A Survey on Techniques used for Content Based Image Retrieval

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Abstract - *Development of digital technology has lead to increase in the number of images that can be stored in digital format. So searching and retrieving images from large image databases has also become more challenging. Since the past few years, Content Based Image Retrieval (CBIR) gained increased attention from researcher. CBIR is a system which uses visual features of images in large image databases and performs user's requests. Important features of images are color, texture and shape which give detailed information about the image. CBIR techniques using different feature extraction techniques are being reviewed in this paper.*

Key Words: Color, Texture, shape features, Text based retrieval, CBIR.

1. INTRODUCTION

CBIR, Content Based Image Retrieval has been an important area of research in the last few decades. For services to be efficient in all fields such as government, academics, hospitals, crime prevention, engineering, architecture, journalism, fashion and graphic design they make use of images. Due to its popularity, this digital image database becomes huge databases, and to search and retrieve specific images from these huge databases becomes difficult and time consuming. Traditionally, to solve these problems text-based retrieval were used. To search images, the user provides keywords as query terms and the system will return images similar to the query .

In text based image retrieval keywords, label, tag or any information associated with the image is used for this metadata image retrieval . In this method query is entered in text format. But, there are limitations to this type of image retrieval system. Annotation of each database image requires domain experts who add label or other information to the image. Use of different keywords for annotation of each image in large databases is a highly time consuming process. It is also necessary to use unique keyword for annotation of each image which is a very complex task. Text descriptions are sometimes incomplete because they cannot very well depict complicated image features . A language mismatch can occur when the user and the domain expert uses different languages.

2. TECHNIQUES OF CBIR

Indexing and Retrieval are the two important features of CBIR. Color, shape and texture are the most important features of an image. From these, feature vectors are extracted and these vectors are used for indexing purposes.

2.1 COLOR AND TEXTURE FEATURES FOR CONTENT BASED IMAGE RETRIEVAL

A retrieval mechanism using color and texture [2] is being proposed here. Depending on the characteristic of the image texture, it can be represented by multiwavelet transform. The color correlogram in the RGB color space is chosen as the color feature. The main motivation of this system is to use the MultiWavelet decomposition scheme and color correlogram, which yield improved retrieval performance. Through the combination of Multi wavelet decomposition and color correlogram[2] we can increase the number of features, which in turn improves the retrieval accuracy. To support the efficient and fast retrieval of similar images from image databases, feature extraction plays an important role. The technique used for comparing images plays the fundamental ingredient of content based image retrieval.

To create the feature vector, computed standard deviation of each sub-band is used. Then to find similarity between images, Euclidean distance metric is used. The average retrieval efficiency using this method is 75%. The main advantage is that it yields a large number of sub bands and hence improves the retrieval accuracy. A limitation is in its feature set.

2.2 CONTENT BASED IMAGE RETRIEVAL USING COLOR AND SHAPE FEATURES

In this paper, an algorithm is proposed which incorporates the advantages of various other algorithms to Improve the retrieval accuracy and performance. The accuracy of color histogram based matching can be improved by using Color Coherence Vector (CCV)[3] for successive refinement. The speed of shape based retrieval can be enhanced by considering approximate shape rather than the exact shape. In addition to this a combination of color and shape based retrieval is also included to improve the accuracy.

This system makes an approach to retrieve images through an automatic segmentation technique. This allows to get approximate information about the shape of the regions in the images. Shape representation is an important issue in both object recognition and classification.The segmentation is performed through a stochastic algorithm using the brightness of the regions under analysis. Hence, it was found that the image features generated from the image regions allowed higher discrimination among images than the existing approaches. The main advantage of this method is that it creates robust feature set for image retrieval.

2.3 RELEVANCE FEEDBACK FOR CBIR USING SUPPORT VECTOR MACHINE AND FEATURE SELECTION

CBIR using Relevance Feedback [4] approach based on support vector machine is used and also uses feature selection technique to reduce the dimensionality of the image feature space. Each image is stored as a multidimensional vector consisting color, texture and shape informations. In each RF step, the positive and negative examples provided by the user is used to determine a small number of the most important features for the corresponding classification task, via a feature selection technology. After feature selection, an SVM classifier is trained to distinguish relevant and irrelevant images according to user preference, using restrictions from the user examples on the set of selected features. The trained classifier is subsequently used to provide an updated ranking of the database images represented in the space of the selected features.

This approach focuses to minimize the gap between low-level features representation of images and the user's high-level semantic concepts. For that, it uses SVM based on RF (Relevance Feedback) to learn user's query concepts. SVM and feature similarity based relevance feedback using best feature combination improves the precision of retrieval . As number of feedback increases the retrieval accuracy also improves. But in relevance feedback, for the same output different users may have different views about similarity. So it becomes a complex process.

2.4 SEMANTIC IMAGE RETRIEVAL BY COMBINING COLOR, TEXTURE AND SHAPE FEATURES:

The problem of retrieving desired image from huge database is a major problem. The subjectivity of human perception and the rich contents of the images further increase the complexity of the problem. To overcome this problem, a new query-by-example technique [7] using multiple color, texture and shape features is being proposed here.

The system must developed such that it takes into account the different views from different users. Here, the system uses a two phase methodology. In the first phase, feature database is created. In the second phase images related to the query image desired the by the user is retrieved. For image retrieval, the database is filtered very coarsely. It is done using hue histogram technique. Feature matching is then done on this reduced dataset. At the end of this step, for each feature, a set of images are obtained. Finally, we retrieve the images by combining all the features which results in a set of images which are semantically more similar to the query image. A major advantage of this method is that it doesn't miss any relevant images. But the process is time consuming.

2.5 CBIR USING MULTIPLE SVM ENSEMBLES:

Here, multiple SVM ensembles[8] is based on one-against-all SVM multi class approach. Given a database that has been divided into N classes previously, the first ensemble with N SVM machine is trained. Given a query image, the candidate class to which the query image belongs is calculated using this SVM ensemble. Next, a new ensemble is created based on the one-against all approach in order to improve the target search. The process stops when only one class is returned which completes the query classification stage. This class is then used in the final step for similarity computation and retrieval of the image. The images are to be preprocessed with Discrete Cosine Transform for feature extraction before an ensemble is constructed**.**

The system mainly involves three modules: Feature Extraction module, Query module and Retrieval module. In the feature extraction module, the techniques to convert images to feature vectors are included. The idea here is to obtain a more compact representation of the image. Therefore, the feature space has less dimension than the original image feature space. This feature space includes shape features, color, texture, histogram, edge features and image transform features. The query module involves feature extraction of the query image and also provide resources to make modifications on the query images or even integration of keywords onto the query images. Finally, in the retrieval module some similarity measure is computed between the query image and database images. Then the obtained values are sorted and the images with highest similarity are returned as the target ones.

In multiple SVM ensemble for CBIR, the feature extraction step presents a compact representation of the image by using the Discrete Cosine Transform (DCT) of the image.Then, the N SVM ensemble are constructed, one for each class of the database.

Given the query image, this ensemble is used to find the candidate classes for the query classification. Specifically, each SVM " i" returns a real number which is interpreted as the probability that the query belongs to the corresponding class C_i. So that only the classes whose probability is larger than the mean are selected. Next, a

new SVM ensemble is constructed with the selected classes, using the same earlier strategy ,and applied to improve the target search. The process stops when only one class is returned which completes the query classification stage. This class is then used in the final step for similarity computation and retrieval of the image. The method is ”iterative” in the sense that in each instance of the main loop we take the result of the previous one in order to refine the classification of the query. Main advantage of this method is that it narrows down the search space and also could handle large image database.

3. DISCUSSIONS

In the table below a comparison of the above discussed methods are being depicted.

Table -1: Comparison Chart

Comparison of Methods			
S.no	Title	Advantage	Disadvantage
1	Color & Texture Feature for CBIR	High retrieval accuracy.	Insufficient feature set.
2	CBIR using Color, Shape & Texture Features.	Robust feature set.	high semantic gap.
3	CBIR using RF & feature selection	minimize semantic gap.	time consuming .
4	Semantic Image Retrieval combining three features	Reduce dataset & retrieve similar images	Increased calculation.
5	CBIR using Multiple SVM’s Ensemble	Narrow down Search space & handle large db’s.	Insufficient Feature set.

4. CONCLUSION

In this paper, we have surveyed the area of content based image retrieval techniques considering the important features of images. Several techniques are being reviewed which uses different feature extraction techniques. Though, the semantic retrieval method reduces the dataset, it performs image retrieval twice and hence increases computation. CBIR using SVM is found to be a better option among the other methods considered as it narrows down the search space and also could handle large databases. In the future, more efficient techniques can be expected such that it enhances the CBIR concept.

REFERENCES

[1] Rajesh Kumar, Rajeev Srivastava, and Subodh Srivastava," Detection and Classification of Cancer from Microscopic Biopsy Images Using Clinically Significant and Biologically Interpretable Features", Journal of Medical Engineering, Vol. 2015, pp.14, 2015

[2] P.V.N Reddy, K.Satya Prasad, “Colour and Texture Features for Content Based Image Retrieval", International Journal on Computer Application and Technology, Vol.2, Issue 4, pp.1016-1020, 2011.

[3] Reshma Chaudary, A.M Patil, " Colour and Texture Features for Content Based Image Retrieval", International Journal of Advanced Research in Electrical, Electronics And Instrumentation Engineering, Vol. 1, Issue 5, pp.386-392, 2012.

[4] Apostolos Marakakis, Nikolaos Galatsanos, Aristidis Likas, and Andreas Stafylopatis, " Relevance Feedback for Content Based Image Retrieval using Support Vector Machine and Feature Selection", Springer, pp.942-952, 2009.

[5] Sumiti Bansal and Er. Rishamjot Kaur, " A Review on Content Based Image Retrieval using SVM", International Journal of Advanced Research in Computer Science and Software Engineering, Vol. 4, Issue 7, pp.232-235, 2014.

[6] K. Ashok Kumar and Y.V.Bhaskar Reddy, " Content Based Image Retrieval using SVM Algorithm", International Journal of Electrical and Electronics Engineering, Vol. 1, Issue 3, pp.38-41, 2012.

[7] Nishant Singh, Shiv Ram Dubey, Pushkar Dixit, Jay Prakash Gupta," Semantic Image Retrieval by Combining Color, Texture and Shape Features", International Conference on Computing Sciences, pp.116-120, 2012.

[8] Ella Yildizer, Ali Metin Balci, Mohammad Hassan, Reda Alhajj , "Content Based Image Retrieval using Multiple Support Vector Machine Ensemble", Journal on Expert Systems with Applications,pp.2385-2396, 2012.

[9] Pasnur M.A, P. S. Malge, " Image Retrieval Using Modified Haar Wavelet Transform and K Means Clustering", Image Retrieval Using Modified Haar Wavelet Transform and K Means Clustering", International Journal of Emerging Technology and Advanced Engineering, vol.3, Issue 3, pp. 89-93, 2013.

[10] Deepika Nagthane, " Content Based Image Retrieval system Using K-Means Clustering technique", International Journal of Computer Applications & Information Technology, Vol. 3, Issue 1, pp.22-30, 2013.

[11] Md. Jaffar Sadiq, Afshan Kaleem, Arif Hussain Mohammad, Mohammed Abdul Wajid, " Content Based Image Retrieval System using Kmeans and KNN

approach by Feature Extraction", International Journal of Computer Science & Communication Networks,Vol 5, Issue 6,pp.391-399, 2015-2016.

[12] Md. Iqbal Hasan Sarker, Md. Shahed Iqbal," Content-based Image Retrieval Using Haar Wavelet Transform and Color Moment", Smart Computing Review, vol. 3, Issue 3, pp.155-165, 2013.

BIOGRAPHIES

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