Online image retrieval system based on Markov chain and Relevance Feedback for mining user queries

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ABSTRACT

Today Image retrieval is important concept when we work with different real time applications. Dealing with large database is very tedious task so Annotation Based Image Retrieval is the technique which is used to retrieve the similar images according to the query provided by user. Query may be in the form of image called Content Based Image Retrieval or it may be in the form of text. But content based image retrieval technique having certain limitations in terms of retrieval speed and time. Hence Annotation Based Image Retrieval technique is used to retrieve the images from large database. Relevance Feedback method along with Markov chain method is basically used to speed up the performance of Image retrieval method.
Keywords:- Annotation based image retrieval, Markov chain, image annotation, relevance feedback.

1. INTRODUCTION

Large amount of growth in image database is increasing day by day. Therefore now a day's dealing with large image database is critical task in image retrieval technique. Image retrieval systems have lot of challenges when the size of database is very large. When database size is large or it contains large number of images then it can cause the different problems like it affects the speed of retrieval and also accuracy of the system. So to fight with such problems different search engines are available. Like QBIC developed by IBM, Virage, Excalibur etc. These are Content Based Image retrieval Systems. It is very broad area to study, it is dealing with large database but it is having two main challenges in this process. First challenge is called sensory gap; it is nothing but the gap between object in the world and information about the same object represented by computer. Another one is semantic gap. Smeulders et al [1] define the semantic gap as the "lack of coincidence between the information that one can extract from the visual data and the interpretation that the same data have for a user in a given situation".

Content Based Image Retrieval systems have some limitations and have to perform more work on images. Hence to avoid extra work and text based technique called Annotation Based Image Retrieval technique is used to justify semantic content approaches such as image captions as well as text based queries. For example Google Image Search, Yahoo! Image Search etc. In which providing the text to every image is known as annotation of image and automatically assigning semantic labels to image this process is nothing but automatic image annotation. So we can state that Annotation Based Image Retrieval (ABIR) System is nothing but the process of retrieving images using annotations assigned to images. Previously Latent Semantic Indexing method is used for document indexing and retrieval process. Also previously LSI method is also used with ABIR to achieve better result. LSI method is having limitations when there is difference in the number of keywords that are assigned to documents and per-image keyword annotation data. Another method based on ABIR is Markovian Semantic Indexing (MSI) is introduced by Raftopoulos et al [2]. MSI method is used to improvement of performance of system in terms of precision and recall compared to other methods but it does not provide assurance in satisfaction of the end user requirements.

2 . PROBLEM DEFINITION

The new method called relevance feedback method is to improve the efficiency of result and user satisfaction in terms of image retrieval result is introduced. In which along with Markov chain method, relevance feedback method is used to improve the result of system. We use both implicit feedback and explicit feedback method with Markov Chain in Image Retrieval process for reducing the time of retrieval system and improve the speed of system.

3. LITURATURE SURVEY

Image retrieval system research has long history. Contents which are provided to the image retrieval system, we can identify the image retrieval system. The large number of content based retrieval system has developed now days. In the recent years, more than 200 content-based retrieval systems have been developed [3]. Mainly two limitations of content

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based retrieval system are semantic gap and sensory gap. Hence another system called Annotation based image retrieval system.

Content based image retrieval is tedious task to retrieve the images. Hence, Annotation based image retrieval system used along with semantic contents of images, text queries and image captions effectively. Previously it was considered that document retrieval method can be used to retrieve the images. Latent Semantic Indexing [4] was first used to perform document retrieval. LSI method related to mainly with synonymy (Many words refer to same object) problem. It is used along with ABIR technique for retrieval of images efficiently. Another optional method to LSI is Probabilistic Latent Semantic Indexing (PLSI) [5] for document retrieval. PLSI is the method which is used in automatic document indexing technique, in which each and every document is represented by its word frequency. PLSI is one of the good text analysis method but it is having some drawbacks like it is incomplete because it does not provide probabilistic model at the level of documents, it has over fitting problems if there are too many parameters in the model and it's not define how to provide probability to a document outside of the training data. In LDA small number of latent topics are combined called document, here each topic is characterized by a distribution over words. Griffiths and Steyvers combined a Markov chain Monte Carlo methodology to LDA [6]. Latent Dirichlet Allocation (LDA) initially proposed by Blei et al. [7] to overcome some limitations of PLSI technique. It is used as effective probabilistic model implemented for modeling words in a document. So new probabilistic model stated by Steyvers et al.[8] that both authors and topics in document retrieval system and incorporating Gibbs sampling is to solve the mainly problems of overfitting. To check more details that are associated with LSI and PLSI and more important details about ABIR method, the concept are stated in [9],[10],[11].

So Konstantinos A. Raftopoulos et al [2] introduced a new probabilistic approach called as Markovian Semantic Indexing (MSI) for automatic annotation, indexing and annotation-based retrieval of images. This method is more suitable when per image sparse keyword annotation is limited.MSI is recent method for mining user queries.

4. PROPOSED WORK

In this paper we have extended the existing method of online image retrieval system by using the Log base feedback methods here system uses both implicit and explicit Log base feedback method along with Markov model based online image retrieval system. So we have studied the Markov Chain based method for online image retrieval system, this is most efficient in terms of precision and recall rates. But we have identified the limitation of this method is in terms of end user satisfaction. Here we are presenting the extension of existing method for online image retrieval by using the concept of relevance feedback methods. We are using both implicit and explicit feedback method along with Markov model based online image retrieval system. This method is used to make this approach more efficient in terms of accuracy as well as reliable. In real time applications such as medical, banking etc we need to have automatic image annotation by using the appropriate input keywords as well as the concept of relevance feedback to satisfy the end user needs. Hence we further extended the Markov chain based method for online image retrieval in order to help the users identify the images that are most satisfied to the users need. This improves the performance of proposed system in terms of efficiency and robustness. We have implemented the existing method given in [2] and then added our proposed approaches to extend the same method through our extensive practical analysis.
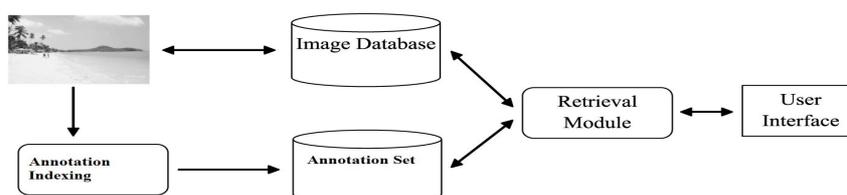
Retrieval Module consists of mainly two modules:

4.1 MSI Module:

This module mainly works on Markov chain process in which the next state of system is depends on current state of system. The user implicitly relates the retrieved (downloaded) images to her/his query. By assuming Markov chain transitions in the order of the keywords this approach is used to quantify logical connections between keywords.

4.2 Relevance Feedback Module:

Relevance Feedback method is mainly based on two methods which are implicit feedback and explicit feedback method. Implicit feedback is generated by system and another method called explicit feedback is generated by user of the system. Relevance Feedback module is used retrieve the images to fast which are already visited by user and stored in database by system so to improve the speed of system in terms of time and accuracy. Hence, to check the accurate working of system we will compare both MSI and Relevance Feedback method to improve the system performance.

Figure 1 System Architecture

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5. Mathematical Model

Let S be the system perspective of the given system.

$S = \{o, p, q, r, s\}$

where,

o : Initial or start state of the system

p : Final state of system

q: Set of number of input such that,

$q = \{q_1\}$ and in this q_1 is the number of queries given by user to the system in character form.

$$q_1 = \{q_1[a\text{-}z]^*[A\text{-}Z]^*\}$$

r: Set of Output provided by system

$$r = \{r_1, r_2, r_3\}$$

r_1: To find Accuracy of the system output.

r_2: To find time required to search the expected images in the system.

r_3: To find precision.

Let k is the processing functions such that,

$$k = \{s_1, s_2, s_3, s_4, s_5\}$$

s_1: To perform preprocessing of query.

s_2: To apply Markov chain technique for mining query.

s_3: To calculate relevance feedback of system.

s_4: To compute MSI distance.
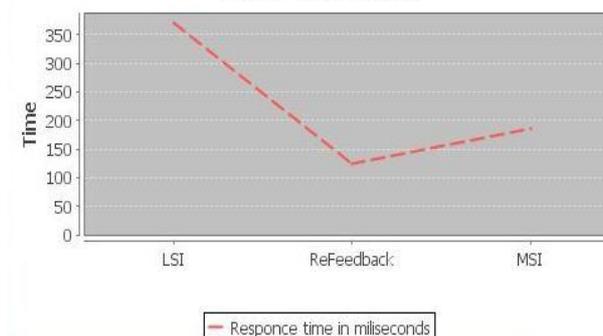
s_5: To compute time required for system.

6. ANALYSIS AND RESULT

Different image retrieval systems have different advantages and limitations. But existing system mostly can have some important features than previous one. So to evaluation of performance for new method called relevance feedback can be done on the basis of mainly three parameters, these are Time, Accuracy and Precision of the system. Performance of new system can be evaluated by comparing previous method with new one. Comparison is done between new and previous methods to improve efficiency of system. Time taken to retrieve the images from database and how much accuracy provided by particular system as well as precision is considered to analyze the result.   The results which are obtained from different models result into the given graph as shown in Fig. 2, Fig. 3 and Fig. 4. In this method called relevant feedback Image Retrieval method, a new method used for fast image retrieval.

Performance evaluation of new method called relevance feedback method is done or calculated using following graphs:

6.1 Graph for Time estimation: From Fig 2, it shows that the graph is against response time in milliseconds which is require to retrieve the user query images and the time at which point user send the request to system for images.From our result analysis it shows that time required to retrieve the images from database using relevance feedback method is less than Markov chain and LSI method. From Result it shows that Markov chain requires 150 to 200 milliseconds to retrieve the images and LSI requires above 350 milliseconds while Relevance feedback method takes less time to retrieve the images that is 100 to150 milliseconds time. So from graph analysis we can show that time require to retrieve images using relevance feedback method is less than Markov chain method and LSI method. Hence, relevance feedback method is more effective than previous methods in terms of time taken to retrieve the images.

Figure 2 Graph for Time Estimation

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6.2 Graph for Accuracy Detection: Accuracy of the system is nothing but how accurate is the system means at output of system should satisfy the user in terms of retrieval result. From Fig 3, the graph of accuracy detection of system in which the accuracy of relevance feedback system is higher than previous one. So, in result analysis and from graph we can prove that relevance fedback method showing more accurate results compared with Markov chain method.
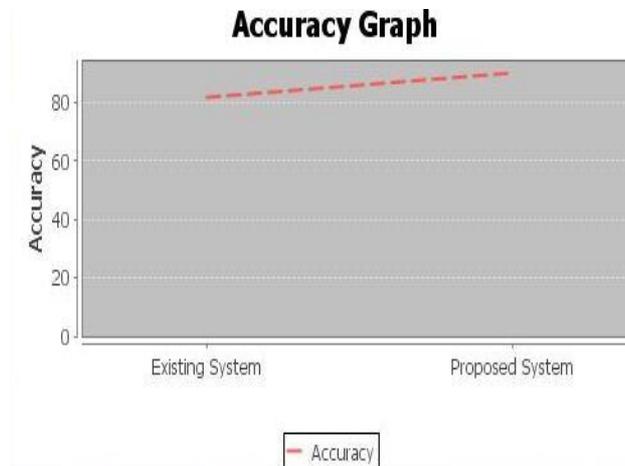

Figure 3 Graph for Accuracy detection

6.3 Graph for Precision Comparision: To check the effectiveness of the relevance feedback method, we first check how many relevant images to the query were retrieved. The effectiveness of retrieval system can be defined in terms of precision and recall rates. When n number time experiments are run times, then average of that results are reported. For each query relevant images are considered to be those images which belong to the same category as per the query given by user. So using this theory we can define the retrieval precision and recall are as follows:

$$Precision = \frac{P_A}{P_R} \qquad (1)$$

$$recall = \frac{P_A}{P_B} \qquad (2)$$

Where, PA represents the number of relevant images similar to the user query, PR indicates number of images which are retrieved by system response to the query, and PB indicates total number of relevant images which are available in the database. Using above we are constructing the following precision graph.
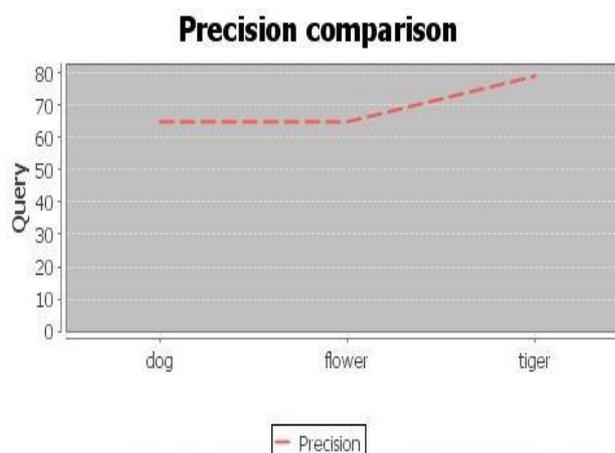
Figure 4 Graph for Precision Comparison

7.CONCLUSION

Hence, by using result analysis we can state that our work is mainly deals with improving previous methods of image retrieval based on ABIR technique. Here we are mainly focused on time, performance and accuracy of the system. We have done the comparative study of Markov chain and Relevance Feedback methods to make system more efficient. So in Relevance feedback method users can provide their explicit feedback and our system generates its implicit feedback and then verifies its real time performances as a result. Using this we can improve future performance of system by comparing as well as by combining the different methods to retrieve the required images.

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