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Region Based Image Retrieval Approach Using SVM with Shape and Texture Based Feature

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Abstract: ***The content based image retrieval is important research in medical and internet applications. This aim is searching the images from database based on query image. Region based image retrieval approach using edge following technique with shape and texture based feature are present in this paper. The Gradient based cluster algorithm is used to find the boundaries of noisy medical images. The performance and robustness of edge following technique is tested to detect the objects in different medical images. To accomplish this, local binary pattern (LBP) as texture feature and Hu moments (Hu), Tchybysheve Moments, invariant moment as shape based features are taken in this paper. These shape and texture features are calculated from segmented images and combine as feature vectors. The advantage of feature vector is to reduce the image dimensionality and less computation time. After feature vector is calculated, comparing the feature vector of query image and feature vectors of given database images and then sorted the images based on distance. The proposed method has better to improve the retrievals accuracy, high speed and less computation time. Our obtained results show the proposed method is robust in different medical image alterations. The proposed method obtains 99% retrieval accuracy, which is satisfactory. The region based image retrieval performance of proposed method is tested of 4000 images with 40 different classes.***
Keywords: content-based image retrieval, shape, texture and Euclidian distance

I. INTRODUCTION

In present days, digital and internet technologies produce the large amount of digital images and therefore digital image databases are becoming a more larger and wider. The CBIR systems divide in two categories. They are image based searching and segment based search (also called region based search). In CBIR systems, a query an image to search the images in database and to be matched. In CBIR contain several well-known methods to retrieve the digital images from database. One of the techniques is IBM QBIC to retrieve the similarity images based on color and texture percentage in the images [1]. Virage [5] is used for video content based Retrieval H. Eidenberger [6] uses interactive learning agent for image retrieval [6]. The color regions arrangement used by Visual Seek system [2]. T. Huang [4] introduced the relevance feedback with MARS in image retrieval. Region based image retrieval with Expectation-Maximization-like (EM) segmentation introduced in [3].

CBIR systems use low-level features vectors such as color, Shape, texture and spatial information [7, 8]. These combination features used to retrieve the similarity images [9]. Color and texture are important features [10] in CBIR systems. The color and texture feature combination has less retrieval accuracy and less speed.

Texture and shape features are less develop compare to color features. Various texture and shape feature are investigated in computer vision and pattern recognition. Yet, medical retrieval by texture and shape are the effective search technique in medical and other application fields [11].

One more important stage in region based image retrieval is distance measurements. Distance between Feature vectors of query image and database image feature vector. This process is independent on query paradigm. The proposed method proposes the Euclidian distance as distance measurements. In find the distance of query and database images, three feature vectors are converted in to single row vector. So, it is high level based feature vector and output of feature vector represents the images of database similarity ratio. Based on feature vector, medical images are retrieved similar images based on Euclidian distance is obtained.

The proposed method can focus the shape and texture; they have no idea how the inter-relationships of regions and multiple objects in a given image. The CBIR system depends on only spatial relationships. The contribution of proposed method as follows: 1) the efficient retrieval of medical image based on edge following technique (EFT). 2) The retrieval process can be examined in CT and MRI medical images. The CBR system is an interactive and provides the correct results in segmented images. The user's can identify the regions in a segmented images and extract them. Based on spatial and individual regions in region based image retrieval

and takes the more storage of image retrieval.

II. SHAPE FEATURE

Shape feature is important feature in content-based image retrieval systems. It is a high level feature technique that can be determining the images similarity from database. This similarity measures used Euclidian distance of corresponding feature vectors. Particularly, the shape features are used in medical images in content based image retrieval. In shape feature, there are different methods are used to representation with feature vector.

A. Invariant moments

Invariant moment is also defined as moment invariant. It is used as shape feature in CBIR systems and classification systems. The object characteristics of invariant Moments can provides the uniquely shape representation. It is also well performed in the multidimensional feature space in retrieval and classification systems. The values of invariant moments are invariant in terms of the scale, rotation and translation of the shape. Invariant moment is determine the centre moments (origin of object). So, it reduces the dimension of object and independent rotation in second and third order values of central moments. Presently , invariant moment are dermine based on boundary shape and interior . The regular invariant moment function f(x, y) in analog form is given by:

$$M_{pq} = \int\int x^p y^q f(x,y)dxdy$$

Where Mpq is the moment of two-dimensional image of the function *f(x,y)*. P is row representation and q is the column representation in image. The regular invariant moment function f(x, y) in digital form is given by:

$$M_{pq} = \sum_X \sum_Y x^p y^q f(x,y)$$

The centre gravity of coordinates x, y in analog form is given by
X=M10/M00
Y=M01/M00
The centre gravity of coordinates x, y in digital form is given by

$$\mu_{pq} = \sum_X \sum_Y (x-\bar{x})^p (y-\bar{y})^q$$

Where µpq is centre gravity of object.

III. TEXTURE FEATURE

Texture is an important feature in nature image. It is high level feature texture. It is formed a repeating values in spatial positions. Basically, the repetition values involves orientation, elements of optical features and scale variations. Texture feature contain different techniques are used in CBIR system.

A. Local binary pattern

Local Binary Pattern (LBP) [4] is one type of invariant texture feature and low level feature descriptor. It is powerful texture feature in image retrieval and classification. The LBP is used in different applications. They are medical classification, face recognition and fingerprint identification. It has low computational time and reduces the size of image dimensionality. D.unay [14] introduces the local binary pattern with MR artifacts. LBP applies the threshold to neighborhood with centre pixel of image gray values and then

get binary results. The local binary pattern of 2D image is given by
LBP=Gp-P
Where Gp is the pixel gray value and P is the local neighborhood pixel
The procedure of local binary pattern in CBIR system as follows in stepwise
Step1: divide the image object into blocks (each block 16×16 pixels)
Step2: compare the each pixel to its 4 neighbors in circle manner or clock wise direction.
Step3: if pixel value is larger the neighbor value then assign 1elsewhere 0
Step4: calculate the histogram and then normalization
Step5: take the histogram values of each cell as a feature.

IV. GRADIENT BASED CLUSTER ALGORITHM (GCA)

Image segmentation is the key role in image retrieval. The images are segmented into dominant image objects or regions. The paper uses segmentation approaching, such as GCA method, the advantage is computing effectively and satisfying the requirement of real-time GCA. Clustering is the process of partitioning a group of data points into a small number of clusters. THE goal is to assign a cluster to each data point. Gradient is a clustering method that aims to find the positions μi=1...k of the clusters that minimize the *distance* from the data points to the cluster. Gradient based clustering solves

$$\arg\min_{\mathbf{S}} \sum_{i=1}^{k} \sum_{\mathbf{x} \in S_i} \|\mathbf{x} - \boldsymbol{\mu}_i\|^2$$

Where si is the set of points that belong to cluster i. The gradient clustering uses the square of the Euclidean distance $d(x,\mu i)=\|x-\mu i\|^2$.
Where $\boldsymbol{\mu}_i$ is the mean of points in S_i.

V. DISTANCE SIMILARITY

Distance similarity calculation between two images of feature vectors. The distance measures can collect from different areas of published papers.

A. Euclidian distance

In this paper, we consider a Euclidian distance as a similarity measurement in CBIR system. Suppose X= {X_1, X_2, X_3… X_i} is the feature vector of medical query image and Y= {Y_1, Y_2, Y_3… Y_i} is the feature vector in database images then calculate the Euclidian distance between X, Y is given by

$$Deludian = \sqrt{(y1-x1)^2 + (y2-x2)^2 + ... + (yn-xn)^2}$$

$$Deludian = \sum_{i=1}^{n} (y_i - xi)^2$$

In this paper, we obtain the distance b/w the mutli feature of query image and multi feature of candidate images i.e database. After that, apply the threshold then retrieve the similarity images of query .

VI. RETRIEVAL ACCURACY

The proposed edge following based context based image retrieval was tested on medical image database. It contains 50000 images and each class contains 100 images. The shape and texture features in section 2 and 3 are used in proposed CBIR system. From the results, the image retrieval accuracy is calculated from precision and recall. The formula of precision is given by

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$$\text{precision} = \frac{\text{No. of correct images retrieved}}{\text{No. of total images retrieved}}.$$

It defined as the ratio of same class images retrieve and total medical image in database. The range of precision value between 0 to 1. If precision value is low, the retrieval accuracy has less in CBIR systems. Using medical image database, retrieval images are made based on query images. In this paper, randomly 500 query images are taken. After retrieve the images, counting the correct retrieve images from database and then calculate the precision. The average precision of proposed method is 0.658 for 50 images retrieve.

Table 1 shows the average precision with different features using proposed method.

Table.1. average precision with multiple features using proposed method

Image category	Shape feature		Texture feature	Combined features
	Rational chebyshev	LBP	Invariant moments	Rational chebyshev+ invariant moments + LBP
KNEE	0.3568	0.2635	0.1565	0.5992
chest	0.3578	0.2530	0.1892	0.5832

Another approach used in retrieval accuracy is recall. The formula of recall is defined as

$$\text{recall} = \frac{\text{No. of correct images retrieved}}{\text{No. of total images in same class}}$$

It defined as the ratio of same class images retrieve and total medical image in same class. The range of recall value between 0 to 1. If recall value is zero, the average retrieval accuracy is 0%. If recall value is one, the average retrieval accuracy is 100%. Table 2 shows the average recall with different features using proposed.

Table.2. average recall with multiple features using proposed method

Image category	Shape feature		Texture feature	Combined features
	Rational chebyshev	LBP	Invariant moments	Rational chebyshev+ invariant moments +LBP
knee	0.95	0.89	0.81	0.99
chest	0.93	0.87	0.82	0.96

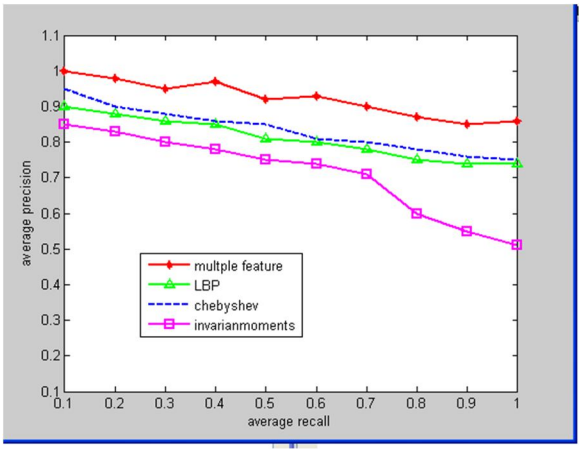

Fig.3. shows that average precision vs. average recall of different feature descriptor

The effectiveness of multiple features using edge following algorithm is better retrieval accuracy comparing to the single feature using edge following algorithm in recall-precision graph shown in fig.3. Figure 3 shows the select feature performance differently

from selected database. In CBIR systems, Multiple features is most suitable compare to single features corresponding as shown in fig.3.

VII. EXPERIMENTAL RESULTS

In proposed method, we use the public medical image database. In this database we take 1,000 medical images and divide the images in to 20 classes of 50 images each. These medical images contain human body like knee, tumor, and lung and so on. These images are gray scale level and convert all images in JPG format. Twenty images from database are various regions and choose a query image in CBIR system. After that measuring the precision and recall in table 1.2.

Medical image retrieval of edge following based CBIR systems as shown in fig.5

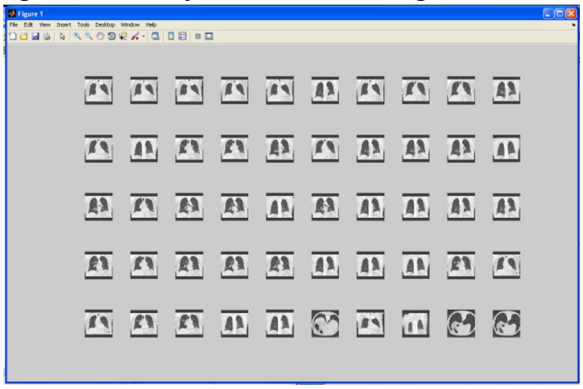

Fig.4 Image retrieval using edge following based CBIR systems.

In fig.4 show first row of first image can be taken as query image. In the edge following based CBIR system, the images are retrieving based on combined features such as chybheshev, local binary pattern and invariant moments. If combine multiple feature, to get the better performance than the single feature in medical images. The feature such a shape and texture are important role in the proposed technique.

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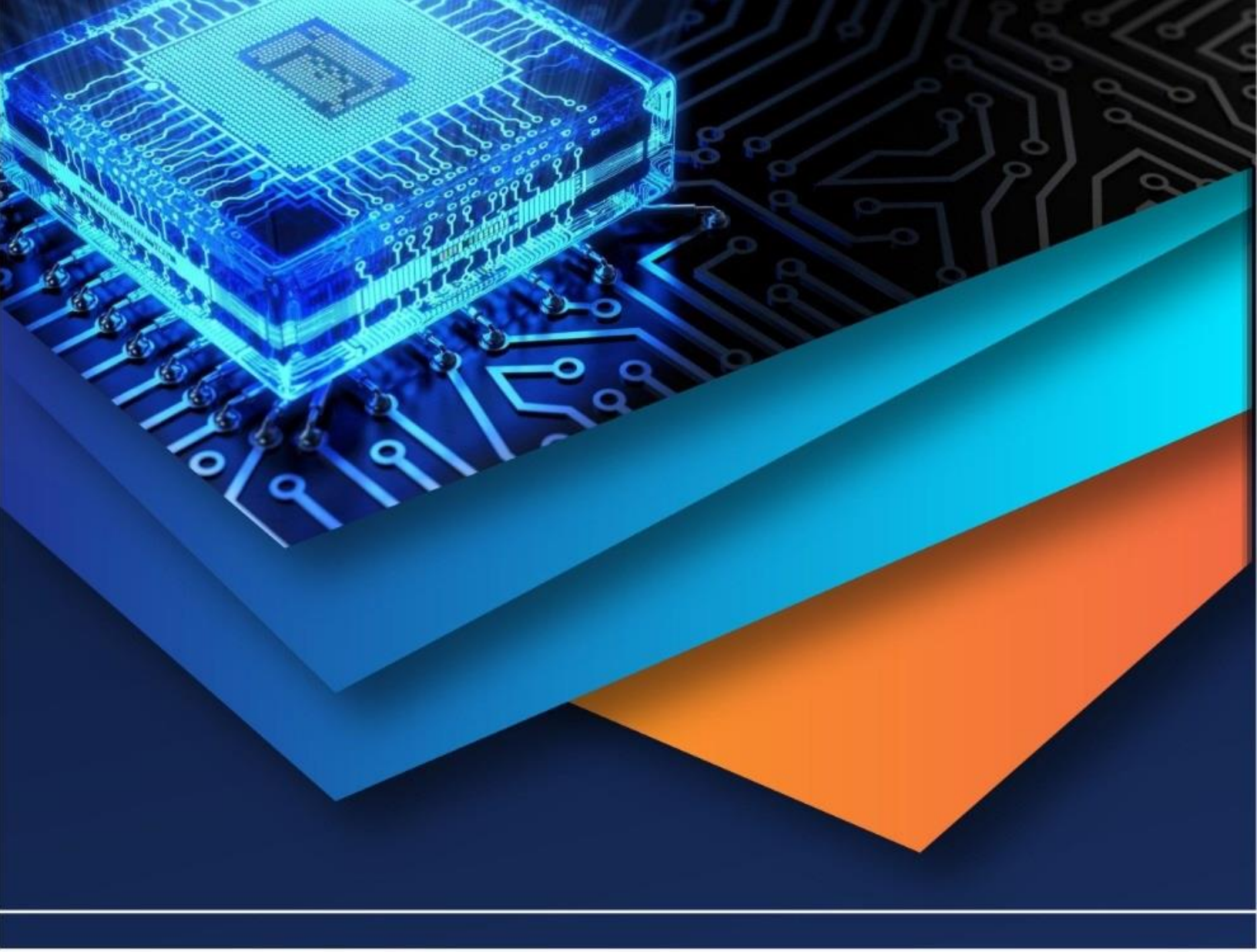

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