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Agglomerative Clustering for Image Ranking Using Semantic Signature of Query Image

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ABSTRACT: Image based retrieval is a common approach to retrieve data from the web easily. Image re-ranking improves the performance of retrieval than traditional approach where search results are retrieved based on text query. Authors introduce image re-ranking concept, where both text based and content based retrieval is performed. Image re-ranking, a viable approach to enhance the results of online image search has been adopted by current commercial internet searchers. A set of images are retrieved based on textual information through a query keyword. Query and image based recommendation made in response to user queries provide an accurate result of images by identifying the visual semantic signatures of the query image by using the re-ranking method. Efficient approach to categorize images based on relevance using hierarchical clustering algorithm is proposed. Hierarchical clustering algorithm that provides the bottom-up approach to image re-ranking is anticipated to improve the efficiency. Image re-ranking performed by comparing their semantic signatures resulted from the visual semantic space by the query keyword is designed for development of efficient system that focuses on significant performance improvement.

KEYWORDS: Hierarchical Clustering Algorithm; Query Expansion; Reference Classes; Re-ranking; Semantic Signature.

I. INTRODUCTION

The users enter a query into the system and information retrieval process begins with user query. Queries are formal explanations of data needs, for instance search strings in web crawlers. In information retrieval concept a query does not extraordinarily distinguish a single object in the collection. Rather, a few objects might match the query, maybe with diverse degrees of relevancy. Most Information Retrieval (IR) frameworks calculate a numeric score on how well the query matches the every object in the database, and rank the objects as indicated by its value. The top positioning objects are then shown to the users. The procedure might then be iterated if the user wishes to refine the query.

The evaluation of an information retrieval framework is the procedure of evaluating how well a framework meets the information needs of its users. Traditional evaluation metrics, modeled for Boolean recovery or top-k recovery, incorporate recall and precision. Many of the measures are designed for assessing the execution performance of information retrieval frameworks has additionally been proposed. IR system, the collection of documents searched and search query are generally considered as a measurements. Every regular measure described here accepts a ground truth idea of relevancy: each result document is known either relevant or non-relevant to a specific query. Practically, query might be not well postured and there might be distinctive types of relevancy.

Image re-ranking, as a successful approach to enhance the output of image search, has been acquired by new commercial search engines. The first pool of images are retrieved with a given query keyword by search engine based on textual information. The user selects a query image from the pool of images; the remaining images are re-ranked in view of their visual similarities with the query image. The main challenge is that the similarities of visual features don't correspond with the images' semantic meaning which describe the user's expected intention of search.

Related work which is required for this research is given in section II, the implementation details in section III where system architecture and modular description is given. Section IV discusses about the algorithm. In next section V, discussion about the Experimental setup is given, where VI discuss the Results and at last provide a conclusion and future work in section VII.

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II. RELATED WORK

A) Visual and textual content based re-ranking:
In Xiaoou et.al given novel internet image search approach supported visual and textual content based re-ranking. This method needs only one-click user feedback [1, 2, and 5]. Intention specific weight schema is employed to unite visual features and to calculate visual adaptive similarity to query images. Despite of human feedback, visual and textual expansions of keywords are incorporated to realize user intention. Expanded keywords are utilized to broaden positive instance images and additionally widen the image pool to carry further relevant images. This structure makes it promising for commercial range image search by each visual and text term. The given image re-ranking structure comprises of many steps, which might be increased independently or replaced by different strategies which is considered systematically effective.

B) Online image search reranking:
In Jingyu et.al given online image search re-ranking algorithm that relies on query image and no online training has been done. This work presents adaptative Similarity that is inspired by the scheme that a user constantly incorporates a detailed intention where as submitting a query image [1, 2, and 12]. As an example, when the user submits an image with a full-size face within the centre, almost actually user needs images with similar face. At first the query image is characterized into one among various predefined classes. Inside each class, a specific weight schema is found to be combined with the options adaptative to the present style of images. Once exploitation this image to question, the user meaning is mirrored by activity the association between question image and its acceptable similarity computation and these classes are named as Intentions. The actual weight schema inside every intention class is associated by minimizing the rank loss for each query images on a training set by the current methodology that is actually changed from Rank Boost technique.

C) Visual Rank:
In Yushi Jing et.al given Visual Rank algorithm, a simple methodology to incorporate the advances created in using network and link investigation for web document search into image search. Visual Rank seems to diverge from a crucial source of knowledge that makes Page Rank more successful, the large amount of manually created links on a diverse set of pages [1, 2, and 4]. On the opposite hand, a significant amount of the human-coded information is reconvened by two systems. First Visual Rank query dependent is created within which the initial set of images are chosen from retrieved answers and human knowledge by means that of connecting relevant images to web pages which is overtly initiated into the system. Second the image similarity graph is developed supported the overall features among images. Those images that detain the common subjects from different images are usually leads to higher relevancy.

D) Bayesian Visual Re-ranking :
In Xinmie Tian.et.al, given Bayesian visual re-ranking that model the visual and textual information from the probabilistic viewpoint and makes visual re-ranking as an optimization system within the Bayesian framework. During this scheme, the textual information is replicated as probability, to breed the divergence between text-based search results and re-ranked results that is represented as ranking distance [1, 2, and 6]. The visual data is replicated as a conditional prior, to point the ranking score uniformity among visually similar examples that is understood as visual consistency. Bayesian visual re-ranking methodology obtains the most effective re-ranking consequences by increasing visual uniformity whereas minimizing distance of ranking. So as to work out the ranking distance more specifically, a novel pair-wise methodology is employed in which it computes the ranking distance with regard to the divergence in terms of pair-wise instructions. For visual uniformity, three completely different regularizes are investigated to extract the best approach for its modeling.

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III. IMPLEMENTATION DETAILS

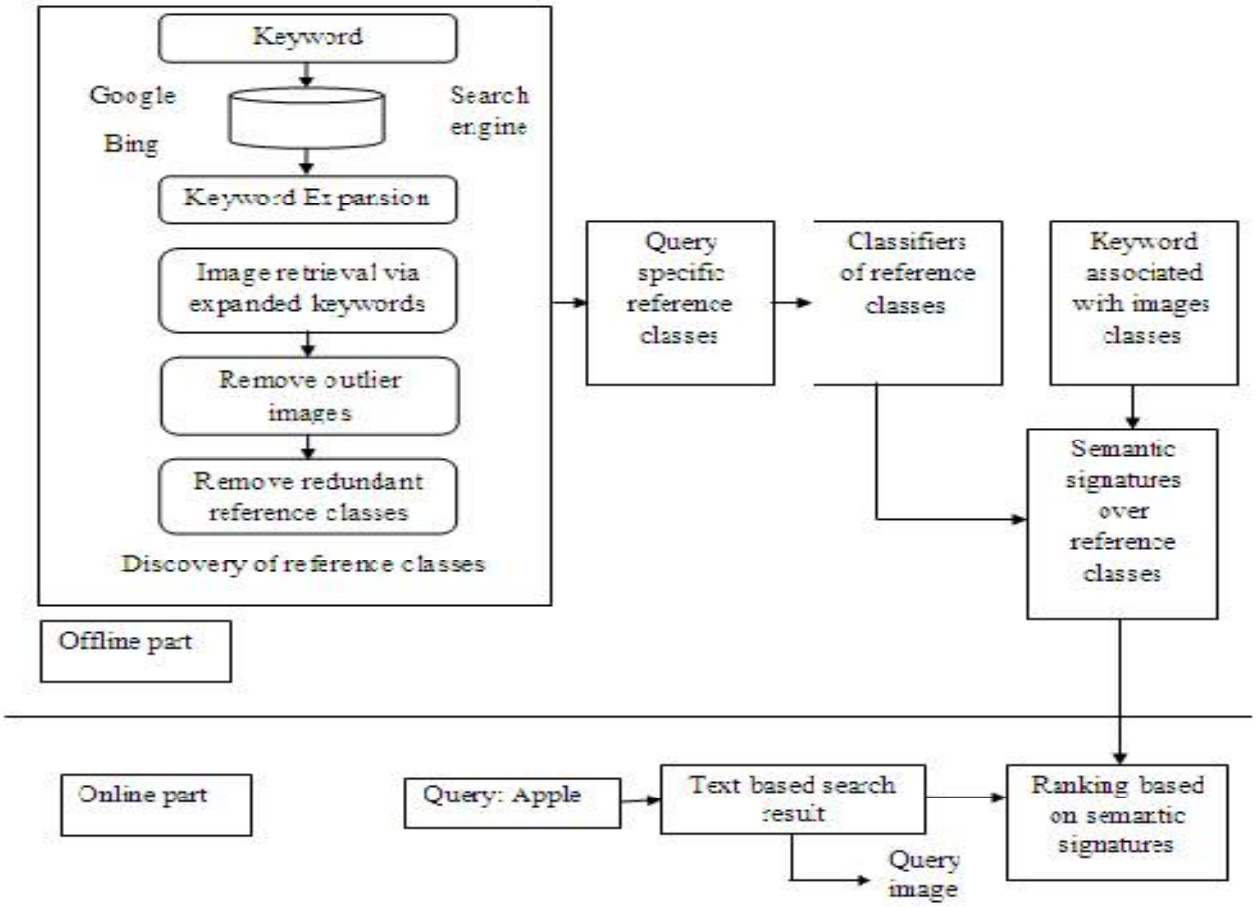

Fig 1: Overview of proposed system

3.1 Introduction

Web search engines are widely used to find data from huge amount of information in a minimal amount of time. Proposed image reranking framework is given in Figure 1. In this framework, there are two stages i.e. offline and online. At the offline stage, for a given query keyword provided by user, a pool of images relevant to the query keyword are retrieved by the search engine according to a stored word-image index file. Usually the size of the returned image pool is fixed. User selects a image as a query image from the set of images and the remaining images in the pool are reranked based on their visual similarities with the query image. The word-image index file and visual features of images are pre-computed offline and stored. At the online stage, visual features are compared.

3.2 Advantages of proposed system

i) The proposed agglomerative clustering algorithm utilizes the usefulness of clustering approaches to capture the finer clusters of images.
ii) The proposed system will improve efficiency and accuracy of images.

3.3 Detailed description about proposed framework

Proposed Framework is divided into different phases -
i. Image collection
ii. Keyword expansion

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iii. Image search with query keywords
iv. Classifiers of reference classes
v. Retrieval
vi. Ranking

Image Collection: Here proposed system is going to create different image dataset. This will contain different images of different keywords. This phase will collect images from Google. According to a name list names of images are to be collected. Output of this process, it will get a collection of different images; every image is associated with some human keyword. These different images are often noisy, which do not always correspond to the correct image name. This type of different images with noisy names called as outlier images.
Keyword Expansion: User has to first enter a keyword for the image which he wants to search. When entering a keyword the keyword matching with already searched log history is suggested for expansion. The history also maintains the semantics of every keyword to make a search faster. The similar keyword having more semantic is displayed first. User can select query keyword from the suggested list or user can enter new keyword.
Image search with query keyword: Based on the keyword entered by user the images are first searched from the database including their Meta information. The Meta information is either file information, file name or any text included to describe an image. If the text matching with the entered keyword found in surrounding information of images then that images are retrieved as a result images. After retrieving the images based on the keyword user have to select one of the images for refining the image search. This refinement is done by comparing selected image with other images.
Classifiers of reference classes: There are different classifiers for different images. It means, if there are k different types of features then there are k different types of classifiers.
Similar image retrieval: It first conducts a query image retrieval process to search for a subset of most similar images (typically top K similar image examples) from the earlier indexed image database.
Ranking: It is done on the basis of semantic signatures which are calculated in database. According to selected query image that images are ranked.

3.4 Approach

1. Divide the approach into the two parts online and offline.
2. In online stage, the different concepts representing by the reference classes are related to query keywords are automatically discovered. For each query keyword (e.g. “apple” ”car”), a set of relevant keyword expansions (such as “red apple” and “apple laptop”) are automatically finalized utilizing both visual and textual information.
3. Define reference classes for different keywords by using set of keyword Expansions.
4. Training set of reference classes are obtained and trained from multi class classifier.
5. If there are k types of textual and visual features like texture, shape, and color, then they can be combining to train single classifier.
6. At online stage, based on query keyword pool of images are retrieved. Once user chooses query image semantic signatures are used to compute similarities of image with pre-computed semantic signatures.
7. At offline stage all reference classes and semantic signatures are calculated.

IV. ALGORITHM

AGGLOMERATIVE CLUSTERING ALGORITHM:

Agglomerative hierarchical clustering is a case of hierarchical clustering techniques. The technique works as repeatedly clustering the documents from top or bottom. The tree formed by this technique can be investigated at various levels. The technique work as follows:

i. Start by assigning each item to a cluster, so that if we have N items, we have N clusters. Each cluster initially contains just one item.
ii. Let the distances (similarities) between the clusters the same as the distances (similarities) between the items they contain.

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iii. Find the closest (most similar) pair of clusters and merge them into a single cluster, so that now we have one cluster less.
iv. Compute distances (similarities) between the new cluster and each of the old clusters.
v. Repeat steps iii and iv until all items are clustered upto a specified threshold.

V. EXPERIMENTAL SETUP

The system is built using Java framework (version jdk 8) on Windows platform. The Netbeans (version 8.1) is used as a development tool. The system doesn't require any specific hardware to run; any standard machine is capable of running the application.

VI. RESULTS AND DISCUSSION

A) Dataset

This research uses images downloaded from internet as well as images which are given in IMDb dataset.

B) Results

Fig 2: search window

User enters query keyword in search box. These query keywords are stored into database. In database images are stored in the form of name-image file.

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Fig 3: resultant images related to given query apple

User has searched the query apple in above Graphical User Interface. According to stored name-image file, images related to apple are retrieved. Images are retrieved on the basis of keyword expansion process such as apple fruit, apple laptop…, etc. Here numbers of images are retrieved.

Fig 4: ranked images of apple

From above Graphical User Interface, one image is selected as a query image. According to stored semantic signatures of query image, resultant images are retrieved. These images are ranked and clusters are formed according to the given query image.

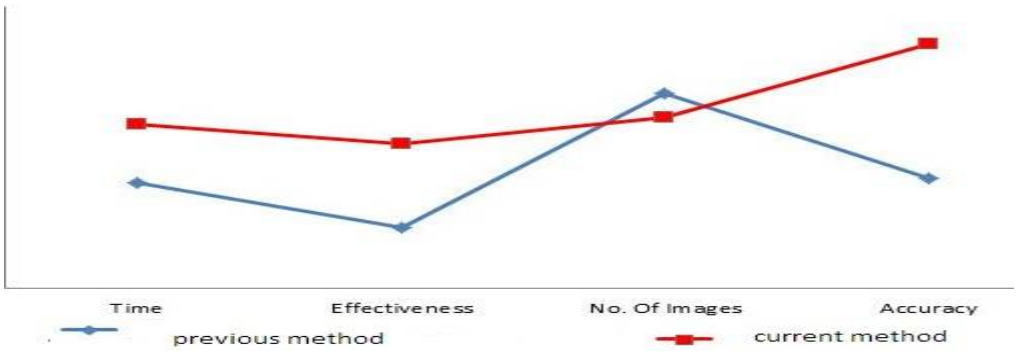

Fig 5: Comparison with existing method

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Above graph represents comparison with existing methods. In this research, hierarchical agglomerative clustering algorithm improves efficiency and accuracy of images.

VII. CONCLUSION AND FUTURE WORK

A capable re-ranking system, aimed on attempt the compelling issue of query ambiguities, semantic gap and visual perception of images. To further develop the scalability, project a clustering-based estimate explanation, which successfully accelerate the optimization job without bring in much presentation degradation with the large set of tests. This work presents efficient approach to categorize images based on relevance using hierarchical clustering algorithm. Hierarchical clustering algorithm that provides the bottom-up approach to image re-ranking is anticipated to improve the efficiency. Image re-ranking performed by comparing their semantic signatures resulted from the visual semantic space by the query keyword is designed for development of efficient system that focuses on significant performance improvement. In future, this work can be extended on hashing algorithm.

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