Image Search Reranking with Multi-latent Topical Graph

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***Abstract*— Image search reranking has attracted extensive attention. However, existing image reranking approaches deal with different features independently while ignoring the latent topics among them. It is important to mine multi-latent topic from the features to solve the image search reranking problem. In this paper, we propose a new image reranking model, named reranking with multi-latent topical graph (RMTG), which not only exploits the explicit information of local and global features, but also mines multi-latent topic from these features. We evaluate RMTG over the MSRA-MM dataset and show that RMTG outperforms several existing reranking methods.**

I. Introduction

With the development of multimedia technologies and the tremendous success of social media, millions of images are uploaded and shared per day. Image search becomes more and more crucial to information retrieval. Currently, most of available Internet image searching engines are on the basis of "query by keyword". Due to the semantic gap between the textual and visual search, visual search reranking has attracted broad attentions in recent years to make up for the deficiencies of current text-based retrieval. Through a number of studies conducted in this field, we can summarize the following difficulties for reranking: 1) image document representation—it is an important foundation of the visual search system, as the representation of visual documents can affect the performance of the successive stages; and 2) reranking model—based on the initial search results, it is necessary to rerank the results according to some relevance model.

Various approaches have been proposed to tackle the above difficulties, where the reranking methods are mainly based on low-level features which are classified into global features and local features, [1], [2], [3]. However, there are several challenges for the above methods. If the similarities of the images are estimated only by global or local features, the returned images cannot be satisfied for all the queries. Figure 1 shows visual examples that each feature has its strengths and limitations. The first row is the reranked images with the query "apple" which gives good performance based on the global features, while the returned images with the query "butterfly" which gives good performance based on the local features. Hence, it is really difficult to determine which kind of feature is more suitable. For this reason, combining different visual features will achieve significant and expected improvement over the visual search baseline with an individual feature.

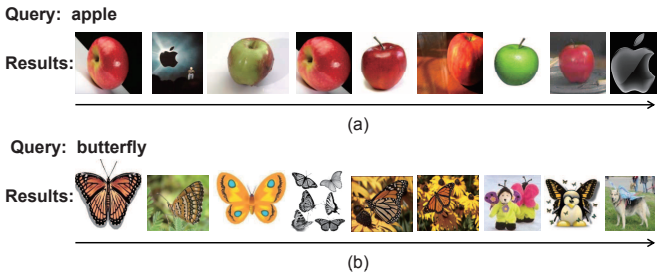

Fig. 1. Visual examples of reranking methods based on global feature and local feature. The reranking oder is the direction of the arrow. (a) is reranking of "apple" query results based on the global feature, and (b) is reranking of "butterfly" query results based on the local feature.

Based on previous analysis, we proposed a new approach, called reranking with multi-latent topical graph (RMTG). We mine the multi-latent topical graph via different features with the inspiration of semi-supervised methods. The multi-latent topical link structure is represented by a connected graph. Figure 2 gives a visual example to show how to rerank with the graph when given the query "sports". Figure 2 (a) shows the explicit links between the images, and the solid lines represent the similarities of images which are weighed by the features. Unlike combining two kinds of feature matrices directly, we select matrix factorization to solve our reranking problem [4],[5], . The multi-latent topical feature vector should be learnt for the images by joining two features. Then, the multi-latent topical graph is constructed by the latent vector.

The novelties of the proposed image reranking approach can be listed as follows:

- Our approach can be used to rerank the top ranked images with semi-supervised machine learning.
- We incorporate two visual features into multi-latent topic analysis which can not only preserve the two kinds of visual features but also mine the information of latent feature .
- Our solution is efficient. Our method can be divided into two parts, online and off-line. Since the latent space graph is learnt off-line, given a query, we are able to achieve real-time image reranking.

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