Implementation of Web Image Re-ranking by Preserving Relevance

Pallavee Patil[1], A B Rajmane[2]
[1]Ashokrao Mane Group of Institutions, Vathar, Maharashtra, India

Abstract **- Text based search techniques for image retrieval has achieved limited success because such a techniques generally ignores the visual contents of image. Image search re-ranking reorders the initial text only search to improve the result and this has received increasing attention in the recent years. But these techniques faces problems as initial search results contains noticeable amount of noise which makes re-ranking process difficult. The purpose of this paper is to classify the methods used for re-ranking process and we also discuss promising technique designed for image re-ranking which preserves the relevance in result.**

Keywords**- text query, re-ranking, relevance.**

I. INTRODUCTION

The images which are present in different websites are accompanied by different tags, comments, annotations and other related information. Images in such type of websites having links, annotations, comments and tags form an image rich information networks. Information retrieval is the process of obtaining the relevant information for a given query from a collection of information resources. Information retrieval in image-rich information networks is very useful but challenging task because of existence of information such as text, image feature, user and group and most importantly the network structure that is used by owner of that site.

To search images user need to enter a search query which can be keyword, image, file, link or click on some image as a feedback, then the system will return images based on search query. After getting the image results one more problem is there, how one can define the ranking of those images? Image Search Re-ranking (ISR) is defined as the refinement of search results by employing image visual information to reorder the initial text-based search results. It comes from the observation that the noisy text-based search results still contain satisfactory images in top hundreds of search results. Current ISR approaches mainly focus on two important aspects: feature extraction and ranking function.

Image retrieval techniques:

1. Text Based Image Retrieval- Text-based image retrieval [1, 2, 3] is generally based on annotations that which are manually added for disclosing the images (keywords, descriptions) or on collateral text that is available with an image like captions, subtitles or nearby text. Most of the image retrieval systems are text-based, but images frequently have little or no accompanying textual information. Keywords are words or phrases describe the content and it can be used as metadata to describe images. Assigning keywords to an image allows users to retrieve, index and organize large collections of image data. An annotation is metadata attached to text, image or other data. It refers to a specific part of the original data or image. Keyword annotation is the traditional text based image retrieval paradigm. In this approach, the images are first annotated manually by keywords then they can be retrieved by their corresponding annotations. As the size of image repositories increases, the keyword annotation approach becomes infeasible. Text-based Image Retrieval has few limitations like -

- The task of visualizing image content is highly subjective.
- Search results may contain large number of irrelevant images which may degrades text based search results.
- Many times, a few words cannot accurately describe the image content, and there may be ambiguity present in meaning.
- The textual descriptions provided by an annotator should be different from the other user. Different users may interpret image in different ways.

2. Content Based Image Retrieval- In content-based image retrieval (CBIR) [4, 5, 6] actual content of an image are searched. CBIR categorises the different regions present in an image based on their similarity in colour, texture, shape, etc. and decides the similarity between two images by computing the closeness of these different regions. Content Based Image Retrieval [4, 5, 6] systems are based on the functionalities like extraction and distance calculation and similarity measurements. Feature extraction is process of deciding the feature based on which re-ranking will be performed. Similarity calculations calculate the difference between the images in terms of corresponding chosen feature.

According to **L. Yang, and A. Hanjalic [7]** text-based image search can be improved by visual search re-ranking process. Text based image search is effective approach for large scale image collection but it suffers difficulties due to the incapability of associated text to appropriately describe the image content. Also **W. Cao, N. Liu, Q. Kong, and H. Feng [8]**, have proposed new content based image retrieval technique which is based on high dimensional information theory to minimize the adverse effect of large semantic gap. They proposed to find out area of interest of people from a complex image and then the high dimensional information character of the place is used for retrieval of the image.

II. EXISING SYSTEM

Design of Ranking Function

Design of ranking function is major key issue in image search re-ranking. Broadly methods of ranking function design are categorized into classification-based methods, graph based methods and learning-to-rank based methods.

1. Classification based method- In classification based method training data is collected from initial search results and classifier is trained with that training data. Major steps involve in this method are feature extraction, training and classification. Support vector machine method is typically depend on such classification problem and **Y. Chen, X. Zhou, and T. Huang [9]** have developed a novel scheme which one is based on one class SVM. They try to construct a tight hypersphere in the feature space to include most positive training samples.
2. Graph based method- In graph based methods, a graph $G=<V, E>$ can be built over the initial search results where each node $v(v \epsilon V)$ corresponds to visual document and the edge e $(e \epsilon E)$ corresponds to the multimodal similarity between two documents. Graph based methods are computationally expensive and also not much applicable to large scale dataset. **W Meng, Hao Li, Dacheng Tao [10]** developed re-ranking approach which explores multiple modalities in a graph based learning scheme. As different from the conventional methods which usually adopt a single modality or integrate multiple modalities into a long feature vector, their method effectively integrate the learning of relevance scores, weights of modalities and the distance metric and its scaling for each modality into a unified scheme.
3. Learn-to-rank method- Learn-to-rank methods are the applications of machine learning, generally supervised, semi-supervised or reinforcement learning. In these methods training data consists of lists of items with some partial order specified between items in each list. This order is typically induced by giving a numerical or ordinal score or a binary judgment (e.g. "relevant" or "not relevant") for each item. The ranking model's purpose is to rank, i.e. produce a permutation of items in new, unseen lists in a way which is "similar" to rankings in the training data in some sense. **Geng, L. Yang, C. Xu, and X. Hua [11]** developed content-Aware Ranking model which is based on learn- to- rank framework, in which textual and visual information are simultaneously leveraged in the ranking learning process. They formulate the Content-Aware Ranking based on large margin structured output learning, by modeling the visual information into a regularization term.

III. PROPOSED SYSTEM

Idea of hypersphere-

In hypersphere based approach, the basic idea is to perform feature extraction and designing of a ranking function. In this method, initially searched images are considered as distributed essentially in a hypersphere. Relevant images are inside the hypersphere and irrelevant are outside of it. **Zhong Ji, Yanwei Pang, Xuelong Li[12]** have proposed method for construction of hypersphere which is based on one-class classification in which relevant images are treated as target data and irrelevant are outliers. It is assumed that relevant images are close to the centre of the hypersphere while irrelevant and fair are away from it.

Hypersphere based relevance preserving projection (HRPP) focuses on both, data locality constraints which preserve divers structure of data and relevance constraints which protects the relevance relation of hypersphere distribution.

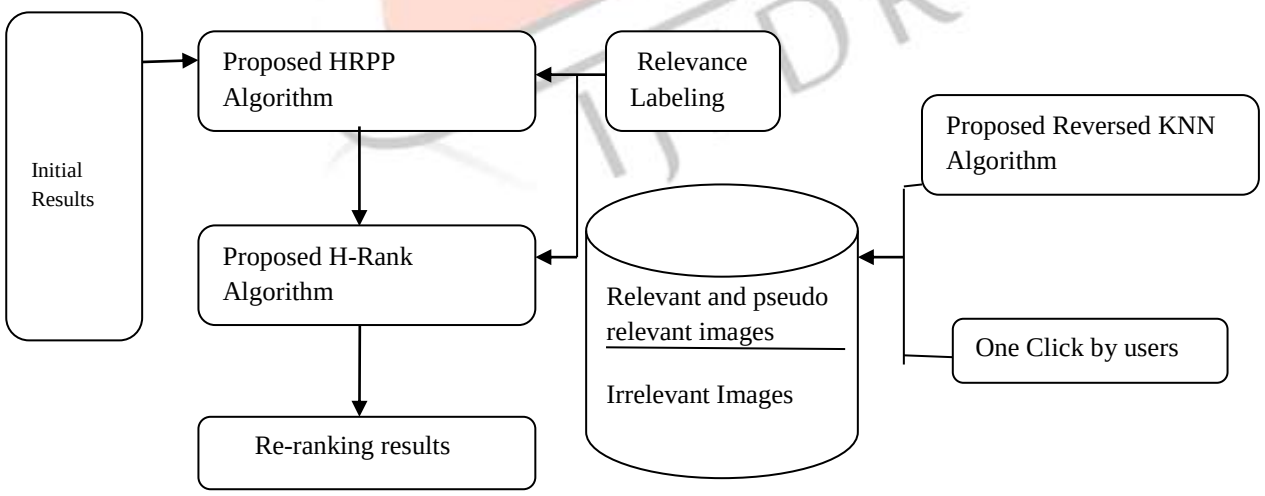


Fig. 1: Architecture of Web Image Re-ranking by Hypersphere Based Relevance Preserving Projection

Relevance

Relevance module first creates and load image tag schema. Based on that it will construct the graph and filters the results as images. It will display the images as a result. These images contain relevant images, irrelevant images and fair images. These images can be accessed from dataset.

Re-ranking

1) The user clicks one relevant image that satisfies his/her intent from the initially searched results. This image is then put into a relevant-image pool.
2) The nearest neighbor of the clicked images is chosen as a pseudo-relevant image from the top N initially searched images by the k-Nearest Neighbor (KNN) algorithm, and this image is also put into the relevant images pool. Now, there are two images in the pool.
3) Find the next pseudo-relevant image by calculating the minimum average distance between the images in the pool and the remained top N initially searched images.
4) Filter results and display to the user.

IV. METHODOLOGY

Hypersphere based Relevance Preserving Projection (HRPP) -This algorithm first examines the image transformation matrix to understand locality and relevance constraints on image. This is necessary to preserve the original structure of image data and to preserve the relevance relationship of hypersphere distribution.

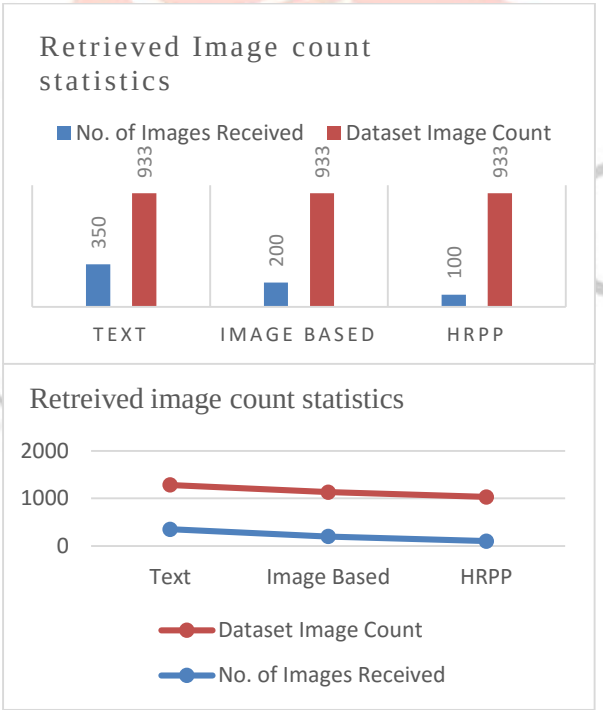
1. Reversed KNN algorithm- Reversed KNN algorithm is used to select only relevant images by harvesting number of pseudo-relevant images.
2. Hypersphere based ranking- After finalizing only relevant images it's time to rearrange them. This proposed algorithm re-ranks the images by sorting them by their distances from hypersphere center.

IV EXPERIMENTAL RESULTS

In this section we illustrate the effectiveness of algorithm. For demonstration Fliker dataset of 933 images with two major dimensions height and width is considered. We compare this algorithm against pure text based, image based methods. Graphical results are shown below,

i. Query Fire

	No. of Images Received	Dataset Image Count
Text	350	933
Image Based	200	933
HRPP	100	933



ii. Elapsed Time Statistics

	Elapsed Time(ms)	Dataset Image Count
Text	1300	933
Image Based	1300	933
HRPP	1300	933

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