image retrieval based on optimum clusters is proposed for improving user inter-action with image retrieval systems by fully exploiting the similarity information. The index is created by describing the images according to their colour characteristics, with compact feature vectors, that represent typical colour distributions. In this, a new method for image classification is formulated in order to reduce the searching time of images from the image database [8].A method for colour image indexing by exploiting the simplicity of the Error Diffusion Block Truncation Coding (EDBTC) method. A feature descriptor obtained from a colour image is constructed from the EDBTC encoded data (two representative quanitzers and its bitmap image) by incorporating the Vector Quantization(VQ).The CHF effectively represents the colour distribution within an image, while the BHF characterizes the image edge and texture[9].To solve the problem of Object-Centric Content Based Image Retrieval (CBIR), motivated by concepts from theory of cognitive sciences. According to cognitive models, there are two lobes in human brain; one is responsible to solve the problem of object recognition, while the other solves the problem of localization (or detection). It is the exchange of mutual information (back and forth) between these two lobes which enables the human brain to simultaneously detect and recognize the objects in a complex scene[10].For content-based

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image retrieval (CBIR) by exploiting the advantage of low complexity ordered-dither block truncation coding (ODBTC) for the generation of image content descriptor. In the encoding step, ODBTC compresses an image block into corresponding quantizers and bitmap image. Two image features are proposed to index an image, namely,colour co-occurrence feature (CCF) and bit pattern features (BPF), which are generated directly from the ODBTC encoded data streams without performing the decoding process. The CCF and BPF of an image are simply derived from the two ODBTC quantizers and bitmap, respectively, by involving the visual codebook [11].A new application of a well-studied image coding technique, namely block truncation coding (BTC). It is shown that BTC can not only be used for compressing colour images, it can also be conveniently used for content-based image retrieval from image databases. From the BTC compressed stream (without performing decoding), They derive two image content description features, one termed the block colour co-occurrence matrix (BCCM) and the other block pattern histogram (BPH).They use BCCM and BPH to compute the similarity measures of images for content-based image retrieval applications[12].

A Content based image retrieval method is a modification in original block truncation coding (BTC) for content based image retrieval system. Texture features are found by calculating the standard deviation of the Gabor filtered image. Gabor Filter Modified Block Truncation Coding based feature vector is extracted then compared with corresponding feature vector of images stored in the database. Images are retrieved based on the similarities features [13]. A survey some technical aspects of current content-based image retrieval systems and described the image segmentation in image processing and the features like neuro fuzzy technique, colour histogram, texture, and shape for accurate and effective Content Based Image Retrieval System after doing the deep study of related works[14].

A model for content-based image retrieval (CBIR) which depends only on extracting the most relevant features according to a feature selection technique. The suggested feature selection technique aims at selecting the optimal features that not only maximize the detection rate but also simplify the computation of the image retrieval process. The proposed model is divided into three main techniques, the first one is concerned with the features extraction from images database, the second is performing feature discrimination, and the third is concerned with the feature selection from the original ones[15]. A new method for image retrieval using high level semantic features is proposed. It is based on extraction of low level colour, shape and texture characteristics and their conversion into high level semantic features using fuzzy production rules, derived with the help of an image mining technique [16].

Effective colour image retrieval scheme for combining all the three i.e. colour, texture and shape information, which achieved higher retrieval efficiency. Firstly, the image is predetermined by using fast colour quantization algorithm with clusters merging, and then a small number of dominant colours and their percentages can be obtained. Secondly, the spatial texture features are extracted using a steerable filter decomposition, which offers an efficient and flexible approximation of early processing in the human visual system. Thirdly, the pseudo-Zernike moments of an image are used for shape descriptor, which have better features representation capabilities and are more robust to noise than other moment representations. Finally, the combination of the colour, texture and shape features provide a robust feature set for image retrieval [17].

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