

RECENT ADVANCES AND TRENDS IN IMAGE RETRIEVAL USING DATA MINING

Srinu¹

Abstract: In the recent years, image classification had received a tremendous growth because of its wide application in various domains such as education, entertainment, military and biomedicine. Today a wide number of image retrieval system using different approaches and algorithms has been proposed and implemented .So this paper gives an introduction to the emerging trends and challenges of current scenario in the field of image classification and its retrieval using data mining.

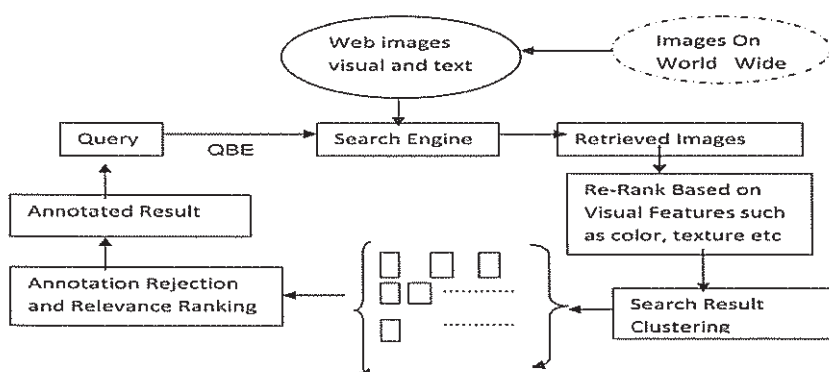
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1. INTRODUCTION

In the current scenario, the image classification is one of the critical problem that attracted many researchers towards it, not only this it increasing contribution in various applications and domains had led it to an explosive growth in recent years.

Traditionally images are classified and retrieved by using features such as color, textures and their combination which includes use of approaches such as histogram intersection method. The color of an image is extracted by using color histogram, one of the most popular approaches for color extraction; the main drawback of this system is it does not consider features such as textures, shapes, size and position of an object. To overcome from the above drawback, a combination or multiple features are used .Recent work [1] shows that a combination of color and texture features is more efficient and gives more accurate result than the traditional methods. Some of the examples of this application include QBIC [2], Photobook [3], Virage [4], VisualSEEK [5], Netra [6] and MARS [7].

2. OVERVIEW OF EXISTING IMAGE RETRIEVAL MODEL



The image retrieval system used today consists of searching, mining, clustering ranking and re-ranking of images. The user provides a query that is feeded in the form of Query-By-Example (QBE) to the search engine. The search engine retrieved the images from the World Wide Web using textual indexing. The retrieved images are re-ranked using visual features such as color, texture or its combination based on the algorithm used. Then a suitable clustering algorithms are applied that segment the image into clusters with specific information associated with it by using auto-annotation system .Finally the images are given relevant ranking by removing irrelevant annotation and the annotated result is given to the end user .

3. IMAGE CLASSIFICATION

In current multimedia mining methods, collecting and labelling of images is one of the challenging tasks. Usually the raw image collected is annotated by using Image Annotation System .In this, mining of the surrounding text that comprises of phrases is done. One of the major drawback in this method is due to the lack of standard grammar structure it is difficult to apply Natural Language Processing (NLP). Secondly, as the annotated images consists of large number of noisy textual data, so algorithm such as name assignment algorithm [10] is applied in order de-noise the textual data associated with it.

In order to produce a reliable annotated images or labels most of the approaches require human intervention which is difficult, expensive and produces inconsistent annotation. So in recent years other image annotation techniques [8][9][10] that assigns a specific information to the image is used. For instance, consider an image of "Manmohan Singh" the traditional image annotation system label the image as "human "only but current annotation system is capable of generating more specific information about the image such as "Manmohan Singh" ,"Prime Minister Of India".

Thus researchers had developed and proposed many learning models [11] ,[12] ,[13], [14] , [15], [16] ,[17],[18],[19],[20] that assigns keywords onto the image or image region automatically.

The researchers mostly work in the following two directions for automatic image annotation-

- a) Learning the joint probability between images
- b) learning the conditional probability

Mainly the image auto-annotation model maximizes the conditional distribution [21] $p(w/I_q)$ where w is terms or phrases in the vocabulary and I_q denotes uncaptioned query image

$$W^* = \arg \max_w (w/I_q)$$

Or

$$W^* = \arg \max_w \sum p(w/I_i) p(I_i/I_q)$$

Where I_i denotes the i^{th} image in the database

By applying Bayesian Rule, we obtain

$$W^* = \arg \max \sum_i (\sum_j p(w/t_j) p(t_j/I_i)) p(I_i/I_q)$$

Where $p(I_i/I_q)$ denotes the similarity between I_i and I_q

If we assume that there lies a hidden layer of “topics” from which words are generated than t_j represents the j^{th} topic in the topic sequence.

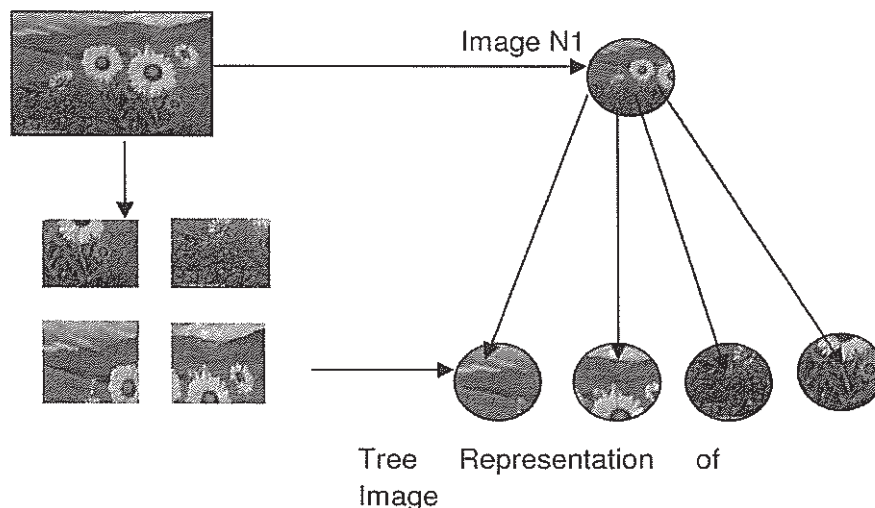
Most of the current commercial search engines uses Query-By-Example scheme to retrieve the images because of following reasons:-

- a) It overcomes the semantic gap problem
- b) Reduction in the computational expensiveness

4. FEATURE EXTRACTION

As we have already describe that multiple feature use in image classification is better than the traditional one so mostly regions based approach [22],[23],[24],[25],[26] were used for retrieval of images.

In this approach, the entire image is divided into small regions and each region feature is extracted individually for whole image retrieval. Feature extraction is one of the important criteria for classification of images as it reduce dimension for the image content analysis. Moreover it is one of the ways to understand the semantic of the image more appropriately.



JSEG, a color segmentation method [27] is used in order to extract the regional features. It performs the following steps for the regional feature extraction-

- a) The color of an image is quantized to several representative classes
- b) Then forms a class map of the image by labelling pixels with the color classes
- c) Lastly, image is segmented using multiscale J-Image [27]

5. CLUSTERING ALGORITHM

In this section, we give a brief description of the various clustering algorithm used in data mining and image processing for classification of images [28]. Mostly the clustering algorithms are divided into following categories:-

5.1.1 Hierarchical algorithm [29],[30],[31],[32]

It use a linkage criteria in describing a measurement of similarities and dissimilarities between objects together. It organises the data in a hierarchical fashion according to the proximity matrix that contains similarities and dissimilarities in the data set. The cluster obtained is then applied with either of the following algorithm:

5.1.1 Agglomerative Algorithm-Each cluster is merged until the object belonging to same group is obtained.

5.1.2 Divisive Algorithm-The cluster is again partitioned successively till a singleton cluster is obtained.

5.2 Partial Algorithm [33],[34],[35],[36],[37],[38]

It is mostly applied to large databases and optimizes the criterion function by portioning the dataset into clusters.

5.3 Artificial Neural Networks [39],[40],[41]

In this supervised and unsupervised neural networks approaches are used. In supervised learning, a training phase is used in order to adjust the connection weights for the neurons whereas unsupervised learning consists of a single layer of neurons called Kohonen Layer that are self-organizing networks.

5.4 Density Based Algorithm [42],[43],[44]

In this the algorithm, it divides the dataset into low density and high density regions of objects in data set.

5.5 Graph Theory Based Algorithm [45]

In this nodes represents the object and edges represent similarity between separate objects.

5.6 Kernel-Based Algorithm [46],[47]

The data points are mapped in such a way that a higher dimensional feature space can be linearly separated from the data points.

6. CONCLUSION

In this paper a brief description of the current trends and advances in image retrieval system using data mining is highlighted. The classification and retrieval of images efficiently and accurately is still an open challenge. The paper describes some of the challenges in current scenario that need to be consider while developing an efficient and accurate image retrieval system using data mining approaches.

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*¹Srinu
CBES Boys Hostel,
Department Of Information Technology
Chaitanya Bharathi Institute of Technology, Gandipet.
Hyderabad-500075
srinu.ch.cbit@gmail.com*