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CONTENT BASED IMAGE RETRIEVAL USING MULTI SVM AND COLOR AND TEXTURE COMBINATION

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ABSTRACT

The dramatic rise in the sizes of images databases has stirred the development of effective and efficient retrieval systems. The development of these systems started with retrieving images using textual connotations but later introduced image retrieval based on content. This came to be known as Content Based Image Retrieval or CBIR. Systems using CBIR retrieve images based on visual features such as texture, color and shape, as opposed to depending on image descriptions or textual indexing.

In the proposed work we will use various types of image features like color, texture, shape, energy, amplitude and cluster distance to classify the images according to the query image. We will use multi-SVM technique along with clustering technique to compare the features of the input image with the input dataset of images to extract the similar images as that of the query image

KEYWORDS: CBIR; SVM; Content Based Image Retrieval; Modified SVM; Clustering based SVM Technique.

1. INTRODUCTION

Retrieval of the relevant images according to the query image from a large datasets is becoming more and more challenging today as large collections of images are available today to the public, from image collection to web pages, or even video databases. In recent years, the image retrieval has become an interesting research field due to use of Image retrieval in various fields like image forensics, criminal investigation system etc. CBIR system has drawn more attention in this field as CBIR aims at developing new techniques for the retrieval of the similar images from a large image dataset by identifying the image contents like colour, texture, shape, intensity , energy etc. In the past, researchers have used various techniques for image retrieval under CBIR like semantic retrieval, relevance feedback, iterative learning and other query methods. The CBIR problem is inspired by the increasing space of image and image databases effectively. For the feature extraction and selection techniques in CBIR the visual content of a still image is used to search the relevant images in large datasets. In general the retrieval process works in two steps, first one is feature extraction step in which the features of every image is extracted and stored in temporary location. The feature describes the contents of the image. Most commonly Visual features used for describing an image are shape , colour, texture, energy , cluster distance etc. The second step which is also termed as classification step compares the features of query image with that of database images and sort images according to the similarity and extracts the result for the user. So the important part of CBIR is development of efficient and effective feature extraction methods.

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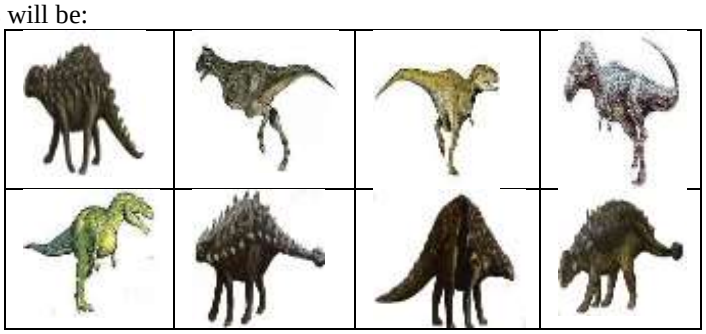
As the example shown below our query image is an image of a dinosaur so the relevant images we search for will be the same as the query images shown in fig:

If our query image is :

Then the relevant images will be:



The basic approach for the CBIR system is:
Basically in CBIR system the features of the query image are compared with the features of the images present in database that were extracted before. After comparison we are left with the relevant images that matches with the query image.

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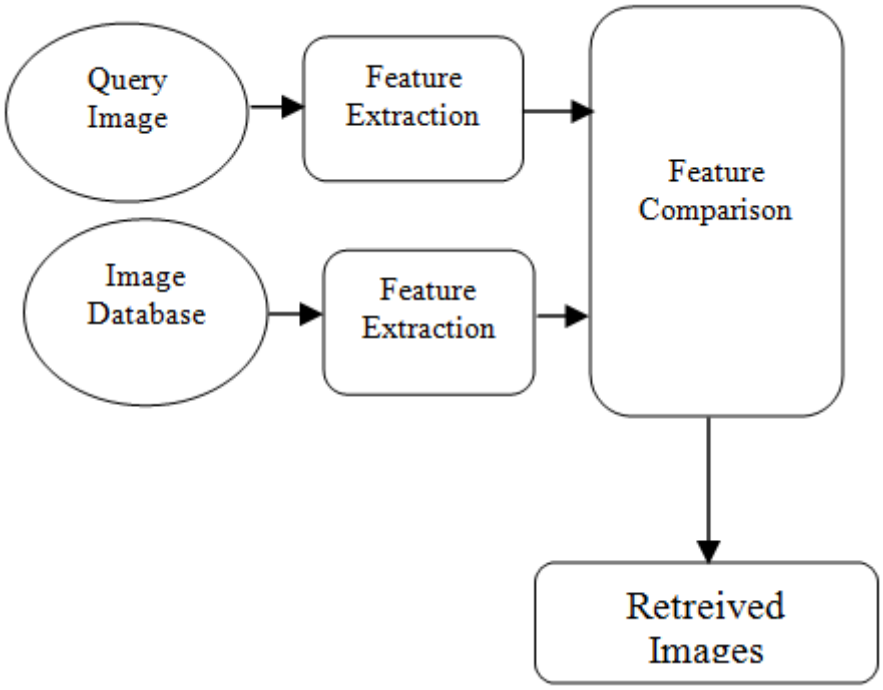

CBIR system and its various components

Applications of CBIR:

- Crime Prevention
- The Military
- Medical Diagnosis

Crime prevention: The agencies related to law enforcement need to maintain large archives of evidences of past suspects like facial photographs as whenever some serious crime is committed, they can match the evidence from the crime scene with that data in their archives. The basic technique of fingerprint matching is now used by police forces around the world. Face recognition is also a reasonably advanced technology and these techniques are been improved day by day.

The Military: Imaging technology in the military applications are used for the recognition of enemy aircraft on the radar screens, to identify the targets from the satellite images, also helpful in guiding the cruise missiles. Many of the techniques used for crime prevention may also be used in the military field.

Medical Diagnosis: The medical images are now stored by most of the hospitals due to the increase of diagnostic techniques like radiology, histopathology and tomography. There is increasing interest in CBIR techniques as it is easy to diagnose by identifying similar past cases.

2. LITERATURE SURVEY

Relevance Feedback: When we talk about high level features the CBIR system show poor response in extraction that includes objects and their meanings, actions, and feelings. This is said to be semantic gap and requires research in CBIR system towards retrieval of images by relevance feedback.

Relevance feedback diminishes the semantic gap by using the feedback provided by the user. Performance keeps on improving as the user provides more and more feedback to the system.

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Deshmukh and **Phadke** used the relevance feedback technique in 2011 and the average precision value was 0.66 and the average recall value was 0.10.

Also this was used by **Yong Rui et al**, image feature vectors were converted into weight learn vectors. Two approaches were used wavelet based and co-occurrence matrix. In wavelet based the query image is fed to wavlet filter bank and divided into sub-bands. Each band contains features of some scale. Ten sub-bands were used as texture representation of image. Co-occurrence matrix examined the texture features by analyzing the gray tone spatial dependencies. After constructing co-occurrence matrix the texture features were extracted . the average value for precision in wavelter based was 83.85% and co-occurrence was 60.42%.

SVM model and Bayesian relevance feedback: This approach is used by Wang and Chen , three steps were proposed, first to feature extraction of each image and employing color indexing and Gabor wavelet transforms for features. Second combining of SVM classifiers to cluster images in database and third the relevance feedback is applied to get the relevant images from the database.

Ultrametric Contour Maps and Oriented Watershed Tranforms : This is been used to form an outline representation or hierarchical region tree, whichs leads to segementation. Contours have the advantage that it is easy to represent in the presence of true underlying contour and it is done by associating a binary random variable to it. Image retrieval is region based, incorporating graphs multilevel semantic representation and SVM been proposed by Pablo Arbelaez et al.

FIRST(Fuzzy Image Retrieval SysTem): Fuzzy Attributed Relational Graphs(FARGs) were used to represent images, in which each node represents an image region and relation between two regions was represented by each edge. It can handle exemplar queries, linguistic queries, graphical sketch based, attributes as well as spatial relations. The desired query is given to FARG and matching algorithm is used to compare with the FARG in database, this scheme is used by R krishnapuram et al.

Kannan et al. used statistical features of grey levels methods to classify texture. The Grey Level Co-occurrence Matrix (GLCM) is used to extract second order statistics from an image. GLCM have been very successful for texture calculations. Zhang et al. retrieved those images that contain similar semantic region. Automatic image segmentation method is adopted so that each image can be segmented into a set of regions and each region is represented by 8 dimensional feature vector.

3. PROPOSED METHODOLOGY

Content based retrieval of visual data requires a paradigm that differs significantly from both traditional databases and text based image understanding systems. The challenge in CBIR is to develop the methods that will increase the retrieval accuracy and reduce the retrieval time.

Proposed system for content based image retrieval works in two phases which are as follows:
Pre Processing Phase: In this phase a dataset of images is provided to the system. For every image provided to the system, system evaluate some features like color, texture , shape and distance in between the neighbor clusters and then store the results for every image in the database.

Image retrieval Phase: In this phase query image is passed as an input to the system and features of query image are calculated as in the previous phase. These features are then compared with the features already stored in the database. Images whose features matches exactly are given high priority and other images whose features are related closely is given low priority. Final results are then displayed to the user from high priority images to the lower priority images.

The following are the steps for the proposed system working (Preprocessing Phase) :

Step 1: Input the image dataset.
Step 2: Count the number of images.
Step 3: Extract the features of images (Color, Texture and cluster Distance)
Step 4: Combine these features.

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Step 5: Divide the image into clusters.
Step 6: Calculate the mean cluster distance.
Step 7: Compare the features of the Ith image.
Step 8: Store these features in the database.

The following steps are used in Image Retrieval Phase:

Step 1: Input the query image.

Step 2: Extract the features of query image(Color, Texture and cluster Distance)

Step 3: Combine these features

Step 4: Divide the image into clusters.

Step 5: Calculate the mean cluster distance.

Step 6: Compare these features with the features stored in the database.

Step 7: Load the pre-processed dataset.

Step 8: Count the number of entries.

Step 9: Store the return score.

Step 10: Display the result according the image priority.

4. RESULTS AND DISCUSSIONS

Performance of the Proposed system is evaluated using standard wang dataset i.e. of 1000 images out of which 300 images are being tested. Proposed system shows nearly 100% efficient results on this standard dataset. Proposed system is also checked on these images by adding noise and blur components to them. Here is the table showing results:

Results when images retrieved are 10:

Images	Results	Blurred 10%	Blurred 15%	Blurred 20%	Noise 10%	Noise 15%	Noise 20%
	100%	100%	80%	80%	100%	80%	60%
	100%	100%	100%	50%	100%	100%	100%
	100%	80%	40%	30%	100%	80%	80%
	100%	90%	50%	50%	80%	100%	100%
	80%	40%	20%	70%	50%	60%	30%
Overall Accuracy	96%	82%	58%	56%	86%	83%	74%

The above table shows the statistics of the proposed system when the images queried (ie. N=10). It is shown that the proposed system shows almost 100% results except for the images which has low energy value or in

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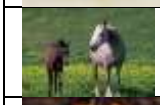
which cluster formation is poor. As shown in the above table results are evaluated on the original images, images with different amount of noise and blur. Proposed system also show the good results on these degraded images.

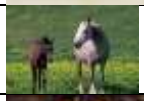
Results when images retrieved are 20 (N=20)

Images	Results	Blurred 10%	Blurred 15%	Blurred 20%	Noise 10%	Noise 15%	Noise 20%
	70%	95%	95%	90%	70%	70%	70%
	90%	85%	75%	75%	95%	95%	90%
	80%	65%	60%	40%	70%	65%	60%
	100%	35%	25%	20%	100%	95%	90%
	45%	35%	25%	20%	25%	20%	15%
Overall Accuracy	77%	63%	56%	49%	72%	69%	65%

The above table shows the statistics of the proposed system when the images queried (ie. N=20). It is shown that the proposed system shows almost 98% results except for the images which has low energy value or in which cluster formation is poor.

As shown in the above table results are evaluated on the original images, images with different amount of noise and blur. Proposed system also show the good results on these degraded images.

Results when images retrieved are 30 (N=30)

Images	Results	Blurred 10%	Blurred 15%	Blurred 20%	Noise 10%	Noise 15%	Noise 20%
	90%	86.67%	83.34%	80%	66.67%	66.67%	66.67%
	73.33%	70%	70%	70%	73.34%	73.34%	73.34%
	60%	56.67%	46.67%	40%	63.34%	60%	53.34%
	90%	33.33%	30%	30%	96.67%	93.34%	90%
	33.33%	26.67%	16.67%	13.33%	26.67%	26.67%	23.34%
Overall Accuracy	69.33%	54.67%	49.34%	46.67%	65.34%	64%	61.34%

The above table shows the statistics of the proposed system when the images queried (ie. N=30). It is shown that the proposed system shows almost 95% results except for the images which has low energy value or in

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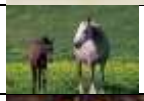
which cluster formation is poor. As shown in the above table results are evaluated on the original images, images with different amount of noise and blur. Proposed system also show the good results on these degraded images.

Results when images retrieved are 50 (N=50)

Images	Results	Blurred 10%	Blurred 15%	Blurred 20%	Noise 10%	Noise 15%	Noise 20%
	72%	72%	72%	50%	60%	56%	50%
	44%	44%	42%	42%	44%	44%	44%
	56%	38%	38%	28%	52%	50%	50%
	64%	32%	22%	16%	62%	62%	60%
	32%	20%	14%	10%	26%	26%	20%
Overall Accuracy	53.6%	41.2%	37.6%	29.2%	48.8%	47.6%	44.8%

The above table shows the statistics of the proposed system when the images queried (ie. N=40). It is shown that the proposed system shows almost 85% results except for the images which has low energy value or in which cluster formation is poor. As shown in the above table results are evaluated on the original images, images with different amount of noise and blur. Proposed system also show the good results on these degraded images.

5. CONLUSION AND FUTURE SCOPE

Conclusion

The dramatic rise in the sizes of images databases has stirred the development of effective and efficient retrieval systems. The development of these systems started with retrieving images using textual connotations but later introduced image retrieval based on content. This came to be known as Content Based Image Retrieval or CBIR. Systems using CBIR retrieve images based on visual features such as texture, colour and shape, as opposed to depending on image descriptions or textual indexing. The main objective of this dissertation is to retrieve the images from database in a fast and an efficient manner. The images are pre-processed with various techniques and the texture calculation is highly focused. Here, the images are clustered based on RGB Components, Texture values using Artificial Neural Network algorithm. Proposed system is very efficient and powerful to handle large data sets. It assists faster image retrieval and also allows the search for more relevant images in large image databases. Auto-correlation is used to compare the images and to improve the system performance.

Proposed system is evaluated on two datasets one of which is wang dataset containing 1000 images of 10 different categories and another dataset contains nearly 10000 images of various categories.

Future scope

In future , the system can be improved by using efficient edge detection technique along with color feature based on SVM. In future, proposed system can be extended to extract the features from medical images like CT Scans, X-Ray images so that the proposed system can be used with the medical images. In future, time to extract and store the features in the database can also be improved.

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