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Image Based Information Retrieval

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Abstract - *The use of digital images have drastically increased. There is a high requirement of a system which manipulates these images and delivers relevant information. This paper focuses on the significance of monument recognition. The use of Content Based Image Retrieval is inculcated to match the similar features of the images. Such a system can find its use in tourism applications where there is a need to find the monument's information using the image of the monument. Images can be technically divided into classes based on its features. The prominent features of an image are color, texture and shape. This research paper uses an algorithm which is based on shape feature extraction. Few image samples are taken and their region wise similarity is mathematically compared.*

***Keywords*: Digital images, recognition, similar features, Content Based Image Retrieval, tourism**

1. INTRODUCTION

Image processing is a process of manipulating the images for different purposes such as image quality improvement, noise reduction, object detection, object recognition and content based image retrieval. With growth in digitalization the use of digital images have grown rapidly in all the fields such as in forensic investigation, medical image analysis. There is yet another field which can find image processing a useful tool for recognition and information retrieval purposes. This research paper uses Content Based Image Retrieval (CBIR) as a core concept for similar feature matching.

1.1 Querying with the image

There is an immense scope of such systems because textual annotation of every image manually is not possible so a system which works with an image as input is necessary. This can be bought in use when querying is specifically through image. There may arise a situation when recognition is possible only with the visual contents of the image and there is no associated text with it in such cases querying by image finds its use. The most common example of this is finger print recognition system where identity of the person is revealed by just the scanned images of the fingers. Different image processing systems consider different aspects of images for purposeful computations. Images are stored for comparison or computations in an image data base which have fields according to the application architecture i.e. what many aspects of image and related information to the image is to be stored for manipulation.

1.2 Content Based Image Retrieval

CBIR is also called as Query By Image Content (QBIC). The features of the query image are manipulated and compared for similarity matching with the already stored image

“Content-based" means that the search will analyze the actual contents of the image. Various visible features which make an image different are color, texture and shape.

Steps for CBIR include:

1) Query image: It is the image which is given as input for similarity matching
2) Image database: It consists of n number of images depending on the choice of the user.
3) Feature extraction: It consists of visual information (feature vector) gathering of the image and saves these features along with the image in the image database.
4) Image matching: These feature vectors are used to compare the query image and the other images
The feature vectors stored in database are compared with the feature vectors of the query image
5) Resultant retrieved images: It returns the similar images and related information based on the closeness of the feature vector values from the image database.

1.3 CBIR Techniques

1.3.1 **Color retrieval**: Each image has a certain combination of color in it. Color becomes one of the intuitive feature of the image and histograms are used to describe the colors. A color histogram shows the proportion of pixels of each color within an image. This calculated color histogram is stored in the database. A color histogram is the distribution of colors in an image.

1.3.2 **Texture retrieval**: Visual patterns with properties of homogeneity. Contrast, density and uniformity makes up texture of an image. Classes of texture descriptors include statistical model based and transform based.

1.3.3 **Shape retrieval**: Shape is a well-defined feature which mostly does not depends on the size of the object. Shape of the object is taken into consideration for similarity matching between images.

2. LITERATURE REVIEW

We analyzed various research papers that described the new trends of CBIR techniques by some authors in various domain of computer vision and its applications

2.1 A. Khokhar" Content-based Image Retrieval: Feature Extraction Techniques and Applications" In this paper they have discussed the difficulties faced by researchers when text based image retrieval systems are used.

The first problem discussed is the size of the database manual annotation of such large database is a very tedious process the second problem is that description of images could be highly subjective that can generate different text labels for the same particular image. These problems have led to the development of systems which retrieve images and related information based on the automatically derived features which covers features such as shape, color and texture and such system is called Content Based Image Retrieval.

2.2 Zobeir Raisi, Farahnaz Mohanna, Mehdi Rezaei
" A Journal on Content Based Information Retrieval on Tourism Applications " In this paper they have discussed the techniques to retrieve images using all the three features shape , color, texture one by one. From this paper we have picked the study material for shape feature as our research paper is based on shape feature computation. Edge histogram descriptor (EHD) is bought in use. EHD represents the distribution of five types of edges in any local sub area of an image. The whole image is divided in 16 sub images and dominant edge is found out in each in sub image block. The five types of edges are horizontal, vertical, 45 degree diagonal, 135 degree diagonal and non-directional. If the maximum value among five edge magnitudes exceeds a particular threshold value then that sub image block is said to have that particular edge as its dominant edge, otherwise that block has no edge.

2.3 Ramesh K Lingadalli , N.Ramesh , "Content Based Image Retrieval using Color, Shape and Texture" This paper describes feature extraction techniques for all the three features. Color is the basic visual attribute for humans and computer vision so color is perhaps the most expensive of all the features. The scalable color descriptor (SCD) is defined in the hue-saturation-value (HSV) color space with fixed color space quantization, and uses a novel Haar transform encoding. For texture feature extraction Grey-Level co-occurrence matrix (GLCM) is used widely and its proven that results obtained using GLCM are better than any other texture discrimination algorithms. GLCM is a combination of how often various different combinations of pixel brightness values also called as grey levels occur in a particular image. But this is found that this matrix is sensitive to rotation.

3. METHODOLOGY:

For this research Content Based Information Retrieval (CBIR) is taken as methodology. CBIR approach has the capability of retrieving the most similar images to a given query image from a database of images. It is the process of searching for digital images in large database.
Content based means search will analyze the actual content of the image.

3.1 Generic Process

Step1: Input the query image
Step2: Querying the database with the help of an image
Step3: The features of the image are extracted and matched with the features of the images stored in the database.
Step4: Most similar image with the query image is retrieved as result.

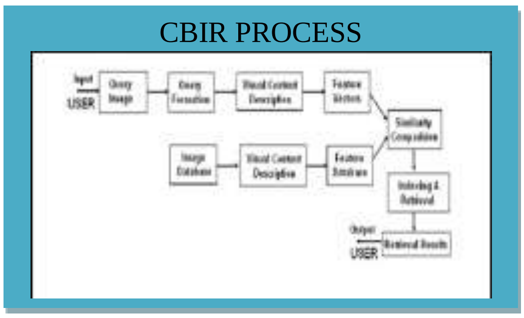

Fig 1 : CBIR PROCESS

In a typical CBIR system features related to visual content such as shape, color, texture are initially extracted from the query image and then they are matched with the target image stored in the database.

In this paper, we have taken Shape as the feature extraction basis i.e images will be matched basis of their shape. The distribution of edges is a good texture signature that is useful for image to image matching.
For that we are using Edge Histogram Descriptor (EHD) to capture the spatial distribution of edges.
Our idea is to take the query image of a monument as input and then retrieve the information of that particular monument as result.

3.2 Edge Histogram Descriptor (EHD)

The MPEG-7 Edge Histogram Descriptor (EHD) is an efficient visual feature descriptor to extract the contents from images.

It is also used as a Shape descriptor as long as the edge field contains the true object boundaries.

The EHD method represents the distribution of 5 types of edges in each local area called as sub-image which are vertical, horizontal, 45-degree diagonal, 135-degree diagonal and non edge.

The methodology followed is given below:-

Step 1: First of all, the query image is divided into 16 non-overlapping sub-blocks called as sub-images.

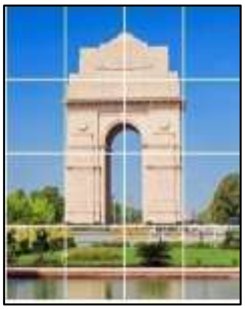

Fig 2 : Original image partitioned into sub-images

Step 2: To characterize the EHD, each sub-image serves a basic region to generate an edge histogram which consists of 5 bins with vertical, horizontal,45-degree-diagonal,135-degree diagonal and non directional edge types.

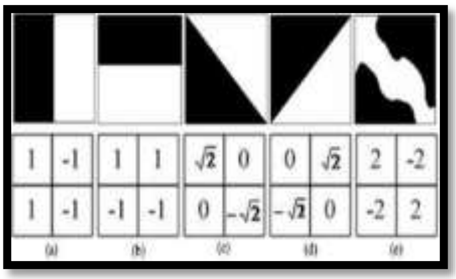

Fig 3 : Types of Edges

Step 3: The histogram for each sub block image represents the relative frequency of occurrence types of edge in the corresponding sub-image.
Step 4 : To extract edge features, each sub-image is further divided into four sub-blocks.

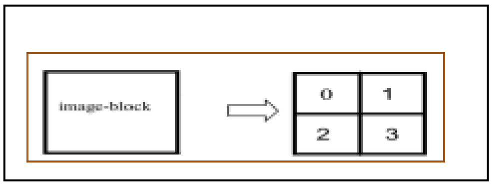

Fig 4 : Sub-blocks and their labeling

Step 5: The luminance values of the four sub-blocks are used for the edge-detection. The mean values of the four sub-blocks are convolved with the filter coefficients to obtain the edge magnitude.

Step 6: For the k^{th} (k=0,1,2,3) sub-block of the $(i,j)^{th}$ image-block, the average gray level is calculated.

Step 7: The filter coefficients for vertical, horizontal, 45-diagonal, 135-diagonal, non-directional edges are shown as fv(k), fh(k), fd-45, fd-135, fnd(k) respectively.

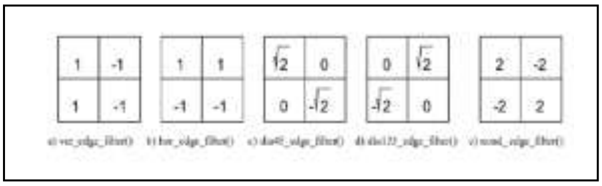

Fig 5 : Filters for Edge Detection

Step 8:Now the respective edge magnitudes mv(i.j), mv(i,j),mh(i,j),m(d-45)(k),m(d-135)(i,j) and mnd (i,j) for the $(i,j)^{th}$ image block can be obtained as follows :-

$$m_v(i,j)=\left|\sum_{k=0}^{3} a_k(i,j)\times f_v(k)\right| \quad (1)$$

$$m_h(i,j)=\left|\sum_{k=0}^{3} a_k(i,j)\times f_h(k)\right| \quad (2)$$

$$m_{d-45}(i,j)=\left|\sum_{k=0}^{3} a_k(i,j)\times f_{d-45}(k)\right| \quad (3)$$

$$m_{d-135}(i,j)=\left|\sum_{k=0}^{3} a_k(i,j)\times f_{d-135}(k)\right| \quad (4)$$

$$m_{nd}(i,j)=\left|\sum_{k=0}^{3} a_k(i,j)\times f_{nd}(k)\right| \quad (5)$$

$$\max\{m_v(i,j), m_h(i,j), m_{d-45}(i,j), m_{d-135}(i,j), m_{nd}(i,j)\} > Th_{edge} \quad (6)$$

Step 9: If the maximum value among 5 edge magnitude obtained from (1) to (5) is greater than the threshold, then The image-block is considered to have the corresponding edge (6).Otherwise the image block has no edge.

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4. EXPERIMENT/RESULT:

For a particular monument one image was taken and its edge magnitude values were compared with the most similarly appearing images, it gave the following edge magnitudes mentioned in the table.

The table consists of two columns the first column consists of 16 region wise edge magnitudes of the first image and the second column consists of 16 region wise edge magnitudes of a similar image(as of first image). Each row of the table shows the edge magnitude of the respective region number in both the images. If the two values are numerically close to each other in a particular row it depicts that respective region number has a similar kind of edge. If more respective set of regions have a similar edge present in them, it concludes that both the images have similar shape of objects within it.

1.HUMAYUN TOMB

Image: i1

Image: i2

TABLE I : Edge Magnitude Value (i1 ,i2)

Sub-Block	EM Value(Image -i1)	EM-Value(Image -i2)
1st	1.5346e+03	1.4383e+033
2nd	1.5854e+03	1.4859e+03
3rd	1.5297e+03	1.5266e+03
4th	1.4951e+03	1.4939e+03
5th	1.4972e+03	1.4098e+03
6th	1.1985e+03	1.2631e+03
7th	1.2017e+03	1.2534e+03
8th	1.4888e+03	1.4424e+03
9th	1.1019e+03	1.2447e+03
10th	919.2380	1.0709e+03
11th	1.0265e+03	1.0181e+03
12th	1.0279e+03	1.2682e+03
13th	821.0668	1.0697e+03
14th	1.076e+03	1.1612e+03
15th	1.0444e+03	1.1046e+03
16th	947.8289	898.1925

2. STATUE OF LIBERTY

Image: i3

Image: i4

TABLE II : Edge Magnitude Value (i3,i4)

Sub-Block	EM Value(Image-i3)	EM Value(Image-i4)
Ist	1.5952 e+03	1.5034 e+033
2nd	1.4768 e+03	1.4017 e+03
3rd	1.5634 e+03	1.5397 e+03
4th	1.6197 e+03	1.6096 e+03
5th	1.9343 e+03	1.8959 e+03
6th	1.4665 e+03	1.5251 e+03
7th	1.5727 e+03	1.5797 e+03
8th	1.8558 e+03	1.6713 e+03
9th	1.9405 e+03	1.9242 e+03
10th	1.7022 e+03	1.4943 e+03
11th	1.3833 e+03	1.6201 e+03
12th	1.9131 e+03	1.9250 e+03
13th	1.9183 e+03	1.9428 e+03
14th	1.5768 e+03	1.7116 e+03
15th	1.3776 e+03	1.3492 e+03
16th	1.8776 e+03	1.9117 e+03

5. CONCLUSION:

We can conclude that if two images have similar shape (close-set of edge magnitudes) of objects in it, they are more likely to be the image of the same object. This solves our agenda of similar image matching for monuments. Thus shape can be considered as a prominent image feature for similarity matching.

5.1 Future Scope

1. There is a rapid growth in the use of digital images on the internet so there is a need to manage them effectively
2. Specifically when the query is through image only. It finds immense scope in criminal identification if we only have images with us.
3. Google has introduced an image recognition mobile app known as Google lens. It is designed to bring up the relevant information using visual analysis

5.2 Limitations

We do not yet have a universally acceptable means of characterizing the human vision more specifically in the context of image understanding.
Hence it is not surprising to see continuing efforts.

5.3 Applications of CBIR

- Medical image retrieval
- Forensic Investigation
- Face recognition
- Finger-Print Recognition

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