Rapid Relevance Feedback Strategy Based on Distributed CBIR System

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ABSTRACT

This article describes the capability of online data storage which has been enhanced by the emergence of cloud datacenter development. Distributed Hash Table (DHT) based image retrieval system using locality sensitive hash (LSH) has provided an efficient way to set up distributed Content Based Image Retrieval (CBIR) frameworks. However, with the fixed LSH function adopted, LSH and other codebook-based distributed retrieval systems are facing the problem of flexibility, and also are difficult to satisfy the user’s demand. In this article, LRFMIR is proposed to introduce semantic search into DHT based CBIR system. LRFMIR is established on a DHT based network, where a flexible result truncating strategy is employed to fuse provided results by using multiple features measurements. Experiments show that LRFMIR provides a higher accuracy and recall rate than single feature employed retrieval systems, and possesses good load balancing and query efficiency performance.

KEYWORDS

Content Based Image Retrieval, Distributed Hash Table, Feature Reweighting, Locality Sensitive Hash, Relevance Feedback

1. INTRODUCTION

Content Based Image Retrieval (CBIR) is considered as the mainstay of image retrieval systems. Due to the complexity of multimedia contents, image understanding and semantic searching have become a difficult yet interesting issue in the field. Text-based image retrieval systems requires manually annotated information provided by text descriptors, and the considerable level of human labor requirement becomes the bottleneck of these approaches (Ying et al., 2007). Meanwhile, the storage of the large-scale image database itself reaches some problems nowadays, as the traditional centered database may not meet the need of searching on the scaled datasets.

Cloud computing enables users to flexibly access reconfigurable computing resources without the burden of managing and maintaining the resources (Peng et al., 2012). It has the essential characteristics including reliable and infinite storage capacity, data access independent of locations and time, and dynamical resources provision in a multi-tenant way to avoid costly wasting (Dikaiakos et al., 2009). Due to these features, cloud computing has been acquired by the distributed storage and retrieval systems nowadays.

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With the employment of the peer-to-peer (P2P) paradigm, flexible and reliable frameworks for data storing and querying tasks can be provided, which allow designing CBIR systems on large databases. The typical CBIR systems are constructed in similar ways: the features of images are extracted by the system, images containing similar features are considered related, and methods are provided to distinguish whether the images are similar or not. In the P2P paradigm employed system, the distributed storing system provides a method to store images separately while maintaining the searching performance. By using these designs, the LRFIR system is set up to provide CBIR functions on distributed systems (Liao et al., 2014). Different from Approximate Nearest Neighborhood (ANN) algorithms (Ozan et al., 2016), LRFIR provides algorithms of finding exact results instead of ranked list of whole dataset, which is suitable for P2P searches, but the performance is considered promotable.

In real systems, the user of a retrieval system may propose different forms of searching demands, and sometimes those demands are related hierarchically. For example, user may be willing to find either the other traffic sign or exactly the same sign delivered in a searching query. Users may use different benchmarks to judge similarity rather than using single feature distance, e.g., when retrieve images using sketches (Peng et al., 2017), color sensitive features may lead to worse performance compared to texture or shape features.

These two kinds of semantic mismatch are described as gradient mismatch and objective mismatch. In both situations, the cause of mismatch could be somehow related to the features used to express the image. Different features used to describe images such as Multi-Texton Histogram (MTH) (Liu et al., 2010) and Speed-up Robust Features (SURF) (Bay et al., 2006), have different capabilities to measure images in different dimensions. For instance, when finding similar images in a cloth dataset, texture and color information may each represent different categories of similarity, yet users may only pay attention to one kind of them. Hence the problem is to find a combination method to provide high recall rate by using precise feature while maintaining the accuracy by reducing the interference of imprecise features.

To overcome this problem, it is necessary to find a way to let the retrieval system understand the high level semantic information instead of low level image features, which is very difficult to realize. The semantic gap between the high level perceive and the low-level features is hard to cross, and thus a different way of dealing with the semantic gap is proposed: let the retrieval system imitate instead of understanding the choices made by following the high level semantic information, which makes the system function like human.

In this paper, a speed up relevance feedback strategy is proposed and a novel CBIR system called LSH-based and Relevance feedback for Multiple Feature Image Retrieval (LRFMIR) is presented for the large scale P2P datacenter to solve the paradox presented above. LRFMIR supports semantic similarity search by providing a flexible strategy of combining several different features, which allows the system to provide retrieval results that meet different demands. Several traditional techniques including MTH feature, SURF feature, the Locality-Sensitive Hashing (LSH) (Haghani et al., 2009) algorithm and the Chord network are used to form a simple yet efficient distributed image retrieval system, and the novel relevance feedback strategy is deployed on it to further promote the performance of the retrieval system. Experimental results show that the relevance feedback strategy further boosted the performance of the distributed CBIR system on different image datasets.

The rest of this paper is organized as follows. Section 2 shows an overview of related work. Section 3 presents the framework of LRFMIR. Section 4 introduces the workflow of LRFMIR including query processing as well as index construction and refreshing. Section 5 evaluates the performance of our approach. Finally, section 6 concludes our discussion.

2. RELATED WORK

Despite its relatively short history, relevance feedback evolves consistently and remains an active research topic (Yongdong et al., 2014, Vimina et al., 2015). The main intuition behind heuristic-based
ACRONYM: Context Metrics for Linking People to User-Generated Media Content
www.igi-global.com/chapter/acronym-context-metrics-linking-people/76177?camid=4v1a

Learning of OWL Class Descriptions on Very Large Knowledge Bases
www.igi-global.com/article/learning-owl-class-descriptions-very/4113?camid=4v1a