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Intelligent Semantic Web Image Search Engine

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Abstract: ***Search engine services are popular means of information retrieval. Search engines perform a number of tasks to retrieve required information from web based on their respective architecture. This paper proposes a novel approach for web crawling and image retrieval based on the image re-ranking strategy by considering both textual and visual features of the image. A pool of images will be retrieved when the user gives a query keyword, then user has to select a query image which is similar to the target image from the initial search results. User's search intention can be identified using this one click user feedback. The query image is then fed to a SVM classifier that identifies the reference classes by analyzing the features of the image. Then the images are re-ranked using rank SVM algorithm by considering the query and click data. This image searching strategy has improved accuracy and efficiency.***

Keywords: Reference class, SVM algorithm, Keyword expansion, Image re-ranking

1. Introduction

With the Internet getting available to more and more people in the last decade and with the rapidly growing number of web pages, the Internet is a vast resource of information and images. The big challenge in image retrieval is how to find just the right bit of images that user need from the Internet. Even though there are a lot of well-known search engines like Google or Yahoo, still it is sometimes not easy to find the images one is interested in. The existing web image search engines retrieve and rank images mostly based on the textual information associated with the image in the hosting web pages such as the title and the surrounding text. The text-based image ranking is often effective to search for relevant images. But the precision of the search result is largely limited by the mismatch between the true relevance of an image and its relevance inferred from the associated textual descriptions [1].

Most search engine works on text based approaches but there exist alternative approach content based image retrieval that require a user to submit a query image and then compares the similarity in content and return images that are matched. Google is one of the search engines that work on content based Image re-ranking. The visual information extracted is natural and objective, even though it completely ignores the role of human knowledge in the interpretation process. Because of this, a red flower may be regarded as the same as a rising sun and a fish the same as an airplane etc.

Adding visual information to image search is important. But the interaction has to be simple as possible. In this paper, a novel image search strategy is proposed that uses a one-click user feedback and image re-ranking approach. Given a query keyword initial search results will get from that user can click on one image indicating that this is the query image. Then all the returned images are re-ranked based on the re-ranking algorithm.

2. Related Works

Web-scale image search engines mostly use keywords as queries and rely on surrounding text to search images. The main problem in this particular context is that they suffer from the ambiguity of query keywords. Sometimes it is hard for users to accurately describe the visual content of target images only using keywords. To solve the ambiguity, Rui et al. [2] proposed a method called content-based image retrieval with relevance feedback. It requires users to select multiple relevant and irrelevant image examples from which visual similarity metrics are learned through online training. Based on the learned visual similarities images are re-ranked. For web-scale commercial systems, users' feedback has to be limited to the minimum without online training.

Yan et al. [3] proposed pseudo relevance feedback approach that used top ranked images as positive examples to train a one class SVM. Although the true relevance of the top ranked images is unknown since human is left out of the loop. Yan et al. [4] also suggested a negative pseudo relevance feedback approach for image re-ranking. It used top ranked images as positive examples and bottom ranked images as negative examples to train a SVM.

Online image re-ranking [5], which limits users' effort to just one-click feedback, is an effective way to improve search results. To achieve high efficiency the visual feature vectors need to be short and their matching needs to be fast. Efficiency is not satisfactory if visual features with high dimensions are directly matched. Another major challenge is that the similarities of low-level visual features may not well correlate with images' high-level semantic meanings, without online training, which interpret users' search intention. If images of the same object are captured from different viewpoints under different lightings or even with different compression artifacts, their low-level features may change significantly, although humans think the visual content does not change much.

3. Proposed Work

In the proposed system, the large image collection is subjected to feature extraction process where the attributes of the image both visual such as shape, color and texture and semantic such as clicks, labels, intentions etc. are extracted from the feature database using appropriate methods.

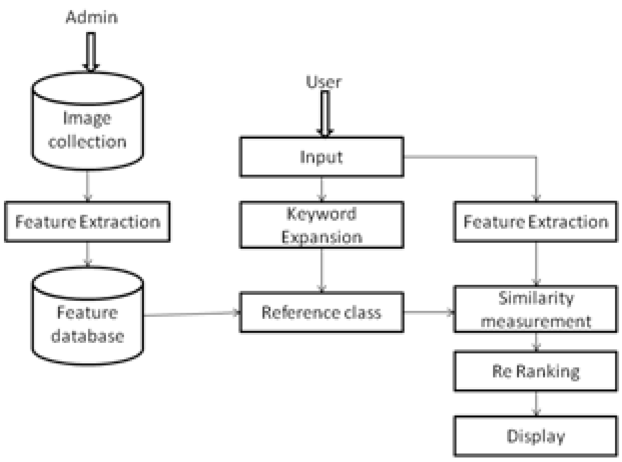

Figure 1: Image re-ranking architecture

The query image is subjected to feature extraction process and query features are extracted. In similarity measurement process, the feature of the query image is compared with the features stored in feature database. The distance between the two features is calculated and weights are obtained. Then the output images are sorted and ranked for displaying most similar images to the user.

4. Functionalities of the Proposed System

1. Data Collection

When a new image added to the database its features are automatically extracted and stored in the feature database. The admin will manage the image collection. Image collection is the backbone of the image search engine.

2. Feature Extraction

A feature is defined to capture a certain visual property of an image either locally for a small group of pixels or globally for the entire image. The most commonly used features include those reflecting shape, color, texture and salient points in an image. We are considered the features such as color and shape in our work.

First of all, appropriate pre-processing of images like size and image transformation is taking place and then visual content of images are extracted from images in the database and are described by multi-dimensional vectors. A feature database is created using the feature vectors of the images in database. To retrieve images users provide the retrieval system with query images. The system then converts them into internal representation of feature vectors.

Color feature is the one of the most widely used visual features in image retrieval. Typically, the color of an image is represented through some color model. We used RGB color model to describe color information. Color is perceived by humans as a combination of three color stimuli: Red, Green, and Blue, which forms a color space. This model has both a physiological foundation and a hardware related one. RGB colors are called primary colors and are additive. Other colors can be obtained, by varying their combinations.

One representation of color content of the image is by using color histogram. It denotes the joint probability of the intensities of the three color channels. For a three-channel image, we will have three of such histograms. A feature vector is then formed by concatenating the three channel histograms into one vector. For image retrieval, histogram of query image is then matched against histogram of all images in the database using some similarity metric. Color histogram describes the distribution of colors within a whole or within an interest region of image. The histogram does not contain semantic information and two images with similar color histograms can possess different contents.

(i) Visual Features
If the entered query is sunset, color should be the considered feature as color is the primary identifier. It will be appropriate for building color as a feature rather than shape. In the case of snow if color and shape is considered then differentiation between snow and cotton would become difficult for the system. So texture will become the primary identifier for snow and not color or shape.

(ii) Semantic Features
Semantics is the actual intention of the user behind the query. The intention of user cannot be interpreted by the machine which results in the semantic gap. For example, if the entered query is ford user may intend for a car or a person named Ford. The system cannot interpret the intended semantic. The semantic feature needs to be considered to reduce the semantic gap.

3. Keyword Expansion
Google image search provides the Related Searches feature to suggest likely keyword expansions. Even with the same query keywords the intention of users can be highly diverse and cannot be accurately captured by these expansions. In this approach, query keywords are expanded to capture users' search intention inferred from the visual content of query images that are not considered in traditional keyword expansion approaches. A word, w, is suggested as an expansion of the query if a cluster of images are visually similar to the query image and all contain the same word, w. The expanded keywords better capture users' search intention since the consistency of both visual content and textual description is ensured. Fig.2 shows the extracted words and image clusters for the query image green apple.

4. Reference Class Identification
When a new image is added to the database its reference class is identified by analyzing its features using SVM–classification approach. By analyzing a set of training examples, those marked as belonging to one of two categories the SVM training algorithm builds a model that assigns new examples into one category or the other, that makes it a non-probabilistic binary linear classifier. The SVM model is a representation of the examples as points in space mapped so that the examples of the separate

categories are divided by a clear gap that is as wide as possible. Then new examples are mapped into that same space and predicted to belong to a category based on which side of the gap they fall on.

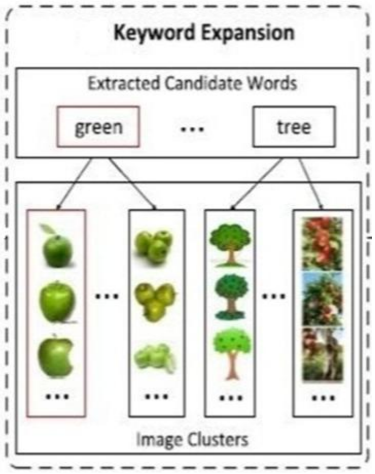

Figure 2: Keyword expansion and Image clustering

5. Similarity measurement and distance calculation
This step calculates the difference between the images in terms of corresponding feature. The images will be more similar when the distance is less. The distance can be computed using any of the distance measurement techniques such as mahalanobis, Euclidean, etc.

Consider two feature vectors A and B such that

$$A=\begin{pmatrix} a_1 \\ a_2 \ldots \\ a_n \end{pmatrix} \qquad B=\begin{pmatrix} b_1 \\ b_2 \ldots \\ b_n \end{pmatrix}$$

Euclidean distance is given by:

$$\sqrt{\sum_{i=1}^{n} (a_i - b_i)^2}$$

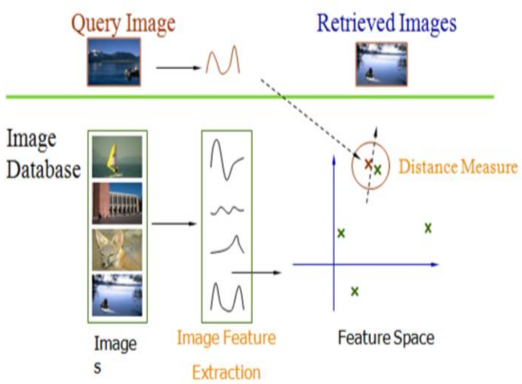

Figure 3: Distance calculation and measurement

6. Re-Ranking
Ranking SVM is an application of Support vector machine. The original purpose of Ranking SVM is to improve the performance of the internet search engine. It is used to solve certain ranking problems. Ranking SVM is one of the pair-wise ranking a method that is used to adaptively sort the web-pages by their relationships (how relevant) to a specific query. To define such relationship a mapping function is required. The mapping function projects each data pair (query and clicked data) onto a feature space. This can be considered as the training data for machine learning algorithms.

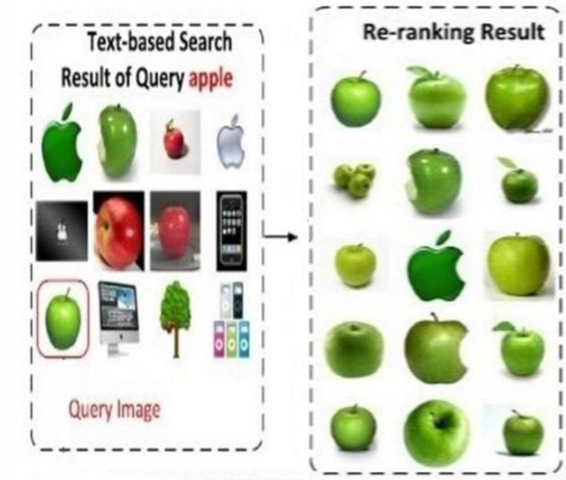

Figure 4: Reranking result for query image green apple

The three steps in the training period of Ranking SVM include:

a. It maps the similarities between queries and the clicked images onto certain feature space.
b. It calculates the distances between any two of the vectors obtained in step (a).
c. It forms optimization problem which is similar to SVM classification and solve such problem with the regular SVM solver.

5. Conclusion & Future Scope

We have studied a unique re-ranking framework that can be used for searching image on internet in which only one-click as feedback by user. Specific intention weight schema is used proposed to combine visual features and visual similarities which are adaptive to query image. The feedback of humans is reduced by integrating visual and textual similarities which are compared for more efficient image re-ranking. User has only to do one click on image based on which re-ranking is done.

Also duplication of images is detected and removed by comparing hash codes. Image content can be compactly represented by using hashing technique. Specific query semantic spaces are used to get more improved re-ranking of image. Features are projected into semantic spaces which are learned by expansion of keywords.

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References

[1] Linjun Yang and Alan Hanjalic “Prototype Based image Search Reranking,” in Proc. CVPR, 2008.
[2] Y. Rui, T.S. Huang, M. Ortega and S. Mehrotra "Relevance Feedback: A Power Tool for Interactive Content-Based Image Retrieval", IEEE Trans. Circuits and Systems for Video Technology, vol. 8, no. 5, pp.644 -655 1998
[3] R. Yan, E. Hauptmann, and R. Jin, “Multimedia search with pseudo-relevance feedback, ” in Proc. of Int’l Conf. on Image and Video Retrieval, 2003.
[4] R. Yan, A. G. Hauptmann, and R. Jin, “Negative pseudo-relevance feedback in content-based video retrieval, ” in Prof. ACM Multimedia, 2003.
[5] X. Tang, K. Liu, J. Cui, F. Wen and X. Wang "Intent Search: Capturing User Intention for One-Click Internet Image Search", IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 34, no. 7, pp.1342 -1353 2012