Exploration of Modern knowledge based Approach for CBIR Systems: a Review

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Abstract— in this paper, we discuss use of knowledge and knowledge base approach in content based image retrieval. Applying knowledge base method in content base image retrieval system, we target semantic gap between actual result and human perception as per query. Knowledge base technology has become an established technology. Different requirements count nowadays when developing knowledge-based solutions for image retrieval. The knowledge base contains "domain knowledge," which normally provided by human experts or end user in query. Even modern content based image retrieval system researchers work on semantic gap reduction crisis. Many different techniques are invented to solve this problem. In this paper, we present use of knowledge base method in CBIR to reduce semantic gap. Knowledge is present in semantic features that are learned from different learning methods. Hence, improve performance of content based image retrieval system researchers work on semantic gap reduction crisis. Many different techniques are invented to solve this problem. Knowledge base method in CBIR to reduce semantic gap. Knowledge is present in semantic features that are learned from different learning methods. Hence, improve performance of content based image retrieval system researchers work on semantic gap reduction crisis. Many different techniques are invented to solve this problem.

Many new concepts for content based retrieval have been developed and prototyped. However, the dramatic increase in volume, details, complexity and the user demand for simultaneous access to multi-domain image data urgently requires new approaches for image image mining, multi-domain information management, knowledge management and sharing.

II. BASIC OF KNOWLEDGE-BASED SYSTEM

While building knowledge base, we have the problem of how to represent it. Human could just write down what we are told but, as the information grows, it becomes more and more difficult to keep track of the relationships between the items. To build the knowledge base, one problem is there how to represent it. Knowledge representation concerns the mismatch between human and computer 'memory'. We call these representations knowledge bases, and the operations on these knowledge bases, inference engine as shown in fig.1. The knowledge base contains "domain knowledge," which normally provided by human experts. It is typically very specialized for a particular problem domain. Knowledge base is often encoded as IF-THEN rules. It may incorporate heuristics or probabilities. It is a valuable commodity.

Fig.1. Basic Knowledge-Based System

Knowledge representation includes facts and Representation of the facts. Facts is truths about the real
world and what we represent. Representation of the facts defines the representation in terms of symbols that can be manipulated by programs. Knowledge Representation has Four General Representation Types such as Logical Representations, semantic Networks, Production Rules and Frames.

Knowledge-Based Systems are at the applied edge of research in Artificial Intelligence. The key factors that underly knowledge-based systems are knowledge acquisition, knowledge representation, and the application of large bodies of knowledge to the particular problem domain in which the knowledge-based system operates. Knowledge-Based Systems are Symbolic, Heuristic, Transparent and Flexible.

- **Symbolic:** It incorporates knowledge that is symbolic as well as numeric
- **Heuristic:** It reasons with judgmental, imprecise, and qualitative knowledge as well as with formal knowledge of established theories.
- **Transparent:** Its knowledge is simply and explicitly represented in terms familiar to specialists, and is separate from its inference procedures. It provides explanations of its line of reasoning and answers to queries about its knowledge.
- **Flexible:** It is incrementally refinable and extensible. More details can be specified to refine its performance; more concepts and links among concepts can be specified to broaden its range of applicability.

It is an expert system if it provides expert-level solutions.

### III. RELATED WORK

Content-based image retrieval system for lung cancer diagnosis developed with expert knowledge methods [1]. This system used for analysis chest CT scan data for the detection and diagnosis of lung cancer. In lung cancer computer-aided diagnosis systems, having an accurate ground truth is critical and time consuming. Because of the expert knowledge methods, this system became more intelligent and accurate.

Content-Based Medical Image Retrieval is developed using digital image processing knowledge base and a hybrid approach to perform content-based retrieval on medical image databases [3]. It takes advantage of a pre-processed case base that is batch updated. DICOM information is used to perform pre-filtering to speed up the retrieval process and an image processing knowledge base is used to dynamically reconfigure the most appropriated image processing procedures to perform the image feature extraction. It shows that pre-filtering can speed up considerably the retrieval process and also that some image features produce very similar results what leads to future work on defining the needed digital image processing knowledge base.

Smart knowledge techniques are proposed for efficient and robust content based image retrieval[4]. This content based image retrieval system use shape and color low level features for image retrieval with knowledge techniques. Here, knowledge combine with other image retrieval techniques for Content Based Image Retrieval result in high performance and improved relevance.

Knowledge-based clustering and its application with content based document image retrieval is really effective on Chinese keyword spotting [5]. Without OCR, document indexing directly based on image content is more general and convenient. However content-based Chinese document retrieval is difficult for the complexity of Chinese character structure and large class numbers. This system is based on a novel algorithm of knowledge-based clustering and gives a mechanism of serial batch clustering for large data set. Knowledge derives from an artificial document image collection. Chinese characters with high frequency are edited and synthesized to images automatically.

Architecture of a satellite image retrieval system is developed by combining concept of image information mining, multi-domain information management, knowledge management and sharing [6]. In order to have a flexible and dynamic image retrieval system, this system integrates Web technologies with modern pattern recognition systems applied to satellite images. This satellite image retrieval system can retrieve any kind of image, sensor, satellite, together with the kind of classifiers can be customized by the system user. More concretely, image, sensor and satellite features can be imported/exported and updated, and the algorithms can be imported/exported and refined/improved from the system. In particular, the image retrieval system allows the data and knowledge exchange. In order to equip the system with importing/exporting facilities for data and knowledge exchange, well known Web technologies are used: the XML for data exchange, and the Web Ontology Language for knowledge exchange.

Knowledge-based image retrieval system is developed by using unsupervised Kohonen’s self-organizing maps [7]. Most of the retrieval systems concentrate much on low-level features such as color, texture, shape and position. The present system is mainly developed based on the visual descriptors of the image such as color, texture and shape descriptors, etc. along with the high-level semantic analysis of the image content through different processing modules in the proposed architecture. Similarity measures are proposed and the performance evaluation has been done. As an image browser, apart from retrieving images by image example, it also supports query by natural language. This system works well both online and offline.
this system used unsupervised Kohonen’s self-organizing maps technique to train the images and our own indexing scheme with reference system based on R-tree SOM. This system use fuzzy color histogram for color retrieval, and Lie descriptors for the retrieval of shapes.

A content Based Image Retrieval system integrates an automatic generated knowledge base in a CBIR system based on relevance feedback method [8]. An extensive analysis of the database structure has been carried out using fuzzy clustering algorithms to build the knowledge base. This knowledge base is used to make users aware of the overall organization of the image database during the query process. The relevance feedback method has been used to model the cluster structure as well as the correspondence between high-level user concepts and their low-level machine representation by performing retrievals according to multiple queries supplied by the user during the course of a retrieval session.

Nowadays, image search engine is develop by mainly using two kinds of technique traditional Text-Based Image Retrieval and Content-Based Image Retrieval. Because of the limitation in both methods, the semantic gap is bottleneck. To overcome this, new image retrieval method is developed for content based image retrieval system, which is based on semantic network. The technology requires the use of the knowledge library for storing semantic networks and mapping [9]. This creates a mapping from low-level image visual features to high-level semantic, and attempt to identify the semantic concept of visual features. This system introduces user feedback, guide search results to the optimal direction, and make it to fit the natural way for humans to understand image.

As we know, current content based image retrieval system are suffer from semantic gap. To overcome this semantic gap, a new approach is proposed for semantic satellite image retrieval with knowledge base techniques, describing the semantic image content and managing uncertain information [10]. It’s based on ontology model which represents spatial knowledge in order to provide semantic understanding of image content. This retrieval system is based on two modules: ontological model merging and semantic strategic image retrieval. The first module allows developing ontological models which represent spatial knowledge of the satellite image, and managing uncertain information. The second module allows retrieving satellite images basing on their ontological model. In order to improve the quality of retrieval system and to facilitate the retrieval process, this CBIR propose two retrieval strategies which are the opportunist strategy and the hypothetic strategy which improve the quality of image

With knowledge representation technique, Content-based Medical Image Retrieval is developed for medical images [11]. Current CBMIR is not sufficient to capture the semantic content of an image and difficult to provide good results according to the predefined categories in the medical domain for less using the medical knowledge. This CBMIR system proposes a mapping modelling of visual feature and knowledge representation is proposed to approach for medical image retrieval. Firstly, the low-level fusion visual features are extracted based on intensity, texture, and their extended versions. Secondly, a set of disjoint semantic tokens with appearance in lung CT images is selected to define a vocabulary based on medical knowledge representation. Finally, a mapping modeling is investigated to associate low-level visual image features with their high-level semantic.

With Semi-automatic knowledge extraction techniques, a new automatic content based image retrieval system is proposed [12]. Automatic indexing and retrieval of digital data poses major challenges. The main problem arises from the ever increasing mass of digital media and the lack of efficient methods for indexing and retrieval of such data based on the semantic content rather than keywords. To enable intelligent web interactions, or even web filtering, a capable of interpreting the information base in an intelligent manner is needed. For a number of years research has been ongoing in the field of ontological engineering with the aim of using ontologies to add such knowledge to information. In this paper, we describe the architecture of a system Analysis and semantic metadata Management designed to automatically and intelligently index huge repositories of special effects video clips, based on their semantic content, using a network of scalable ontologies to enable intelligent retrieval.

For satellite images, contented based image retrieval system is developed using Knowledge-based region labeling for remote sensing image interpretation [13]. The increasing availability of High Spatial Resolution satellite images is an opportunity to characterize and identify urban objects. Thus, the augmentation of the precision led to a need of new image analysis methods using region-based approaches. In this field, an important challenge is the use of domain knowledge for automatic urban objects identification, and a major issue is the formalization and exploitation of this knowledge. This system builds a knowledge-base of urban objects allowing performing the interpretation of HSR images in order to help urban planners to automatically map the territory. The knowledge-base is used to assign segmented regions into semantic objects (i.e. concepts of the knowledge-base). A
matching process between the regions and the concepts of the knowledge-base is proposed, allowing bridging the semantic gap between the images content and the interpretation. This system automatically identify urban objects using the domain knowledge.

an image retrieval framework based on a rule base system is introduced use clustering knowledge techniques [14]. The proposed framework makes use of color and texture features, respectively called color co-occurrence matrix (CCM) and difference between pixels of scan pattern (DBPSP). These features are used to perform the image mining for acquiring clustering knowledge from a large empirical images database. Irrelevance between images of the same cluster is precisely considered in the proposed framework through a relevance feedback phase followed by a novel clustering refinement model. The images and their corresponding classes pass to a rule base system for extracting a set of accurate rules. These rules are pruning and may reduce the dimensionality of the extracted features. The advantage of the proposed framework is reflected in the retrieval process, which is limited to the images in the class of rule matched with the query image features.

Cross-media retrieval focuses on searching multimedia data of different modalities with content-based methods. Most of those methods are designed for multimedia retrieval in single modality, such as image retrieval and audio retrieval. A novel cross-media retrieval approach is presented for general multimedia data, such as image and audio by fusing inherent and external knowledge with nonlinear learning [15]. First, image and audio samples are mapped into an isomorphic feature subspace with kernel-based method; second, multimedia semantics is learned from inherent feature correlation by local linear regression; also a graph model is constructed to utilize external knowledge from relevance feedback; then we build a unified objective function integrating inherent and external learning results, and by solving the objective function.

IV. CONCLUSION

In this paper, we focus on use knowledge base techniques for content base image retrieval. With the help of knowledge, content base image retrieval became more and more intelligent. Knowledge based CBIR used for satellite images, medical images as well as many other scientific and real life applications etc. Large amounts of spatial data are becoming available today due to the rapid development of remote sensing techniques. Several retrieval systems are proposed to retrieve necessary, interested and effective information such as key-word based image retrieval and content based image retrieval. However, retrieval result faraway from human perception due to the well gap between visual features and semantic concepts. This semantic gap and human perception mismatch problem is solved by using knowledge based techniques in content based image retrieval.

REFERENCES


