A Survey on Various Optimization Techniques to Retrieve Text and Images

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***Abstract*—The traditional image retrieval approach allows users to create, share and comment media on a large scale. The large scale data not only promote users in sharing and organizing multimedia data, but provide useful information to develop multimedia retrieval in terms of text, images and all other forms. Numerous studies have been developed to effectively meet the user's requirements for the past few decades. There are various ranking methods developed to deal with the image and text retrieval systems. A user's request is taken to generate a rank list based on various features of text and images, including, content, texture, shape and color. The central contention is handled by a semantic search and by providing re-ranking procedure. In this survey, various approaches for retrieving text and images using various retrieval systems, semantic search and ranking based techniques are discussed.**

I. INTRODUCTION

Searching by giving a keyword is one of the simplest and efficient methods for retrieving text and images on a large scale. But the investigations have indicated that, most of the searches produce irrelevant results. There are certain reasons pertaining to the search results such as, irrelevant queries and user's wrong interpretations for the same query. One solution to address these issues is the ranking approach. Here, the user's information is measured to produce the exact target of the search results. Re-ranking is considered as an important factor to improve the satisfaction of the users. Regarding the re-ranking of multimedia data [1] such as text, image and video, one more issue has to be addressed in terms of high-level and low-level features of annotations, metadata and other media types. The latter can be stored easily within a database. With the large and widespread development of search engines, retrieving by re-ranking has the potential to improve the searching experience.

When the user queries are compared with un-ranked list, the rank of the text and images are predicted only by the queries. In re-ranking, both the query relevance and the preference of the users are considered to produce the exact search result. Here, a natural two-step computation scheme is followed: re-ranked score between the query and the document is computed to find the result of estimating the user's preference to that particular query. Finally, a merge operation is implemented to generate a final rank list. This two-step computation scheme suffers from certain problems such as, interpretation and intuition. Therefore, determining the merging strategy is not so trivial. In this survey various methods to retrieve text and images are discussed. Also, various approaches to retrieve information and images using ranking are interpreted and their limitations are discussed.

The paper is organized as follows. Section 2 describes the Information retrieval system. Section 3 describes the image retrieval systems. Section 4 describes the semantics enabled search for retrieval systems. Section 5 implies the ranking in information and image retrieval systems. Section 6 describes the result re-ranking technique for both text and images. Section 7 describes the various results and discussions' regarding the survey and the survey is concluded in section 8.

II. INFORMATION RETRIEVAL SYSTEM

The growth in volume of data, particularly seen on the internet allows the users to obtain redundant results which may slow down indexing time and searching time. Information retrieval is concerned with various techniques to organize information [2]. A typical interface between user and information retrieval system is the user, submitting queries. Information retrieval IR [3] system estimates the user's query by assigning a numeric score to every documents and by ranking the documents based on the scores. A ranked list is returned which has some relevance to a user's request to that of the query. Steps to retrieve information are as follows:

2.1 Spelling Based Evaluation

Language is a subset of affixes, effectiveness of words and their corresponding meanings. There are many combinations with many morphological omissions. The precision of certain documents is measured by the performance of documents with its corrected percentage [2] . The documents are recalled by finding the results of user's preferred keywords. Here, no desired documents should be eliminated. The keyword is compared with the dictionary find the correct spelling. The corrected spellings are considered as queries and it is used for further evaluations.

2.2 Query-Based Evaluations

Information retrieval needs query to make assessments to certain documents. Certain paradigms are followed for collecting the queries and to retrieve the information. A

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test set is formed by collecting a large number of queries. For each of the queries, the convinced amount of documents is collected, associated with the query name. User's assessments are made to get the relevance judgment and it is ranked. Here, the average measure is used to evaluate the performance of the ranked queries.

III. Image Retrieval System

Image retrieval system (IRS) intends users to receive a query by means of keywords and it is expected to return some set of images that satisfies the user's request. The main aim of image retrieval systems [4] is to extract the relevant images from a large set of images containing irrelevant images. The primary goal of an image retrieval system is to bridge the gap between user's expectation and visual or textual descriptions. Thus, image retrieval systems [5] can be implemented into four types. They are,

- Content-Based Image Retrieval (CBIR)
- Textual-Based Image Retrieval (TBIR)
- Query-Based Image Retrieval (QBIR)
- Annotation-Based Image Retrieval (ABIR)

3.1 Content-Based Image Retrieval

Content based image retrieval approach [6] allows users to retrieve image semantically from a database based on some automatically-derived features of an image. CBIR approach allows users to organize digital images by considering their visual content. Using this system, users can distinguish different regions of images based on texture, shape and color. Behind CBIR [5] , major conception is to represent the image by some set of visual features. This system is successful in presenting the images by a set of visual representations. But there is difficulty in retrieving images for identifying the concept of image precisely.

3.2 Textual-Based Image Retrieval

To enhance the accuracy of the image annotation, TBIR (Textual-Based Image Annotation) [7] is considered. Here, the textual information such as, file name, title, keywords and URL is extracted and tags are given to identify the classification of images. Text-based search for retrieval of images provides better results than compared with Content-Based search. Here, several approaches to rely textual information in the form of image metadata using user tags are maintained.

3.3 Query-Based Image Retrieval

QBIR approach is considered as one of the effective ways which helps the users to search and retrieve images easily. However, queries are short and general and sometimes it is difficult to formulate the proper queries. In order to avoid these issues, query recommendation [8] is considered. By this method, multiple searches and clicks of users are covered over recommendations by queries.

3.4 Annotation-Based Image Retrieval

Image annotations [9] are mostly represented by considering single instance or by multiple instance. For certain concepts, the performances will be in a mixed state. Therefore, single instance to represent images will be most suitable, while for furthers, the multiple instance representations are considered. For certain photo sharing websites, photo annotations [10] are considered to visualize the concepts and to retrieve images. Many outcomes indicate that using annotation, promising results are obtained to retrieve images in a short period of time.

IV. Semantic Enabled Search for Retrieval Systems

Keyword-based searching mechanisms, in spite of using queries for ease of retrieval systems, have failed to represent the semantics to represent the detailed information in terms of both information and image. The major conception of information retrieval [11] is performed by searching the meaning rather than searching literal strings. The major contribution of retrieving information is the comprehensive semantic search model that tackles the challenges of the enormous web environment by integrating keyword and its associated semantics.

Semantic based image retrieval [12] is introduced to combine the visual features and to fully capture the high level concept of image sets. In addition, the content of these images with the semantic terms allows users to access images through an easy and preferred way. Semantic search [13] handles the process of extraction, recognition and the extensions to achieve the following objectives:

- To determine and analyze some semantic features to develop semantic structure and pattern.
- To analyze the user's query for extending semantic features to match and generate the contents.

4.1 Bridging the Semantic Gap

One of the challenging problems is to bridge a semantic gap [12] in retrieval systems. To fulfill the user's satisfaction in semantic terms is a serious issue. To solve this issue, a unified approach [14] is developed to make a fusion between contents and tags : 1) To build a unified graph and to fuse the visual similarity between query and tag. 2) A novel based approach is developed to balance the query contents and tags.

4.2 Semantic Content Representation

For a large dataset, the effectiveness and the efficiency can be obtained by producing semantic content [15] . This content cannot be created automatically; it requires some human contribution to a certain degree. A set of successful communities [16] such as online communities, social web communities and other open source software communities analyze the semantic annotation tools to embed some mechanisms to create a semantic content. If the produced semantic content is theoretical , the tasks will be highly dependent on human intervention and it cannot be reliable. Therefore, semantic content must be created carefully to develop the retrieval systems.

V. Ranking in Retrieval Systems

5.1 Ranking in Information Retrieval System

The information retrieved from various systems should be ranked based on the preference of the users. Information is ranked based on certain methodologies. They are,

- Ranking by relevance
- Ranking by consequence

5.1.1 Ranking by Relevance

The main aim of ranking by relevance is to produce a rank list between the documents and the query. In this method, each individual document takes as inputs and it is computed to measure the scores between the document and the query. Thereby, the documents are sorted in descending order. Contextual information retrieval [17] uses various user's context and techniques which are ranked by relevance measurements of queries.

5.1.2 Ranking by Consequence

The documents are ranked based on their own importance. Page ranking [18] acts as one of such examples. In this method, web page is ranked by considering the hyperlink structure. Random clicks of users are extracted at a particular webpage to rank the webpage. The page rank value is only dependent on that particular webpage. Finally, efficient pages are retrieved based on the page rank values.

5.2 Ranking in Image Retrieval Systems

A collection of images including their properties such as texture, shape and color are taken. These images are ranked in a decreasing order [19] according to the image descriptor. Certain methods to rank the images are described.

5.2.1 Query Refinement

Query refinement [20] is performed by modifying original queries according to the user's expectations. Refinement includes the augmentation of queries along with a change in original weight of every query term. Some context of the information is collected from the users and a generic technique is provided to expand the terms. This is done by mapping the queries with dictionary to find the user-specific topic and this is considered as query refinement.

5.2.2 Result Filtration and Ranking

Result filtration is done by filtering irrelevant results that are not of interest to the particular user. For a higher level of results, low level filtration is not consistent. For a high level filtration, object bank [21] method is employed to produce a large-scale variant. For an efficient and fast filtration vocabulary tree [22] method is undergone. Here, a geometric similarity between descriptor and augmentation of queries is related to producing stable scores. A similarity between user's interests and document topics is found and the queries are formalized to measure the user relevance. User relevance is given a higher rank than compared to other document topics. These queries are filtered and stored in a database.

VI. Result Re-ranking

Re-ranking acts as the one of the efficient ways to improve the results in searching and retrieving. A particular query is given to retrieve a set of data and images from a database. In re-ranking information [23], temporal queries are modified based on the number of documents used. A simple re-ranking technique has an adverse effect on enhancement of information retrieval. A typical process was handled in [24] where, overall ranking scores not only depends on similarity matching between documents and query but also among the document's topics and user's interests.

Some reliable mechanisms [25] are followed to re-rank the results for image retrieval : 1) visual reliability. The images that are closely related to that of search query will be visually similar. These images which occur recurrently in the first few web pages will be given high ranks. 2) Visual saliency. This refers to visually catching the user's eye in selecting the most relevant images that match certain queries. These two mechanisms can be effectively utilized to re-rank the images into a more satisfactory level.

VII. Results and Discussions

The results of the survey are represented in the table. 1. Here, various efficient approaches have been compared to search and retrieve text and images for a large dataset. The results imply that, by using re-ranking techniques, user queries are considered to produce more satisfactory results than compared with other methods to retrieve text and images.

TABLE.1
VARIOUS TECHNIQUES FOR RETRIEVING TEXT AND IMAGES

Authors	Year and reference	Technique	Performance
M. Sanderson	2010[2]	Information retrieval (IR)	Determining the interface between user and queries
O. Kashefi, et al.	2010[3]	Test collection based evaluation of information retrieval	Execute the performance of documents with its corrected spellings
H. Kekre, et al.	2010[4]	Image retrieval system	Efficient method to retrieve images by filtering irrelevant images.

J. Abbas, et al	2010[7]	Text-Based Image Retrieval	Enhance the accuracy of image retrieval
S. Nowak, et al.	2011[10]	Photo annotations	Visualizing concepts to retrieve images
M. Fernández, et al.	2011[11]	Semantic based information retrieval	Query and its associated meaning are handled for result generation
H. H. Wang, et al.	2010[12]	Semantic based image retrieval	Handles the visual features of images with the query contents
K. Siorpaes and E. Simperl	2010[15]	Semantic content creation	Efficient method to create semantic content
T.-Y. Liu	2011[18]	Page ranking	Ranking webpage by considering the hyperlink structure.
S. S. Tsai, et al.	2010[22]	Vocabulary tree	Stable scores are produced by considering the geometric similarity
J. Huang, et al.	2011[24]	Re-ranking technique for information retrieval	Re-ranking by considering document's topics and a user's interest
J. Huang, et al	2011[25]	Re-ranking technique for image retrieval	Re-ranking based on some reliable mechanisms to retrieve images

VIII. Conclusion

The paper constitutes the survey results for various approaches representing text and image retrieval systems. The survey depicts several methodologies, including context, textual, annotation, semantic and ranking approaches. The results of the survey show that retrieval of text and images of large data sets are not consistent. Retrieval of a large dataset for text and information from multiple databases by demand re-ranking is considered as our future work.

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