Topic Diversity Method for Image Re-Ranking

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Abstract—This paper involves a topic diverse ranking approach for tag based image retrieval for promoting the topic coverage performance. An attribute assisted hyper graph learning method is to reorder the ranked images which is returned from search engine based on textual query. Hyper graph is thus able to improve re-ranking performance by mining visual feature as well as attribute information. The hyper graph model has been widely used to exploit the correlation information among the images[1]. A tag graph based on the similarity between each tag is constructed. Then, the community detection method is conducted to mine the topic community of each tag. After that, inter-community and intra-community ranking are introduced to obtain the final retrieved results.

Keywords—tag-based image retrieval, hyper graph, topic community, image search, re-ranking.

I. INTRODUCTION

As the usage of Social media is growing nowadays, there are many images and videos that are everywhere on the Internet. This phenomenon has brought great challenges to multimedia storage, indexing and retrieval.[2] Tag-based image search is more commonly used in social media than content based image retrieval and content understanding. Due to the low relevance and diversity performance of initial retrieval results, the ranking problem in the tag-based image retrieval has gained researchers’ wide attention. So the following challenges block the path for the development of re-ranking technologies in the tag-based image retrieval.

i. Mismatch of Tag

In Social websites, tagging requires users to label their uploaded images with their own keywords and share them with others.[3] Image annotation is used for labelling images. Every user has their own way to tag images. Thus, the same image can be delivered in several ways with several different tags according to the background behind the image. In this case, there will be irrelevant tags introduced.

ii. Query Ambiguity

An issue in the ranking of the tag-based social image retrieval[4] is to solve these problems constantly. The “tag mismatch” problem is concerned with the tag refinement, tag relevance ranking and image relevance ranking approaches[5] have been given to overcome it. As for the “query ambiguity” problem, an effective approach is to provide diverse retrieval results that overall cover multiple topics that comes under that query. Currently, image clustering and duplicate removal[6] are the major approaches in prevent from the diversity problem. To diversify the top ranked search results from the semantic aspect, the topic community belongs to each image should be considered.

At first, apply graph clustering to assign the images to clusters, then utilize random walk to obtain the final result. The diversity is achieved by setting the transition probability of two images in different clusters higher than that in the same cluster. They first organize images to different clusters and finally use a greedy algorithm to obtain the highest topic cover score list.
Dang-Nguyen et al first propose a clustering algorithm to obtain a topic tree, and then sort topics according to the number of images in the topic. In each cluster, the image uploaded by the user who has highest visual score is selected as the top ranked image. The second image is the one which has the largest distance to the first image. The third image is chosen as the image with the largest distance to both two previous images.

It is used for constructing the tag graph and to mine the topic community to diversify the semantic information of the retrieval results. Then a topic diverse ranking approach considering the topic coverage of the retrieved images is proposed. The inter-community ranking method and intra-community ranking methods are proposed to achieve a good trade-off between the diversity and relevance performance.

II. RELATED WORK

Relevance Ranking Approach

It is used to directly rank the raw photos without undergoing any intermediate tag processing, it utilized an optimization framework to automatically rank images based on their relevance scores to a given tag. Visual consistency between images and semantic information of tags are both considered. A hypergraph learning approach is proposed, which aims to estimate the relevance of images. They investigate the bag-of-words and bag-of-visual words of images, which is extracted from both the visual and textual information of image. A support vector machine classifier per query to learn relevance scores of its associated photos.

A two-step similarity ranking scheme that aims to preserve both visual and semantic resemblance in the similarity ranking. In order to achieve this, a self-tune manifold ranking solution that focuses on the visual-based similarity ranking and a semantic-oriented similarity re-ranking method are included. An image ranking method which represents image by sets of regions and apply these representations to the multiple instance learning based on the max margin framework.

Enhancement of Diversity

The relevance based image retrieval approaches can improve the relevance performance, but the diversity performance of searching is also very important. Many researchers dedicated their extensive efforts to make the top ranked results diversified. Different from clustering, a re-ranking method is proposed to meet users’ ambiguous needs by analyzing the topic richness. A diverse relevance ranking algorithm to maximize average diverse ranking in the optimization framework by mining the semantic similarities of social images based on their visual features and tags is proposed. A social image ranking scheme is to retrieve the images to meet the relevance and diversity performance according to the ambiguity level of the given query.

An approach for diversifying the landmark summarization from diverse viewpoints based on the relative viewpoint of each image is proposed. The relative viewpoint of each image is represented with a 4-dimensional viewpoint vector. They select the relevant images with large viewpoint variations as top ranked images.

III. ALGORITHM

GREEDY ALGORITHM

A Greedy Algorithm is an algorithmic paradigm that is used to follow the problem solving heuristic of making the locally optimal choice at each stage with the hope of finding a global optimum.
For example, a greedy strategy for the traveling salesman problem is the following heuristic: "At each stage visit an unvisited city nearest to the current city". This heuristic need not find a best solution, but terminates in a reasonable number of steps; finding an optimal solution typically requires unreasonably many steps. In mathematical optimization, greedy algorithms solve combinatorial problem shaming the properties of Metroid.

In general greedy algorithms there are five components:
1. A candidate set, from which a solution is created
2. A selection function, which chooses the best candidate to be added to the solution
3. A feasibility function, that is used to determine if a candidate can be used to contribute to a solution
4. An objective function, which assigns a value to a solution, or a partial solution, and
5. A solution function, which will indicate when we have discovered a complete solution

**Fig1. Datasets**

**IV. PROBLEM DEFINITION**

The modules are
- Web Image Search Re-Ranking
- Image Annotation
- Image Retagging Approach
- Matching module
- Ranking Module

**i Web Image Search Re-Ranking**

Web image search re-ranking is emerging as one of the promising techniques for automotive boosting of retrieval precision which is given in Fig:2. The basic functionality is to reorder the retrieved multimedia entities to achieve the optimal rank list by exploiting visual content in a second step.

In particular, given a textual query, an initial list of multimedia entities is returned using the text-based retrieval scheme. Subsequently, the most Relevant results are moved to the top of the result list while the less relevant ones are reordered to the lower ranks.

The whole search position at the top ranks can be enhanced greatly. According to the statistical analysis model which is used, the existing re-ranking approaches can roughly be categorized into three categories including the clustering based method, classification based method and graph based methods.

**ii Image Annotation**

The aim of annotation methods is to attach textual labels to un-annotated images or the unlabelled images, as the descriptions of the content or objects in the images. The final goal
of image annotation is mostly to perform image retrieval by providing users with a text based interface for search.

The image annotation is used because as the countless images exist in our lives it is not possible to annotate them all by hand. And so annotation by computer is a potential and promising solution to this problem precisely. The ability to annotate images semantically based on the objects that they contain is essential in image retrieval as it provides the mechanism to take advantage of existing text retrieval systems.

### iii Image Retagging Approach

The high-level meanings can be associated to images or image regions through image tagging, also known as captioning or annotations. Tagging improves the content of images and helps image retrieval search engines to better retrieve desired images in response to text queries.

For this wordnet is been integrated. Images can be tagged with a variety of descriptions, keywords and structured metadata. While image tags are a set of keywords, metadata is a structured way of expressing the image descriptions.

### iv Matching Module:

Matching Module takes SPARQL query as input from the Query Engine and executes the same on the Semantic Knowledge Base to retrieve the most related images. SPARQL Query is an RDF query language, which is a semantic query language for databases, able to retrieve and manipulate data stored in Resource Description Framework format. If the query results in successful search, the output images are passed to ranking module for result ranking.

### iv Ranking Module:

Ranking module is responsible to rank the images according to relevance with the user query. The resultant image set passed by Query Matching Module contains image and matching value (which is calculated as a sum of matched semantic concepts with reference to user query); the result set is sorted in descending order according to the matching value. After sorting, top ten images are displayed to the user (i.e. most matched images are showed first) and the remaining are displayed on user request in the decreasing order.

![Architecture for retrieving images from web engines and graph is generated](image_url)
A topic diverse re-ranking method for tag-based image retrieval is proposed. In this topic diverse re-ranking method, inter-community ranking and intra-community ranking are carried out to get satisfactory retrieved results. Tag graph construction and community detection are two effective ways to enhance the diversity. Besides, each tag’s word vector is trained by using the Word2vec model based on the English Wikipedia corpus to enhance the relevance performance of the retrieved results.

However, we consider the community similarity in the intercommunity ranking process while the topic similarity of representative images is ignored. In addition, much information in social media image set, such as Flickr dataset are still unutilized, such as title, time stamp and so on. For future work, we will investigate the similarity among representative images. Besides, we may fuse these relationships to enhance the diversity performance of image ranking system.

REFERENCES

