This is the extended abstract of J. You and Harvey A. Cohen , *A New Approach to Image Retrieval by Fast Indexing and Searching* DICTA-97, Auckland, N.Z., Dec 10-12, pp **425 - 430**

A NEW APPROACH TO IMAGE RETRIEVAL

BY FAST INDEXING AND SEARCHING

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Extended Abstract

The Internet and wireless communication offer unprecedented access to information. To effectively collect useful information from massive available sources requires the development of new methodologies and techniques that can substantially increase speed and flexibility in a distributed environment. Focusing on content-based image retrieval, this paper presents the use of transportable agents as the steering tool for dynamic indexing and flexible searching.

Very large collection of images (image libraries) are becoming common and networking and wireless communication offer users unprecedented access to theser preference for accessing images in these collections based on their content. Creating indices for these collections by hand is unlikely to be successful, because these databases can be gigantic [1]. Furthermore, it can be very difficult to impose order on these collections. Consequently, it is difficult to have a uniformed searching engine that suits various image content. Focusing on content-based image retrieval, this paper presents the use of transportable agents as the steering tool for a flexible approach to indexing and searching distributed image libraries, which can

* simultaneously extract useful pictorial information from different image collection sources on the network,
* categorise images by an index-on-demand scheme that allows users to set up different index structures for fast searching, and
* support a flexible searching scheme that allows users to choose effective met
* support a flexible searching scheme that allows users to choose effective methods to retrieve images.

Although digital image libraries are distributed located, most of the current researches on content-based image retrieval has been focused on a single-machine-based system. The methods developed for such a system cannot be search images with specific features from distributed image collections, it is -essential to have a sort of ``agents'' that can be launched to create index based on specific image feature or to search

specific images with given content network-transparent image indexing and searching, which is featured as

* platform-independent,
* high-performance in terms of speed , cost and flexibility,
* easy and friendly user access.

In addition to the functions provided by the traditional transaction/RPC-based approach, a transportable agent embedded with specific indexing or searching engines can migrate between computers and perform specific functions on site, can create other objects on different computers for parallel indexing and searching, and can be synchronised and reclaimed. The impact of using transportable agents is beyond indexing and searching image collections. It can flexibility.

This paper is organised in the following sections to present a platform-independent transportable agent as tool to support dynamic image indexing and flexible image searching.

Platform-Independent Transportable Agent

Transportable agents are programs, typically written in a safe language, such as, TCL and Telescript, which may be dispatched from a client computer and transported to a remote server computer for execution. As an emerge paradig supported by traditional client-server model. Depending on the extra features added to the safe language, an agent not only can migrate between computers, it also can fork and join. These extra features make transportable agents more suitable for transactions and information retrievals that require high flexibility [2].

In the work reported in this paper, we extended an available Java-based Agent, such as Java-To-Go from Berkeley [3]. Initially, we added migration, communication, synchronization, control and management functions to the package deployed on servers first, and then requests can be sent from the client to the In the second stage, a control mechanism (like a Workflow) will be added intots- the package developed in the first stage. An agent then follows the control strategy to travel between servers and performs its functions on its path. Finally, the agent can be reclaimed from the final destination. In addition, a transportable agent can be launched from a mobile computer to the Internet. In such a case, after the launch of the agent, the mobile computer will be disconnected from the agent. On the completion of the specifie transportable agent from the final destination.

Dynamic Image Indexing

In this section we address the following two central problems related to image indexing:

* image feature extraction

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* index structure

First we introduced new algorithms for multiple image feature selection and representation. In the computer vision approach to image indexing, the user wants to give each image a relevance score in terms of certain attributes. These attributes are computed from pixel values and may correspond to local colour, texture, or matched filter response, the shape or arrangement of region features or models (less than a dozen) will give better performance. Unlike existing approaches [5] which mostly rely on different individual operators to detect image feature points, we extended our previous work on fractional functions as discrimination functions to perfor robust (in the presence of noise), selective (band limited) and contextual feature extraction [6]. Such feature points will be further grouped into coarsed `spatial-statistical' measurement to represent texture feature in image, which involves the computation of statistics of various local image functions. Rather than representing such texture measurement in its true value as reporte d in the related literatures [7], [8] and our previous studies [9], we extended the fuzzy compactness approach [10] to measure fuzziness in terms of texture energy [11] via fuzzy set [12]. Furthermore, visual shape of an object is another important datum in real world. In general, it is difficult to uniquely describe an object's shape in terms of alphanumeric descriptors [13].We proposed to combine invariant moments computing and B-Spline curve representation to represent shape features. Our parallel algorithms include parallel shape boundary tracing, parallel computing the shape moments, parallel computing other shape attributes using moments and iterative B-spline parameter shape attribute. We implemented these algorithms in a transportable agents and deliver it to distributed image collections for indexing.

Second we organised the index structures based on the basic image features such as colour, texture and shape. We will develop hierarchical structures to construct image feature index.

Flexible Image Searching

The problem of how to measure image similarity is one of the key issues for image searching. It is unreasonable to expect that searching image library only attributes of the picture conspire to generate the rich image content. Thus many attributes need to be considered simultaneously for effective content-based image searching. We will combine multiple similarity measures, which individually represent colour, texture and shape, to cooperate for effective similarity measurement. Rather than combining different features by fixed weights as reported in some research and industrial systems [14], we took an important step in combining measures by ranking each image when ordered by relevance score in terms of its fuzziness membership which is introduced in the previous stage. We further combined ranks of different features with unequal weights to get new similarity measure. The weight and fuzziness reference value will be determined by the user dynamically. The library searching was performed by the transportable agent.

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In this paper, our final objective is to demonstrate the feasibilities of our approach to an image archiving system. We used images involved in MIT Photobook.

Key words and phrases:

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Content-based image retrieval, image indexing and searching, feature extraction, transportable agents, distributed computing.

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