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Content Based Image Retrieval System Using Relevance Feedback

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Abstract

Content based image retrieval (CBIR) is the basis of image retrieval systems. Image retrieval based on image content has become an interesting topic in the field of image processing. To be more profitable, relevance feedback techniques were introduced into CBIR such that more precise results can be obtained by taking user's feedbacks. However, existing relevance feedback based CBIR methods usually request a number of iterative feedbacks to produce refined search results, especially in a large-scale image database. To achieve the high efficiency and effectiveness of CBIR we are using two type of methods for feature extraction like SVM (support vector machine) and NPRF (navigation-pattern based relevance feedback). By using SVM classifier as a category predictor of query and database images, they are exploited at first to filter out irrelevant images by its different low-level, concept and key point-based features. In terms of effectiveness, the search algorithm makes use of the discovered navigation patterns and three kinds of query refinement strategies, Query Point Movement (QPM), Query Reweighting (QR), and Query Expansion (QEX) to convert the search space toward the user's intention effectively. By using these methods, high quality of image retrieval on RF can be achieved in a small number of feedbacks.

Keywords: *Content based image retrieval, relevance feedback, query expansion, navigation pattern mining*

1. INTRODUCTION

A Content Based Image Retrieval (CBIR), which belongs to a research field of image analysis, also known as Query by Image Content (QBIC) and Content Based Visual Information Retrieval CBVIR). Image content typically consists in low-level features directly extracted from images such as color, texture and shape. The combination of various content features represents images more effectively than individual feature. The color feature is one of the most widely used visual features in image retrieval. Because the human vision system is more sensitive to color information than grey values of images. Shape is one of most significant feature that conforms to the way human being interprets and interacts with the real world object. Also Texture is one of the important characteristic used in identifying region of interest in an image. Here the term content means colour, shapes, textures or any other information that derived from the image. In CBIR systems input provide in terms of an image and based on image attribute matching the most similar images from database are retrieved. Fig 1.1 shows the block diagram of Content Based Image Retrieval (CBIR). The CBIR system consists of following components:

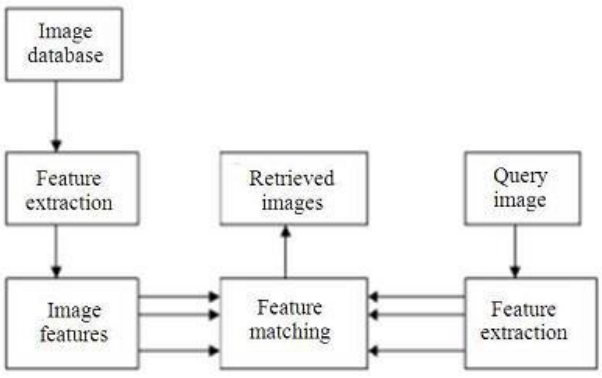

Figure.1.1 CBIR Systems and its components

1. Query image: It is the image to be search in the image database whether the same image is present or not and how many are similar kind of images are exist or not.
2. Image Database: It consists of n number of images depends on the user choice.
3. Feature extraction: It extracts visual information from the image and Save them as features vectors in a features database. The feature extraction finds the image description in the form of feature vector for each pixel. These feature vectors are used to compare the query with the other images and retrieval.
4. Image matching: The information about each image is stored its feature vectors for computation process and these feature vectors are matched with the feature vectors of query image which helps in measuring the similarity.
5. Resultant Retrieved images: It searches the previously maintained information to find the matched images from database. The output will be the similar images having same or very closest features as that of the query image.

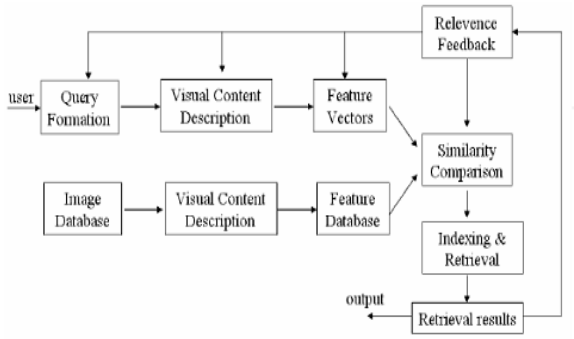

Fig 1.2 CBIR System using relevance feedback

The purpose of CBIR is to present an image conceptually, with a set of low-level visual features such as color, texture, and shape. These conventional approaches for image retrieval are based on the computation of the similarity between the user's query and images via a query by example (QBE) system. The Relevance Feedback (RF) repeats until the user is satisfied with the retrieval results. Existing methods refine the query again and again by analyzing the specific relevant images picked up by the users. To resolve the problems, a method called as "SVM based Navigation Patterns for efficient Relevance Feedback" is used. It will achieve the high retrieval quality of CBIR with RF by using the discovered SVM based navigation patterns in terms of efficiency. The navigation patterns mined from the user query log can be viewed as the shortest paths to the user's interested space. According to the discovered patterns, the users can obtain a set of relevant images in an online query refinement process. In terms of effectiveness, navigation pattern based algorithm combines three query refinement concepts are used i.e. including Query Point Movement (QPM), Query Reweighting (QR), and Query Expansion (QEX).Using SVM based NPRF the results can be obtain in very few feedbacks[2].

2. RELATED WORK

Content based image retrieval is a process of searching images from a database and retrieval of images similar to a query image submitted by the user. Content based image retrieval (CBIR) uses the primary low level image features such as color, shape and texture to represent and index the image [1]. The combination of various content features represents images more effectively than individual feature. Retrieval of image using combination of shape and texture feature is more efficient than retrieval using individual feature [2].Content-based multimedia retrieval does not adapt the query and retrieval model based on the user perceptions of the visual similarity. To overcome this problem a number of relevance feedback techniques are used which refers to a set of approaches learning from an assortment of users' browsing behaviors on image retrieval.

2.1 Query Reweighting

In this work, the feature weights are dynamically updated to connect low-level visual features and high-level human concepts. Neural Network learns the user's query from positive and negative examples by weighting the important features.

2.2 Query Point Movement

Another solution for enhancing the accuracy of image retrieval is moving the query point toward the contour of the user's preference in feature space. QPM regards multiple positive examples as a new query point at each feedback. After several forceful changes of location and contour, the query point should be close to a convex region of the user's interest. One of the QPM approaches is the modified version of MARS. MARS performs weighted Euclidean distance to compute the similarity between the query and the targets.

2.3 Query Expansion

The technique QR and QPM cannot elevate the quality of RF and cannot completely cover the user's interest spreading in the broad feature space therefore QEX is used.

3. SVM BASED NAVIGATION PATTERN FOR RELEVANCE FEEDBACK

3.1 Overview of SVM Based NPRF

SVM based NPRF integrates the discovered navigation patterns using SVM and three RF techniques to achieve efficient and effective exploration of images. The task is divided into two major operations, offline knowledge discovery and online image retrieval.

3.1.1 Online image retrieval Initial Query Processing Phase

Without considering the feature weight, this phase extracts the visual features from the original query image to find the similar images. Afterward, the good examples picked up by the user are further analyzed at the first feedback.

3.1.2 Offline Knowledge Discovery

Knowledge Discovery Phase: Learning from users' behaviors in image retrieval can be viewed as one type of knowledge discovery. This phase concerns the construction of the navigation model by discovering the implicit navigation patterns from users' browsing behaviors. This navigation model can provide image search with a good support to predict optimal image browsing paths.In Web image retrieval system, the user has to submit a query term to the search engine, called as textual based image search. Then the user can obtain a set of most relevant web images according to the browsing log. However, if the result does not satisfy the user, the query refinement can be easily incorporated into the query procedure. The usage log of CBIR suffers mainly on how to generate and utilize the discovered patterns. The data structure can be viewed as a hierarchy, including positive images, query points and clusters. At last, the query sessions, iterations, positive examples and visual query points are stored .If the original log data is ready; the next task is to discover navigation patterns from the original log data. For navigation patterns mining, the frequent item sets are mined from the navigation transaction table.

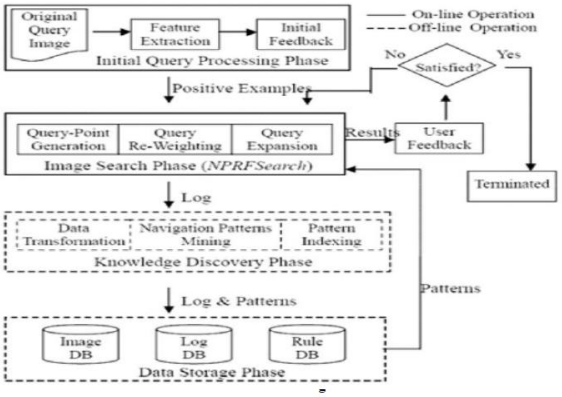

Figure 3.1: Workflow of NPRF Search

3.1.3 Navigation Pattern Mining

This stage focuses on the discovery of relations among the users' browsing behaviors on RF. In this SVM Based NPRF approach, the users' common interests can be represented by the discovered frequent patterns. Through these navigation patterns, the user's intention can be precisely captured.

3.3 Online Image Search

3.3.1 SVM based NPRF Search

Input: A set of examples picked up by the users by using SVM, a set of negative examples, a set of navigation patterns with the referred query seed

Output: A set of the relevant images R;

1. Generate a new query point *qpnew* by G and compute the new feature weights.

The iterative search procedure can be decomposed into several steps as follows:

1. Generate a new query point by averaging the visual-features of positive examples.
2. Find the matching navigation pattern trees by determining the nearest query seeds (root).
3. Find the nearest leaf nodes i.e. terminations of a path from the matching navigation pattern trees.
4. Find the top s relevant visual query points from the set of the nearest leaf nodes.
5. Finally, the top k relevant images are returned to the user [1].

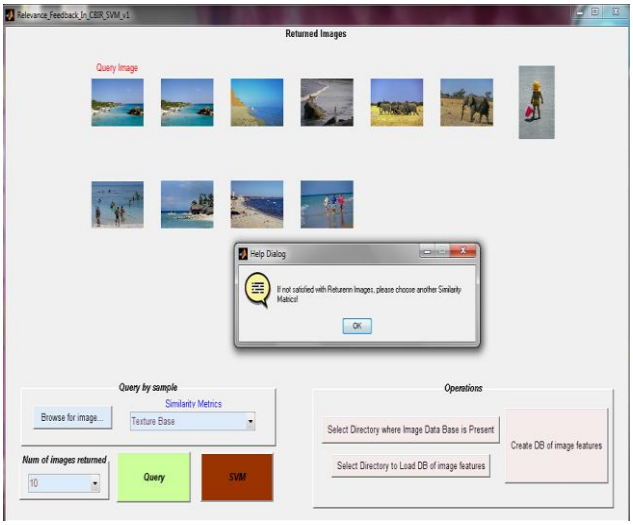

Figure 4.1: Retrieval output Images

4. EXPERIMENTS

Then the SVM Based navigation patterns are obtained by using the pattern discovery mechanism. The knowledge discovered from the navigation patterns can be enhanced once the query is submitted to NPRF. To analyze the effectiveness of this approach, two major criteria, namely precision and coverage, are used to measure the related experimental evaluations. They are defined as

| Correct |

Precision =- ---------- *100%,

where*correct* is the positive image set to the query image at each feedback. First, the precision of NPRF performs better than other existing RF approaches significantly whatever the iteration number is. NPRF can find more diverse images than other approaches. It indicates that the navigation patterns can effectively help the users get away from the local optimal results and capture the desired images in the global search.

The experimental set up gives us the following result:

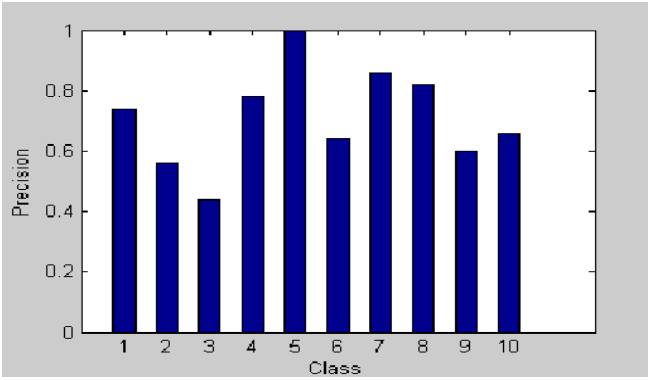

Figure 4.2: Precision of Query image with different classes present in database

5. CONCLUSION

Relevance feedback is a powerful concept in CBIR systems, in order to improve the performance of CBIR effectively. In this dissertation we proposed a relevance feedback technique based on SVM (support vector machine) and NPRF (navigation-pattern based relevance feedback) approach for Speedup the ordinal correlation measure. On one hand, the navigation patterns derived from the users' long term browsing behaviors are used as a good support for minimizing the number of user feedbacks. Within a very short term of relevance feedback, the navigation patterns can assist the users in obtaining the global optimal results and bring out more accurate results than other well-known approaches. As a result, traditional problems such as visual diversity and exploration convergence are solved. For navigation-pattern-based search, SVM is employed to narrow the gap between visual features

and human concepts effectively. In addition, the involved methods for special data partition and pattern pruning also speed up the image exploration. The experimental results reveal that the proposed approach NPRF is very effective in terms of precision and coverage. Within a very short term of relevance feedback, the navigation patterns can assist the users in obtaining the global optimal results.

6. FUTURE SCOPE

In the future, integrate user's profile into NPRF to further increase the retrieval quality apply the NPRF approach to more kinds of applications on multi-media retrieval or multimedia recommendation.

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