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Content based Image Retrieval System using K-Means Clustering Algorithm and SVM Classifier Technique

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ABSTRACT

The dramatic rise in the sizes of pictures databases has blended the advancement of powerful and productive recovery frameworks. The improvement of these frameworks began with recovering pictures utilizing printed implications however later presented picture recovery dependent on the substance. This came to be known as Content-Based Image Retrieval or CBIR. Frameworks utilizing CBIR recover pictures dependent on visual highlights, for example, surface, shading and shape, rather than relying upon picture depictions or printed ordering. In the proposed work we will use various types of image features like colour, texture, shape, energy, amplitude and cluster distance to classify the images according to the query image. We will use multi-SVM technique along with the 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.

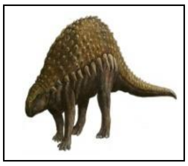
Keywords— *CBIR, SVM, Content Based Image Retrieval, Modified SVM, Clustering based SVM Technique*

1. INTRODUCTION

Retrieval of the relevant images according to the query image from 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 the use of Image retrieval in various fields like image forensics, criminal investigation system etc [1]. 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 [5]. 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.

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 figure.

If our query image is:



Then the relevant images will be:

1.1 The basic approach for the CBIR system

Basically, in the CBIR system, the features of the query image are compared with the features of the images present in the database that were extracted before. After comparison, we are left with the relevant images that match with the query image.

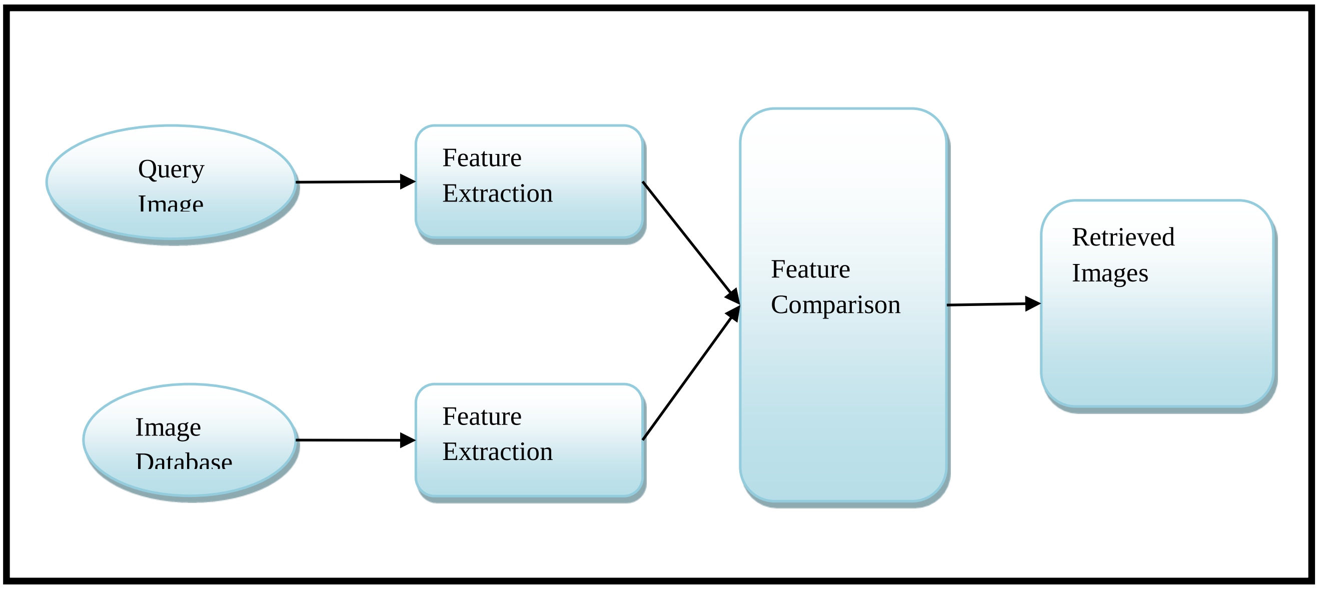


Fig. 1: The basic approach of CBIR System

1.2 Applications of CBIR

- **Crime Prevention**
- **The Military**
- **Medical Diagnosis**

Crime prevention: The agencies related to law enforcement need to maintain large archives of evidence 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 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 a poor response in extraction that includes objects and their meanings, actions, and feelings. This is said to be a 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.

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 wavelet filter bank and divided into sub-bands. Each band contains features of some scale. Ten sub-bands were used as texture representation of the image. Co-occurrence matrix examined the texture features by analyzing the gray tone spatial dependencies. After constructing the 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 colour indexing and Gabor wavelet transforms for features. Second combining of SVM classifiers to cluster images in the database and third, the relevance feedback is applied to get the relevant images from the database.

Ultrametric Contour Maps and Oriented Watershed Transforms: This is been used to form an outline representation or hierarchical region tree, which leads to segmentation. 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, a 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 the database, this scheme is used by R Krishnapuram et al.

Grey Level Co-occurrence Matrix (GLCM): 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 vectors.

3. PROPOSED METHODOLOGY

Content-based recovery of visual information requires a worldview that contrasts fundamentally from both conventional databases and content-based picture understanding frameworks. The test in CBIR is to build up the techniques that will expand the recovery precision and decrease the recovery time.

The proposed system for content-based image retrieval works in two phases which are as follows:

(a) Pre Processing Phase: In this stage, a dataset of pictures are given to the framework. For each picture given to the framework, framework assesses a few highlights like shading, surface, shape and separation in the middle of the neighbour bunches and afterwards store the outcomes for each picture in the database.

(b) Image retrieval Phase: In this stage, the inquiry picture is passed as a contribution to the framework and highlights of the question picture are determined as in the past stage. These highlights are then contrasted and the highlights previously put away in the database. Pictures that highlights coordinate precisely are given high need and different pictures whose highlights are connected intently is given low need. Last outcomes are then shown to the client from high need pictures to the lower need pictures.

The following are the steps for the proposed system working (Pre-processing Phase):

Step 1: Input the image dataset.
Step 2: Extract the features of images (Colour, texture, shape, energy, amplitude and cluster distance) with the help of ANN.
Step 3: Combine these features.
Step 4: 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 the query image (Colour, texture, shape, energy, amplitude and cluster distance) with the help of ANN.
Step 3: Combine these features using Multi-SVM.
Step 4: Compare these features with the features stored in the database.
Step 5: Display the result according to the image priority.

4. RESULTS AND DISCUSSION

Performance of the proposed system is evaluated using standard Wang dataset i.e. of 1000 images out of which 300 images are being tested. The proposed system shows nearly 100% efficient results on this standard dataset. The proposed system is also checked on these images by adding noise and blur components to them. Results, when images retrieved, are 10 are shown in table 1.

Table 1: Results, when images retrieved, are 10

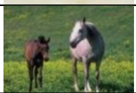
Images	Results	Blurred 10%	Blurred 15%	Blurred 20%	Noise 10%	Noise 15%	Noise 20%
	100%	100%	80%	80%	100%	80%	60%
	100%	100%	100%	50%	100%	100%	100%
	100%	80%	40%	30%	100%	80%	80%
	100%	90%	50%	50%	80%	100%	100%
	80%	40%	20%	70%	50%	60%	30%
Overall Accuracy	96%	82%	58%	56%	86%	83%	74%

Table 2: Results, when images retrieved, are 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%

Table 1 shows the statistics of the proposed system when the images queried (i.e. N=10). It is shown that the proposed system shows almost 100% 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 a different amount of noise and blur. The proposed system also shows the good results on these degraded images.

Results, when images retrieved, are 20 (N=20) are shown in Table-2. Table-2 shows the statistics of the proposed system when the images queried (i.e. 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 a different amount of noise and blur. The proposed system also shows the good results on these degraded images.

Results, when images retrieved, are 30 (N=30) are shown in Table-3. Table-3 shows the statistics of the proposed system when the images queried (i.e. N=30). It is shown that the proposed system shows almost 95% 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 a different amount of noise and blur. The proposed system also shows the good results on these degraded images.

Results, when images retrieved, are 50 (N=50) are shown in Table-4. Table-4 shows the statistics of the proposed system when the images queried (i.e. N=50). 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 a different amount of noise and blur. The proposed system also shows the good results on these degraded images.

Table 3: Results, when images retrieved, are 30

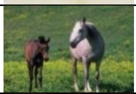
Images	Results	Blurred 10%	Blurred 15%	Blurred 20%	Noise 10%	Noise 15%	Noise 20%
	90%	86.67%	83.34%	80%	66.67%	66.67%	66.67%
	73.33%	70%	70%	70%	73.34%	73.34%	73.34%
	60%	56.67%	46.67%	40%	63.34%	60%	53.34%
	90%	33.33%	30%	30%	96.67%	93.34%	90%
	33.33%	26.67%	16.67%	13.33%	26.67%	26.67%	23.34%
Overall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

Table 4: Results, when images retrieved, are 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%

5. CONCLUSION

The dramatic rise in the sizes of pictures databases has mixed the improvement of reasonable and viable recuperation systems. The progression of these systems started with recuperating pictures using printed suggestions anyway later displayed picture recuperation reliant on substance. This came to be known as Content-Based Image Retrieval or CBIR. Structures using CBIR recuperate pictures reliant on visual features, for instance, surface, shading and shape, instead of depending upon picture delineations or artistic requesting.

The crucial objective of this paper is to recoup the photos from the database in a brisk and a capable way. The photos are pre-arranged with various techniques and the surface check is exceedingly locked in. Here, the photos are gathered reliant on RGB Components, Texture regards using Artificial Neural Network estimation. The proposed system is very capable and pivotal to manage sweeping instructive records. It helps faster picture recuperation and besides allows the sweep for continuously appropriate pictures in immense picture databases. Auto-relationship is used to balance the photos and improve the system execution. The proposed system is evaluated on two datasets one of which is wang dataset containing 1000 pictures of 10 one of a kind characterizations and another dataset contains right around 10000 pictures of various classes.

6. FUTURE SCOPE

In future, the proposed framework can be stretched out to separate the highlights from medicinal pictures like CT Scans, X-Ray pictures so the proposed framework can be utilized with the restorative pictures. In future time to concentrate and store the highlights in the database can likewise be improved.

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