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Application of L1 Norm, L2 Norm and City Block Distance to CBIR

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Abstract:- Huge increase in computer technology results in the vast growth of digital images Due to which we require effective content based image retrieval. Content based image retrieval works on the principal of automatic indexing retrieval. Indexing retrieval is done on visual impression and semantic features. However user struggles while characterizing their information to content based image retrieval. In this paper we study method based on color histogram approach. The potential of this method is measured and results are shown. The focus of this paper is to make content based image retrieval system more effectual. More improvements are required to build better performance in image retrieval.

I. INTRODUCTION

Content based image retrieval works on the low level features such as color texture and shape. we can distinguish images by their visual appearance depending on color shape and texture among all color is the more distinguish feature it can be represent by color histogram. The color histogram of an image provides the frequency of color distributed in an image.color histogram represent the no of pixels which have colors in fixed list of color ranges [1]. Image retrieval is done by two methods TEXT-BASED and CONTENT BASED approach. Most commonly used technique is textual description and categorizing of images. Disadvantage of these methods are people may describe the same image differently due to which problem arise while retrieving it again. It is also takes time while dealing with large database. The solution to these problems is content based image retrieval [2].CBIR retrieves the images based on the features extracted from images such as texture shape and color without considering the description given to the images. In past ages many CBIR techniques are come forward, the common aim for them is to extract a desire image. It is very easy task for human comparing the two images and deciding whether they are similar or not but when it comes to the computers it becomes different issue [3].Color histogram is used in various CBIR approaches.Reaserchers claims that CBIR has limitation. Two drawbacks in text based image retrieval are ,we manually gives the annotation to the images which is very time consuming and costly. Second different human will give different annotation for the same image. Additionally there are those images also which we cannot describe in words. Because of these two problems we require more efficient technique like CBIR [4]. For example.CBIR is useful for medical application where we want to compare the X-ray's with previous cases or finding criminal face from the crowd. This task is based on 'find similar' technique [5]. We have stated the disadvantages of text based and advantage of the CBIR.

II. FEATURE EXTRACTION

We can extract features of an image based on two methods. Previously we extract the textual information about the image or keywords later we use to extract the general features such as color,shape and texture. Extracted features from query image and other images are stored in the database. Features are extracted based on their pixel values [3]. For an example we are finding an image which contains red bus in it CBIR system retrieves an images by feature extraction based on color shape and texture.

A. COLOR

In an image color is an most important visual factor. there are many color spaces are available for ex. RGB, HSV, LUV, VCrCb etc.We are mainly considering RGB color spaces model because it is perceptual to the user. In CBIR system calculation of color histogram of an Query image is done then the comparison of this color histogram with other color histogram of images in database is done. Only those images are retrieved whose color histogram matches closely [1]. Color histogram contains the presence of each color retrieved by counting each pixel having that color.

B. TEXTURE

We can define texture of an image by referring the visual patterns of an image. In these visual patterns we do not consider the presence of color or color intensity it contains information about structural arrangement in an image [3].Representation of texture is very difficult but we can identify texture of an image by modelling texture as a two dimensional gray level variation. Edge detection is simple technique for feature detection of texture analysis while considering particular region of an image its edge pixels gives some hint about the pattern of the region [9]. Detection of repetitive patterns of an image is done with the help of Autocorrelation function.

C. SHAPE

We can recognise any object in an image by their shape. We can describe shape easily to user by sketch or by query. There are several shape descriptors available in literature but some of it is not able to explain entire variation in shape for ex. shape of an object is from several views of an object it may be rotated, skewed, stretched or scaled. Shape is recognised by two techniques boundary based and region based [7]. Previously only outer boundary of the shape is used but now we use the entire shape region. Region based descriptors hence make use of all pixels available in that region to give accurate shape of an object [8].

III. PROPOSED METHODOLOGY

The entire CBIR system is shown in Fig.1 Extraction of features of images which are present in database is done. Feature extraction is done on the basis of color, shape and texture. Then extraction of features is done for query image and the comparison is done between the feature vector of query image and feature vectors of an images in database. Whose feature vector is matches most similar to the feature vector of query image are retrieved.

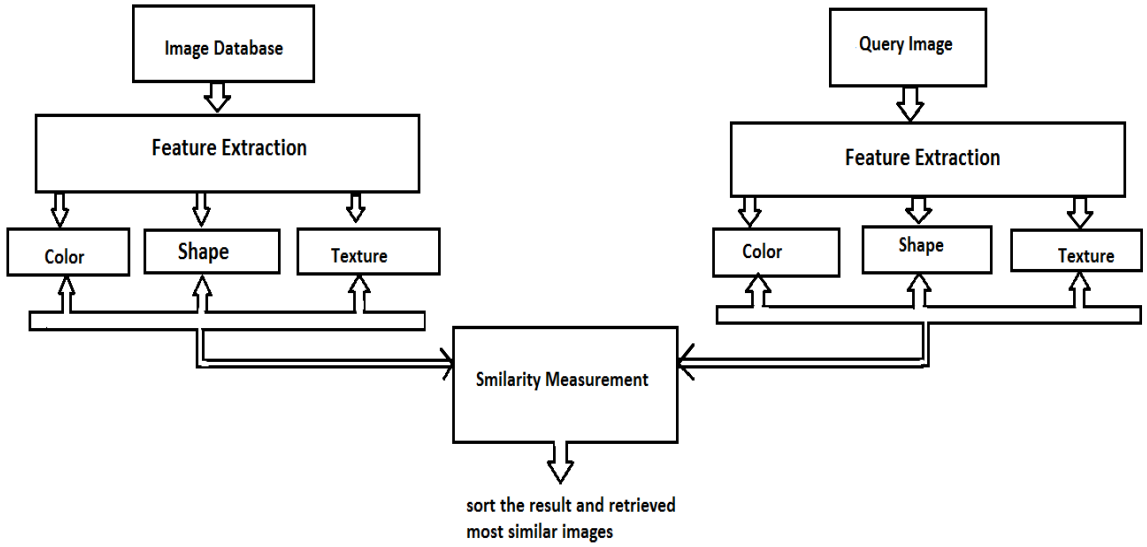

Fig.1: Block Diagram

A. SIMILARITY MEASUREMENT TECHNIQUES

In similarity matching process system compares vector metrics of query image with vector metrics of other images stored in database. Euclidian distance is considered as most important technique.

1) *L1 NORM:* Norm measures the distance between the pixels of query image and image from database.

$$L1\ Norm = \sum ((img\_original\_i - img\_corrected\_i)\ ^2) \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Summation index i denotes the entire pixel in image. It calculates the absolute distance between Query image and image from database.

2) *L2 NORM:* It measures the Euclidian distance between The pixel of the Query image and image from database.

$$L2\ Norm = \sum ((img\_original\_i - img\_corrected\_i)\ ^2) \quad \ldots\ldots\ldots\ldots (2)$$

Summation index i denotes the entire pixel in image. It calculates the absolute Euclidian distance between Query image and image from database.

3) *CITY BLOCKS DISTANCE:* The *City block distance* between two points, *a* and *b*, with *k* dimensions is calculated as:

$$\sum_{j=1}^{k}(|a_j - b_j|) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

City block distance is zero for identical points and high for points that show little similarity.

IV. EXPERIMENTAL ANALYSIS AND RESULT

The aim of this section is to measure performance of different similarity measurement techniques and compare them. We create the database of 1000 images of 10 types. Query image is provided by the user similar image is retrieved from database and displayed [2]. For testing we use 10 test images to show performance of similarity measurement techniques. These test images are shown in Fig.2.

Fig.2: Test Images

The image of 'Bus' is used as query image and images are retrieved for it here we requested 10 similar images using L1 Norm, L2 Norm and City block distance techniques these results are shown in following Figures.

Fig.3: Retrieval result for L1 NORM

Fig.4: Retrieval result for L2 NORM

Fig.5: Retrieval result for City block distance

To calculate the retrieval efficiency we are using the standard parameter such as precision and recall [5].
Precision = Number of relevant images retrieved / Total number of retrieved images ……. (4)

Precision is calculated for all three techniques to know which show high retrieval performance. A high precision value shows a good performance in retrieval. The performance of L1 Norm, L2 Norm and City Block Distance are tabulated in following tables.

Table 1: CALCULATION of PRECISION for L1 NORM

Images	**Precision (%) L1 Norm**				
	N = 1	**N = 5**	**N = 10**	**N = 15**	**N = 20**
69	100.00	100.00	100.00	100.00	100.00
146	100.00	80.00	50.00	60.00	45.00
200	100.00	100.00	70.00	73.33	75.00
320	100.00	100.00	99.00	93.33	75.00
405	100.00	100.00	100.00	100.00	100.00
530	100.00	100.00	90.00	86.66	85.00
609	100.00	100.00	100.00	86.66	90.00
700	100.00	100.00	100.00	100.00	100.00
827	100.00	100.00	90.00	80.00	70.00
922	100.00	100.00	100.00	100.00	100.00

Table 2: CALCULATION of PRECISION for L2 NORM

Images	**Precision (%) L2 Norm**				
	N = 1	**N = 5**	**N = 10**	**N = 15**	**N = 20**
69	100.00	100.00	100.00	93.33	90.00
146	100.00	100.00	80.00	80.00	85.00
200	100.00	40.00	50.00	60.00	60.00
320	100.00	80.00	80.00	80.00	75.00
405	100.00	100.00	90.00	93.33	100.00
530	100.00	100.00	100.00	100.00	100.00
609	100.00	80.00	80.00	73.33	93.33
700	100.00	100.00	100.00	100.00	100.00
827	100.00	100.00	80.00	66.66	70.00
922	100.00	100.00	100.00	100.00	95.00

Table 3: CALCULATION of PRECISION for CITY BLOCK DISTANCE

Images	Precision (%) City block distance				
	N = 1	N = 5	N = 10	N = 15	N = 20
69	100.00	100.00	100.00	100.00	100.00
146	100.00	100.00	100.00	93.33	90.00
200	100.00	40.00	60.00	60.00	50.00
320	100.00	100.00	100.00	100.00	100.00
405	100.00	40.00	40.00	40.00	30.00
530	100.00	100.00	46.66	60.00	70.00
609	100.00	80.00	80.00	73.33	75.00
700	100.00	100.00	100.00	100.00	95.00
827	100.00	80.00	90.00	93.33	95.00
922	100.00	100.00	100.00	86.66	85.00

Recall = Number of relevant images retrieved / Total number of relevant images …….. (5)

Recall is also calculated for all three techniques to know which show high retrieval performance [5]. A high recall value shows a good performance in retrieval. The performance of L1 Norm, L2 Norm and City Block Distance are tabulated in following tables.

Table 4: COMPARISON of RECALL for L1 NORM, L2 NORM and CITY BLOCK DOSTANCE

Images	Recall (%)		
	L1 Norm	L2 Norm	City block Distance
69	85.00	70.00	60.00
146	62.50	60.00	55.55
200	70.00	55.00	60.00
320	66.25	58.75	56.25
405	76.25	70.00	31.25
530	85.00	58.75	46.66
609	81.25	37.50	80.00
700	70.00	60.00	100.00
827	83.75	58.75	90.00
922	76.25	62.50	100.00

V. CONCLUSION

Single feature of an image is not sufficient to describe the content of an image we need to collect the information provided by other features also to achieve high retrieval performance. We proposed technique which retrieves the images based on color, shape and texture features. For similarity matching between features of two images we also need an efficient matching technique. We use three different techniques L1 Norm, L2 Norm and city block distance. Experimental results revels that performance of these techniques is high as compared with conventional image retrieval techniques.

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