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ABSTRACT

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KEYWORDS

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A Review : An Optimized Technique For Image Segmentation

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Abstract: segmenting an image is evaluated as prime steps in processing of a representation. This partitioned a digitized image into different parts within categorize to evaluate them. It is also used to make distinction dissimilar objects in the representation. Various segmentation techniques for an image have been designed and use in practice by the researchers to make them smooth and easy to evaluate separately. In this paper a literature reviews of basic techniques for segmenting a picture from previous five years. Current researches in each of segmentation technique are existing in this paper.

Keywords:segmentation; region based; edge based; threshold based; feature cluster based; model based.

I. INTRODUCTION

Segmenting an image is a primary trouble in processing of an image. It has been researched actively [1–8], to partition an image into meaningful regions automatically. Separating entire image in various pieces which is something more relevant and easier for forward process. The objective is to partitioned the image into many segments or regions/sub regions, so that each sub regions have similar properties e.g. brightness, color & quality. The sub-regions discontinuity is generally in the Segmentation algorithms, i.e. the sub-regions equality, edges however the discontinuity & equality are possible by some segmentation algorithms. The differences between the image segmentation & sample classification are generally not clear. Thus, segmentation & sample classification often functions as individual & sequential method [9]. Before de-noising, segmentation of an image is done to regain the original one. The major motive of segmentation is to diminish knowledge for easy analysis. Segmentation is also beneficial in analysis especially in case of medical images, military purpose images, remote sensing etc. and in Image Compression. In case when the specific sub regions of a segmented image are isolated from other regions then it is assumed that segmentation is completed although it if difficult to segment independently.

II. CLASSIFICATION

Segmentation of an image justifies as follows:

- Region Based
- Edge Based
- Threshold
- Clustering Based
- Model Based

A. Region Based Image Segmentation

segmentation methods using Region-based approach are based on the truth that a pixel cannot be believed as piece of an object or not lies solely on its gray value (methods based over intensity). They incorporate measures of connectivity among pixels in order to decide whether these pixels fit to the similar region (or object) or not. Mathematically, region-based segmentation methods can be described as a systematic way to partition an image I into n regions, R1 , R2, ……, Rn, such that the following properties hold: Here P (Ri) is a logical predicate defined over the points in set Ri and Φ is the empty set. The primary condition mention that the segmentation will be complete, that is, every pixel in the image will be labelled as belonging to one of the n regions. Property 2 requires that all points within a region be 4- or 8-connected. Property 3 states that the regions cannot overlap. Property 4 states which principle must be satisfied so that a pixel is granted membership in a certain region, for example, all pixel values must be within a certain range of intensities. Finally, property 5 says that two adjacent regions are different in the sense of predicate P. In Region based segmentation, we have to find same phase regions according to a specific criterion (intensity value, texture). We check neighbour pixels and detect whether the neighbour pixel should be added or not. Region based approach attempts to cluster the pixels with similar characteristics (such as approximate Gray level equality) into regions. we prefer two approaches in region-based methods:

1. **Region Growing:** It is one of popular methods. Begins with a pixel value and continue go on adding the pixels based on same class, to the region, repeat unless every pixel belong to some particular region [10].

Advantages: join together regions are assured; several conditions at the same instance and give very good results with less noisy .

Disadvantages: In segmentation if the image found to be noisy or has variations in intensity, cannot recognize the shading of the real images and power and time consuming.

2. Region Splitting and Merging: In this approach, it is based on the clustering of neighboring pixels of a region that verifies specific assumptions. The Seed region is spread to contain all same kind neighbors and the process is repeated. The process ends when there is no pixel to be classified. In region splitting method, split in a position of regions that verifies a specific guess.

***A) Various important issues*:**

- The selection of appropriate seed points is important.
- The worth, "to minimum area threshold"
- Corresponding threshold value.

b) Advantages

- We can regulate the seed point and the criteria we need to make.
- We can choose the various criteria at the same
- It implements well with respect to noise [11].

c) Disadvantages

Clustering algorithms like k-means clustering don't assured continuous region to overcome drawback use split and merge technique [10].

B. Edge Based Image Segmentation

Major applications are edge detection for segmented image. This approach of Segmentation presents a broad cluster of methods based on edges information in the image. Resulting image cannot be used as a segmentation result. Steps follow to join edges into chains of edge that correspond better with borders in the image. Difficulty of edge-based approach are an edge present when there is not any border and no edge visible where a border seen. The procedure of separating image into different parts of pixels is refers as image segmentation. Edge is a border between two same phase regions. Detection of edge is locating sharp gaps in an image. The border surface of object in a scene much time refers to oriented localized changes in image intensity, known edges. Edge detection change images to edge from the manipulation of grey tones in images. As a result, edge image is acquired without unexpectedly meet any manipulation in physical excellence of the original image.

It implicit that the edge of a region or an object then it is closed and that the number of objects of interest is equivalent to the number of boundaries in an image. For accurate segmentation, the edge of the boundaries identified must be equal to the object in the given image. For example, these methods have complications with images that are:

- Edge-less
- Very-noisy
- Edge that are very horizontal
- Texture –margin

Other difficult in this technique is to rectify ramp function hence thus produces objectionable results as:

- The segmented area might be smaller or larger than the real.
- The edges of the segmented area might not be attached.
- Terminated or under-segmentation of the image (get up of pseudo edges or missing edges).

C. Threshold Based Image Segmentation

Segmentation of image via thresholding is an uncomplicated other than strong effect for segmenting images having light objects on dark description. A multi-level image converted into a binary image using thresholding operation i.e., It pick out a proper threshold t to separated pixels in respective parts and distinct objects from background. There are 2 category of thresholding procedure they are classifying as global and local thresholding. If T is constant, recognized as global thresholding otherwise it is local thresholding. If the illumination from background is odd globalised thresholding function fail in local thresholding, multiple thresholds are used to reduce for not regular illumination. Disadvantages of thresholding function only 2 classes are introduced can't become overlies to multiple channel images. It does not take into experience the relative features of an image so it is responding rapidly to noise.

***1)* Self selected threshold**: worth for every image by the mechanism without human action is called an automatic threshold arrangement. In variance of predefined selecting threshold function based on clustering of histogram variance means the value of t can be choose.

***2)* Histogram Based Threshold Selection:** In histogram based threshold selection the method using histogram is lying on the positivity of the estimating the threshold worth that divides the 2 homogenous to acquire all happening uniform part in the image parts of the object and background of an image histogram based thresholding is applied. For the highest value of the histogram p1 and p2 be the gray value the value of threshold t is specified by eq.

$$T= (P1 +P2)/2$$

***3)* EMT Technique:** Image is threshold by deploying edge maximization method. In this case part of the object may be involved with the background or parts of the background may as an object. To this reason any of the predefined threshold choice function capabilities becomes much desirable in images with large homogenous and well distinct regions. This segmentation lies on the research about the maximum edge based threshold in the image to begins segmenting that image with help the edge detection techniques

***D.* Feature Based Clustering**

Clustering play and lead role in segmentation. Following a various step where many of them use the method immediately to the image but here the image is change in form into histogram and then clustering [12]. Clustering is done over color image pixels for segmentation making practice of an unsupervised method fuzzy c. It becomes useful meant for regular images. If it is a noisy image, it outcome to fragmentation [13]. A necessary clustering algorithm i.e., K-means is worn for segmentation in textured descriptions [14]. It clusters the associated pixels in the direction of segmenting the image. Segmentation is prepared through attribute clustering and there it will be altered according to the color mechanism. Segmentation is also purely depending on the characteristics of the image [16]. Appearance is in use into report for segmentation [17]. Divergences in the strength and color ethics are worn for segmentation. On behalf of segmentation of color image, they employ Fuzzy Clustering method, which iteratively

generate color clusters by means of Fuzzy relationship function in color space concerning to image space. The procedure is flourishing in identify the color region [18]. Real time clustering based segmentation. An effective consideration section is capture truly for segmentation. [19] Picture is segmented crudely by multi-thresholding. It is after that superior by Fuzzy C-Means Clustering. The advantage is applied to any multispectral images [20]. Segmentation come within reach of for region growing is K-Means Clustering. [21] A cluster practice in favor of image segmentation is done with cylindrical verdict essentials of the color break. The float up is obtaining all the way through histogram and is detecting as a cluster by thresholding [22]. Seeded Growing Region (SRG) is worn in support of segmentation. It has a negative aspect of pixel arrangement for classification. So, to triumph over this margin tilting analogous pixel labeling concert is obtained to SRG [23].

E. Model Based Image Segmentation:

Markov Random Field (MRF) base segmentation is recognized like Model based segmentation [24]. An intrinsic state velvetiness restraint is accessible in MRF which is worn for color segmentation [25]. MRF is united by way of border recognition meant for identify the edges precisely [26]. MRF have spatial area faintness test out and at hand are correlation in the midst of the color mechanism. Expectation-Maximization (EM) algorithm ideals the factor is based on unsupervised operation. Multi-resolution based segmented technique named as "Narrow Band". It is quicker than the usual approach. The initial segmentation is performed at coarse resolution and then at finer resolution. The development moves on in an iterative manner. The oath base segmentation is prepared merely to the piece of the image. So, it is rapid [27]. The segmentation possibly will also be finished by using Gaussian Markov Random Field **(**GMRF**)** wherever the spatial dependency among pixels are well thought-out for the method [28] Gaussian Markov Model (GMM) based segmentation is worn for section growing. The additional room of Gaussian Markov Model (GMM) that detects the province as fit as edge cues inside the GMM structure. The feature space is also detected by using this technique [29].

III. LITERATURE REVIEW

This section represents some previous work in the area of image segmentation done in past which I have reviewed:

Waseem Khan [2013]: fresh investigate within image. This review addresses a variety of image segmentation technique, evaluate them and present the issue associated to individual's technique. Image segmentation is a method used to partition an image into manifold segments. It force create image flat and easy to assess. Segmentation process also helps to find area of attention in a fastidious image. The main goal is to make image more simple and meaningful. Obtainable segmentation techniques can't make happy each and every one form of images [30].

N. Senthilkumaran [2009]: the chief endeavor is headed for inspection the assumption of edge uncovering for image segmentation by means of soft computing come within reach of base on the Fuzzy logic, Genetic Algorithm and Neural Network. Soft Computing is a budding sports ground with the purpose of consists of harmonizing basics of fuzzy logic, neural computing and evolutionary computation. Soft computing technique contain originate broad applications. Single of the nearly everyone chief application is frame exposure on behalf of image segmentation. Edge is a border line flanked by 2 uniform regions. Edge detection refers to the evolution of make out and position razor-sharp discontinuities inside an image [31].

A. Puraneeswari [2014]: the purpose has been to investigate and discuss different traditional and popular image segmentation techniques. Fundamental properties and approaches of different techniques have been highlighted. The advantages and disadvantages of methods discussed in short. Although various methods are available, each method works on specific concept hence it is important which image segmentation methods should be used as per application domain. With this analysis we conclude that segmentation algorithms has been planned in the works but there is no single algorithm that works well for all types of images, but specific work better than others for particular types of images suggesting that developed performance can be obtained by pick out the appropriate algorithm or methods [11].

K. K. Rahini [2014]: It is accommodating used for a right use of existing appraisal methods and meant for civilizing their concert as well as for thoroughly manipulative fresh estimation methods. Image segmentation is a significant investigate quarter in workstation visualization and hundreds of segmentation algorithms comprise been planned in the most recent 30 years. Image segmentation is a tool use to break up an image into multiple segments. The main goal is to make image additional easy and momentous. Mainly methods know how to be off the record into 3 groups: the analytical, the empirical goodness and the empirical discrepancy groups. All group have its be in possession of distinctiveness. Narrative of every one technique in each collection, various relative discussions about different method groups are first carried out. An investigational assessment for some experimental (kindness and inconsistency) method frequently recycled is subsequently performed to present a status of their valuation ability. In addition, some special methods are also discussed [32].

Savita Agrawal [2014]: Investigates in addition to compiles several of the technologies use image segmentation, which is fit suitable in favor of gray scale images multichannel images. More than a few general-purpose algorithms and techniques have been developed for image segmentation [33].

Akshay D. Isalkar [2014]: In This paper proposes an automatically threshold detection mechanism to perform a good segmentation. Diverse initial-point threshold are chosen along with specified on the road to regions by way of excessive and dreary changes during gray-level principles of a picture. The curve thresholds are preferred next to analyzing the rotting regions with the aim of preventing the seek out beginning past it into the wrong lane, and reduction in computational moment know how to be obtained. The outline exploration progression performance too believe the gradients of the left and right neighboring points of every forecasted contour point, in order to subordinate the opportunity of the way mortal not natural by the adjoining noise interferences. Most of the searching procedure requires only the calculation of the gradients of three directions using eight compass directions that reduce the

searching time. The designed way knows how to bear out segmentation on objects within another item and substance that are close up to every one other. In administration of shadowy objects from an out-of-focus flare-up, the projected method can be also segmenting the essential objects. The planned method could take the smallest amount of computational time to find strong and high-quality segmentation performance than the traditional ones. So, the projected scheme be able to be at length and productively operational in a variety of segmentation applications [34].

Mrs. Princy Mishra [2014]: represent a variety of methods of segmentation and clustering which know how to be helpful for medical image segmentation. This review container is helpful for upcoming researchers [35].

Ms. R. Saranya Pon Selvi [2014]: a concise draw round on a quantity of of the nearly everyone usually use segmentation techniques like thresholding, Region based, replica based, Edge revealing etc. Mentioning its reward as fine as the drawbacks. A number of the techniques are appropriate used for noisy images. The fresh technologies are budding in the grassland of Image processing; particularly in the province of segmentation. A number of image segmentation techniques include been urbanized by the researchers in arrange to construct images even and simple to assess [36].

Gloria Bueno [2004]: presents a new method of segmentation of anatomical configuration within health imagery. Adaptive PDE models helped just before uncover the expanse of concern. 3D brain MRI Image is used as a dataset. The model has outperformed 'Snakes' form and decrease a quantity of drawbacks of Snakes model [37].

Nameirakpam Dhanachandra [2015]: the most important endeavor is to assessment the presumption of edge revealing for image segmentation with soft computing come close to based lying on the Fuzzy logic, Genetic Algorithm and Neural Network. Soft computing method contain establish ample applications. Solitary of the the majority vital applications is edge detection for image segmentation. Edge is a frontier sandwiched between two identical regions. We know how to as well apply diverse clustering method with subtractive clustering algorithm [38].

Zhensong Chen [2015]: et al in this paper, we have proposed a novel image segmentation approach based on the DP clustering algorithm. This segmentation method could determine the cluster number and centers directly based on the decision graph, which is composed with the density ρ and distance δ. And the hierarchical segmentation could also be easily achieved via our segmentation approach. Extensive experimental results show that the proposed approach is a good compromise in-between state-of-art method. In conclusion, our proposed method could be a feasible preprocessing method for operations such as pattern recognition and image semantic annotation. In future work, we plan to explore how to select the value of parameter dc automatically based on the input image. [39]

Apurv Vashisht [2016]: the clustering based segmentation. It concludes by way of certain limitations of available techniques and also the possible solutions for the same for future use. The segmentation process breaks up a specified image keen on diverse area and items. Image Segmentation has turn into in style payable to its countless idea application. [40]

Ms. R. Saranya Pon Selvi [2014]: presents a brief outline on some of the most commonly used segmentation techniques like thresholding, Region based, Model based, Edge detection Etc mentioning its advantages as well as the drawbacks. Some of the techniques are suitable for noisy images. The new technologies are emerging in the field of Image processing, especially in the domain of segmentation. Segmentation is considered as one of the main steps in image processing. It divides a digital image into multiple regions in order to analyze them. It is also used to distinguish different objects in the image [41].

IV. EXPERIMENTAL RESULTS

As to apply segmentation technique I have taken some images and segment them using texture, shape etc. Two of them shown below

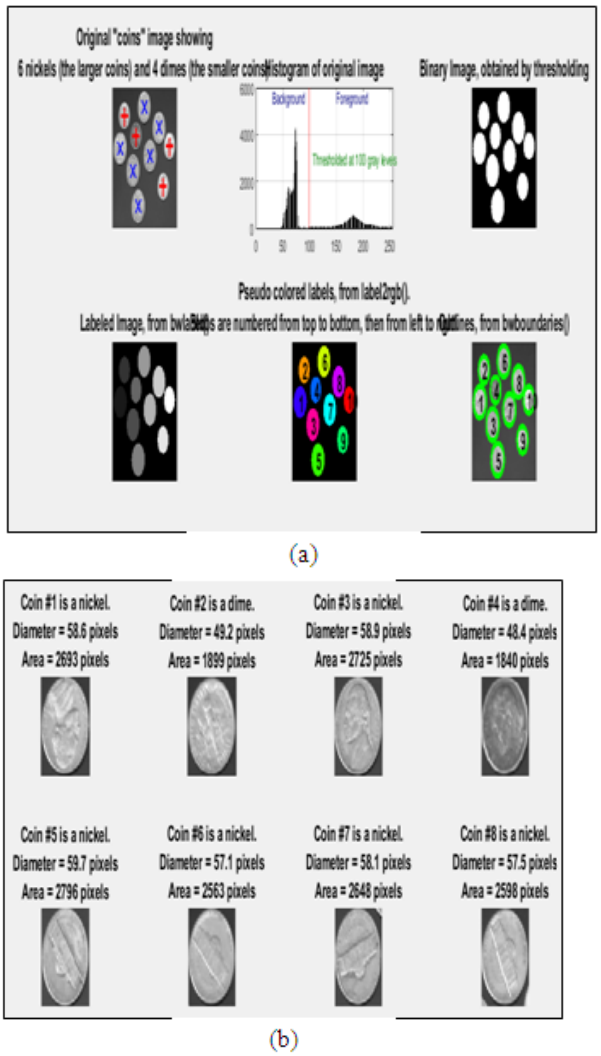

Fig.1.shows segmentation on coins' image

Fig.1. shows segmentation process on coins' image in which we have taken coins.png as input image then calculate area of each coin and call larger coins as nickels and the smaller as dime. Then binary image is obtained by threshold after that do labeling of coins shown in fig.1. (A). Then segment each coin with the help of their area and diameter. Segmented image is shown in fig.1. (b).

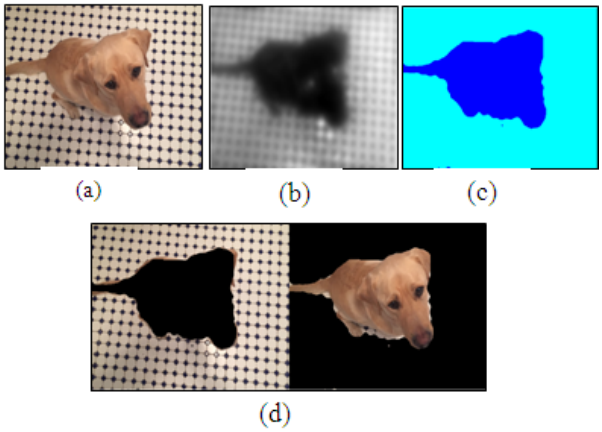

Fig.2. shows segmentation on KOBI image

Fig.2. shows the segmentation process of original KOBI image. In this process we reshape the original image and then show its RGB component. At last we have segment the object from the background shown in fig.2. (d).

Fig.3. (a) Original Kokala Image (b) Segmented kokala Image

Fig.3. (a) shows the segmentation process on the KOKALA image. For this original image is segmented using threshold value. The output image varies with the change in threshold. Fig.3. (b) shows the segmented KOKALA image where threshold is .395.

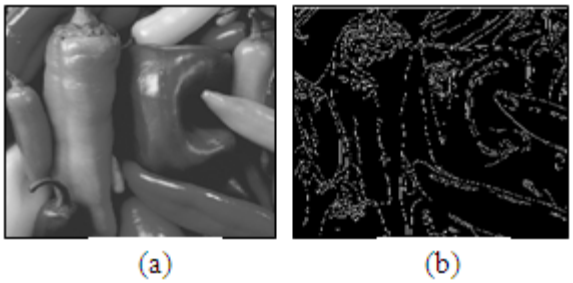

Fig.4. (a) Original Image (b) Segmented Image

Fig.4. shows the segmentation process on original pepper image using the edge based segmentation technique

V. CONCLUSION

This survey paper summarizes various segmentation techniques. Thus segmentation is done to estimate the surfaces. Segmentation can be applied to any type of image. Perfect method for segmenting image based on the result of image segmentation is depends on many factors, i.e., pixel, color, texture, intensity, similarity of images, image content, and problem domain. Therefore, it is not possible to consider a single method for all type of images nor all methods can perform well for a particular type of image. Hence, it is good to use hybrid solution consists of multiple methods for image segmentation problem.

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REVIEW ARTICLE

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An Image Retrieval Framework: A Review

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Abstract: Content-Based Image Retrieval is a process to retrieve the similar images from the large set of image database corresponding to the query image. In CBIR low level or pixel level features such as color, texture and shape of the images are extracted and on the basis of similarity matching algorithm the required similar kind of images are retrieved from the image database. To understand the evaluation and evolution of CBIR system various research was studied and various research is going on this way also. In this paper, we have discussed some of the popular pixel level feature extraction techniques for Content-Based Image Retrieval and we also present here about the performance of each technique.

Keywords: Content Based Image Retrieval; Color; Texture; Shape; Feature Extraction; Similarity Measurement.

I. INTRODUCTION

The multimedia technology and network technology is growing day by day and the databases of digital images are also growing rapidly. Thus, we need an efficient, fast and accurate algorithm to retrieve the relevant images from a huge image repository. The goal of the image retrieval is to browse the large image databases and find out whether the image repository contains the query image pattern which is given by the user on the basis of similarity matrices.

There are two approaches Text-Based Image Retrieval (TBIR) [1] and Content-Based Image Retrieval (CBIR). From 1970's to the present, Image retrieval technology was enhancing from text-based techniques to content-based techniques. In the Text-Based Image Retrieval Technique, firstly images were annotated with the text or number or keyword, and then images are searched on the basis of textual text or keyword. Although, Text based technique is fast and reliable but also it is over dependent on manually annotation on images and the size of the database. There are various limitations of text-based image retrieval such as manual annotation of images with the text or number or keyword which is extremely insufficient, laborious, and time-consuming and obsolete method. For the large databases, it is not an appropriate method.

To overcome the limitations of TBIR, the concept Content Based Image Retrieval [2] came into the frame in 1990's which are efficiently used by peoples. CBIR is a kind of image retrieval technique of computer vision for retrieving the relevant images according to visual feature such as color, shape and texture of images from the large database based on some similarity measures. In a precise way, CBIR, a technique of image retrieval, that could frame out the images that are similar to querying images from the large image database. In CBIR, each image that is stored in the large database, its features are extracted and compared to the feature of the query image. At last, the relevant images can be displayed corresponding to query image. The CBIR figure is shown in figure 1.

The CBIR technology has been used in a several of applications such as fingerprint identification, digital libraries, crime prevention, medical diagnosis, historical research, architectural and engineering design, publishing and advertising, art, education, fashion and graphic design, geographical information and remote sensing systems etc.

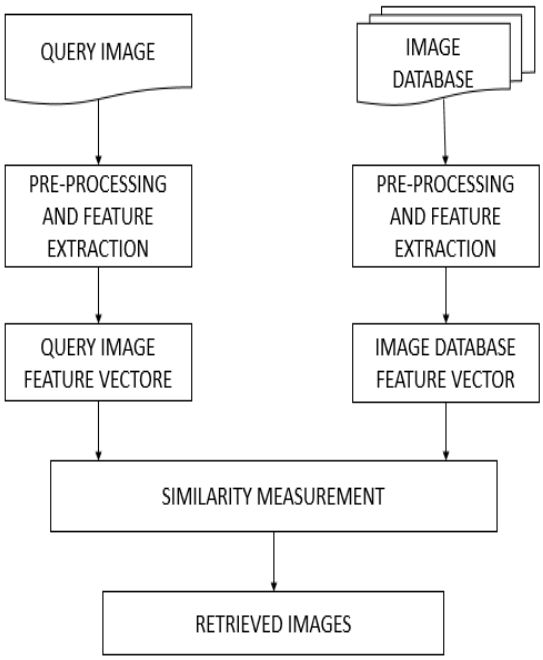

Figure 1. Content Based Image Retrieval

It contains main two parts.

A. Feature extraction

The word 'feature' which specify the quantifiable property of an object or in another way we can say that it describes the object. The features are extracted from the image like spatial based on pixels level features such ascolor, texture and shape. The features play the important role in CBIR. Good features describe the image efficiently and make good effects on accuracy. The classification of feature extraction technique is shown in figure 2.

B. Similarity measurement

Similarity measurement are used to calculate the similarity distance between the images in the large database

and the query image and according to distance, they are ranked in order to retrieve most similar image first. It also plays an important role in CBIR. A good similarity measurement technique proceeds good retrieval rate of images.

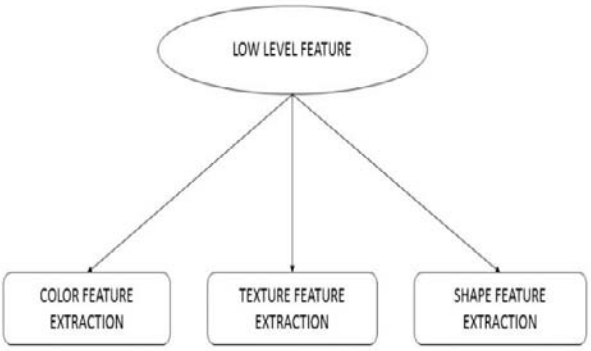

Figure 2. Classification of low-level features

There is some application of CBIR such as Trademark Registration, Medical Diagnosis, Crime Prevention, Web Searching, Surveillance, Remote Sensing, web-related application, Biomedical Applications etc.[3][4]..

II. FEATURE EXTRACTION TECHNIQUES

There are various feature extraction techniques to extract low-level features from the images.

A. Color

It is the sensitive, understandable, essential and widely used feature for image retrieval. The color is the property that is based on reflection of light and processing of that information in the brain. Before selecting the color descriptor, a color space must be chosen first because colors are defined in three-dimensional color space. The various types of color space, which are used widely, are RGB (Red, Green, Blue), HSV (Hue, Saturation, Value), opponent color space etc.

RGB is most widely used color space for displaying the images. It contains three color component which is red, green and blue which are called additive primaries. It is also be called additive color space. By mixing the components of RGB space, the desirable color can be produced. The RGB color space is device dependent and non-uniform color space [5].

HSV (Hue, Saturation, Value) is also widely used in computer graphics and it is the more intuitive way to represent the color, it is also be called HSL (Hue, Saturation, Lightness), or HSB (Hue, Saturation, Brightness) color space. It is most suitable for object retrieval because hue is invariant to changes in illumination and camera direction.

There is various type of type of color descriptors.

1) Color moment

Mean, Standard deviation and Skewness are effective color moments [6]. It is used to find out the distribution of colors in an image. The average color value in an image can be calculated by Mean (M). The square root of the variance of the distribution is calculated by Standard deviation (σ). Skewness (S) can be defined as a measure of the degree of asymmetry in the distribution. The moments are described as:

$$M_i = \frac{1}{N}\sum_{j=1}^{N} P_{ij} \quad (1.1)$$

$$\sigma_i = \sqrt{\frac{1}{N}\sum_{j=1}^{N}\left(P_{ij} - M_i\right)^2} \quad (1.2)$$

$$Si = \sqrt[3]{\frac{1}{N}\sum_{j=1}^{N}(f_{ij} - \mu_i)^3} \quad (1.3)$$

$P_{i,j}$ = the value of the i^{th} color component of the image pixel j.

N = number of pixel in the image.

Three moments for each of the three color component are used to describe the color content of an image. Color moment works well in L*a*b color space in compare to H*s*v color space.

2) Color histogram

Color histogram [7] is an efficient way to calculate the essential features from the image. It is the way of representation of the color content of an image. Any pixel of an image can be framed by the three components in certain color space such as red blue and green color components are described for RGB color space and hue, saturation and value are described for HSV color space. The distribution of color in the image in color space can be described by the color histogram. It contains the number of bins which can be defined for each component. The histogram contains a large number of the bin will only increase the computational cost as well as inefficient indexing also for image databases. So, it needs to quantize the bins. So, quantization process takes place in histogram techniques. It helps to reduce the number of the bins in histogram by taking the color that is similar to each other and putting those color in the same bin. It Histogram technique is two types.

a) Global color histogram (GCH): The GCH [8] calculate the single color histogram of one whole image. It is efficient and takes less computation. Sometimes GCH might not get the proper result because it does not include information concerning the color distribution of the regions.So, it doesn't give full information of the image.

b) Local color histogram (LCH): The LCH [9] gives more information about the image in compare of GCH. It is computationally high. It takes more time to execute. The main task of LCH is to divide the image into a number of blocks and calculate the Histogram for each block then combines that LCH of blocks and form a Histogram. It gives better results than GCH but due to its computational cost, we mostly prefer the GCH.

3) Color correlogram

Color correlogram [10] is a very good technique in compare to Color Histogram because it not only describes the color distribution of pixels but also describes the spatial information of the pair of color. A color correlogram is indexed by the color pair. Where,

The k^{th} entry for (i, j) specifies the probability of finding the pixel of color j at a distance k from a pixel of color I in the image.

Assume,

$$\gamma_{C_i}^{(k)}(I) \equiv \Pr[\mid p_1 - p_2 \mid = k, p_2 \in I_{C_i} \mid p_1 \in I_{C_i}] \quad (2.1)$$

I = set of image pixels.

I_{ci} = set of pixels whose colors are c(i).

Color correlogram can be described as:

Where i, j belongs to {1,2,…..,N}, k belongs to {1,2,…..,d} and $|P_1-P_2|$ is the difference between pixels P_1, P_2. The size of the color correlogram is very vast if we are taking all the possible color pairs. Therefore, instead of this, a simplified version is used for extract the feature, called Color Auto Correlogram [11]. Color auto-correlogram captures only the spatial correlation between identical colors instead of taking color distribution as like color correlogram. That's the way the size is also reduced. In comparing to color histogram, the color auto-correlogram gives better result but it is computationally high.

Some another color feature extraction technique's that can be used in extracting the color's feature such as Edge histogram descriptor, Multi texton histogram, Dominant color descriptors etc.

B. Texture

The texture is another feature extraction technique which describes various properties such as coarseness, smoothness, regularity of surface, randomness etc. it also specifies the how the surface is, its scene depth and orientation. It contains the general and significant information about the structure of surface. Texture can be analyzed by the qualitative and quantitative analysis [20].

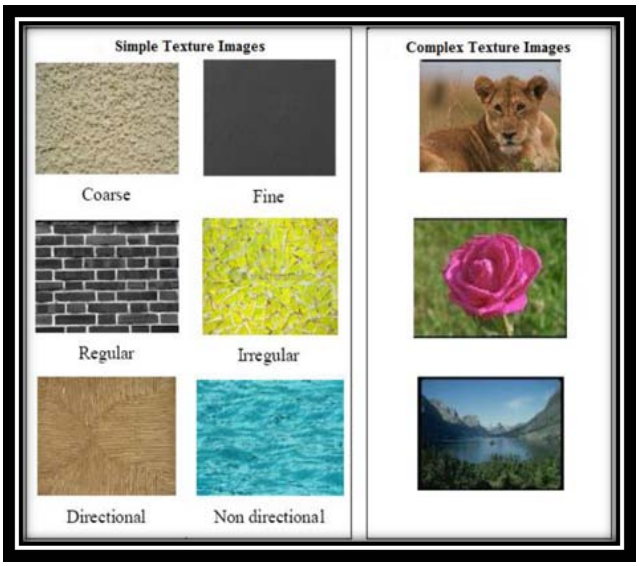

Figure 3. Examples of Texture Images

The surface can be repeated arrangement of pixels over the spatial space. Where, the random and unstructured surface can be displayed when it came into contact with noise. Texture is the visual descriptor of an image, which has homogeneity properties. There are different types of texture properties like regularity, directionality, smoothness, and coarseness, see left part of Figure 3. Texture perception might be more muddled. The different illumination intensities give the hike to a blend of the different human perception of texture as shown in right part of Figure 3.

There is various type of Texture Descriptors which are described below.

1) Tamura feature

The first texture descriptor based on quantitative analysis given by Tamura [14] [15]. Which gives the six different texture feature like Coarseness, Contrast, Directionality, Line-Likeness, Regularity, and Roughness. The well-known system such as QBIC uses first three component of Tamura feature.

a) Coarseness: The Granularity of the Texture can be measured by coarseness. An image contains reoccurred textures arrangement at dissimilar scales, the objects of coarseness is to find out the largest size at which a texture present.

$$A_k(x,y) = \sum_{i=x-2k-1}^{x+2k-1} \sum_{j=y-2k-1}^{y+2k-1} \frac{f(i,j)}{2^{2k}} \quad (3.1)$$

Where, the average of neighborhood is $2^k * 2^k$size.

$$E_{kh}(x,y) = |A_k(x + 2_{k-1},y) - A_k(x - 2_{k-1},y)| \quad (3.2)$$

b) Contrast: The distribution of intensities adjusted in an image can be measured by contrast.

$$\text{Contrast} = \frac{\sigma}{(\alpha_4)} \quad (3.3)$$

$$\text{where,} \quad \alpha_4 = \mu_4/\sigma^4 \quad (3.4)$$

c) Directionality: The directionality measures the frequency distributionof edges which are oriented locally against its directional angles.

$$\text{Dir} = 1 - \text{rn}_{\text{peaks}} \sum_{p=1}^{n_{peaks}} \sum_{a \in w_p} (a - a_p)^2 H_{dir}(a) \quad (3.5)$$

d) Line-Likeness: Line-Likeness in an image is the normal coincidence of direction of edges that co-happened in the sets of pixels separated by a distance along the edge direction in every pixel.

e) Regularity: Regularity is an essential property of tamura feature which evaluates the regular pattern present in image.

$$F_{reg} = 1 - r(S_{crs} + S_{con} + S_{dir} + S_{lin}) \quad (3.6)$$

f) Roughness: Summation of contrast and coarseness measures are called Roughness.

$$Roughness = Contrast + Coarseness \quad (3.7)$$

2) Gray level co-occurrence matrix

Gray level co-occurrence Matrix is an arithmetical method used for observing texture feature and distributing gray levels in the image. Gray level co-occurrence matrix create a matrix which shows how repeatedly pixels with intensity i occurs in a spatial relationship to pixel with intensity j. Haralick [16] [20] proposed 28 types of features of texture

extracted from Gray level co-occurrence matrix (GLCM). Assume an image has H total number of pixels in Horizontal directions and V total number of pixels in Vertical directions and assume gray level at each pixel is quantized at N number of levels. Suppose N_x=1,2,3…..H consist Horizontal space and N_y=1,2,3,….V consist vertical space and G=0,1,2,3,…..N consist N quantized gray level. Gray level co-occurrence matrix is a regularity matrix and its levels are determined by image gray level. Expression shown the co-occurrence matrix in different directions.

$$P(i,j|d,\theta) = \frac{p(i,j|d,\theta)}{\sum_i \sum_j p(i,j|d,\theta)} \quad (4.1)$$

This paper describes five feature of GLCM like Energy, contrast, Entropy, correlation, homogeneity.

a) Contrast: Contrast find out the intensity of a pixel and its neighbor over the whole image and for the constant image, it is considered zero. It is also be known as variance and moment of inertia.

$$C = \sum_{i,j}(i-j)^2 p(i,j) \quad (4.2)$$

b) Correlation: How pixel is correlated to its neighbor over the whole image, it is defined by correlation.

$$C = \sum_{i,j} \frac{(i-\mu_i)(j-\mu_j)p(i,j)}{\delta_i \delta_j} \quad (4.3)$$

c) Entropy: Entropy gives measures of complexity of the image and this complex texture tends to higher entropy.

$$E = \sum_i \sum_j P(i,j) \quad (4.4)$$

d) Energy: Energy is the sum of squared elements in the GLCM and the default value of the constant image is one.

$$E = \sum_{i,j}(i,j)^2 \quad (4.5)$$

3) Local binary pattern

T. Ojala et al. [17] proposed local binary pattern (LBP). LBP is an image indexing technique based on texture analysis of image which is gray scale rotation invariant local pattern measure operator. LBP computes the local feature representation of the image. The LBP representation is calculated by comparing each pixel with surrounding neighbor pixel. The computation of LBP is shown in figure 4.

The value of the LBP code of pixel (x_c,y_c) is given by

$$LBP_{P,R} = \sum_{p=0}^{p-1} s(g_p - g_c)\, 2^p \quad (5.1)$$

$$s(x) = \begin{cases} 1, x \geq 0 \\ 0, x < 0 \end{cases} \quad (5.2)$$

The computation of LBP is given below in figure 4.

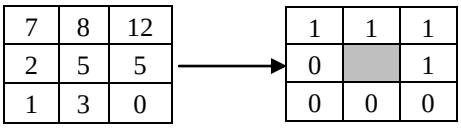

Figure 4. Computation of Linear Binary Partition

LBP = 2^0*1+2^1*1+2^2*1+2^3*1+2^4*0+2^5*0+2^6*0+2^7*0=15

Where,

g_c= the gray-scale value of center pixel,

g_p = the gray-scale value of its neighborhood pixel,

P = the no. of neighbors,

R = the radius of neighborhood.

For calculating LBP descriptor, first, convert the image into grayscale image. For every pixel of the grayscale image, a neighborhood of r size is defined with surrounding the center pixel. Then LBP value is calculated for each center pixels and is stored in 2D array vector which contains same height and width as the input image.

Due to highly discriminative, rotation invariant and gray-scale invariant, it is used in various application such as face recognition, image registration etc.

There are also various extensions of LBP which enhances the techniques of image retrieval such as CLBP, Dominant LBP, CS-LBP, Local tetra pattern (LTP), CS-LTP etc.[19].

There is some more texture extraction technique that is used to extract the feature from the images such as flourier transform, Walsh transform, Gabor descriptor, wavelet transform, co-occurrence matrix etc. [30] [33].

C. Shape

The shape is known to play an important role in object recognition and perception. Visual shape features provide a powerful clue which shows object identity or we can also say that it describes the image content. The shape can be defined as it is part of space which is occupied by an object. The efficient shape feature must contain some properties such as identifiability, translation, the resistance of noise, affine invariance, statistically independent and some reliability. Humans can recognize objects solely from their shapes. The advantage of shape's feature taking into account for CBIR can be seen from the fact that every major CBIR system holds some shape features in one form or another [21]. Shape feature representations are two types. They are boundary-based and region-based. In region-based techniques, to obtain the shape representation, all the pixels within a shape are taken into account. Common region based methods use various moment descriptors to describe shape efficiently [22] [23] [38] [39]. In the boundary based techniques, to obtain the shape representation, only the boundary pixels within a shape are taken into account means that the boundary information will be extracted [23].

There is various shape feature extraction techniques are given below.

1) Hu moments

In shape-based image retrieval system, Hu moments [24] produces good results because it is the non-linear function which has various properties like translation, rotation and scaling invariability. Formulation of Hu moments is given below:

Two-dimensional $(p+q)^{th}$ order moments are given as follows.

$$m_{pq} = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} x^p y^q f(x,y)\,dx\,dy \quad (6.1)$$

If, the image function f(x,y) is a piecewise continuous bounded function, the moments of orders exist and the moment sequence $\{m_{pq}\}$ is uniquely determined by f(x,y) and correspondingly, f(x,y) is also uniquely determined by the moment sequence $\{m_{pq}\}$.

The moments may not be invariant when f(x,y) changes by translating, rotation or scaling. By the help of the central moments, the invariant feature can be obtained using central moments, which can be measured as:

$$\mu_{pq} = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty}(x-\bar{x})(y-\bar{y})f(x,)\,dx\,dy \quad (6.2)$$

Where, $\bar{x} = \frac{m_{10}}{m_{00}}$ and $\bar{y} = \frac{m_{01}}{m_{00}}$ (6.3)

The pixel point $(\bar{x},\bar{y})$ are the centroid of the image f(x,y). The centroid moments μ_{pq} computed using the centroid of the image f(x,y) is equivalent to the m_{pq} whose center has been moved to the centroid of the image. In this manner, the central moments are invariant to image interpretations. Scale invariance can be acquired by normalization. The normalized central moments are defined as follows:

$$\eta_{pq} = \frac{\mu_{pq}}{\mu_{00}^{\gamma}} \quad (6.4)$$

$\gamma = (p+q+2)/2, p+q=2,3,\ldots.$ (6.5)

Based on normalized central moments, Hu introduced seven-moment invariants:

$$\phi_1 = \eta_{20} + \eta_{02} \quad (6.6)$$

$$\phi_2 = (\eta_{20} - \eta_{02})^2 + 4\eta_{11}^2 \quad (6.7)$$

$$\phi_3 = (\eta_{30} - 3\eta_{12})^2 + (3\eta_{21} - \mu_{03})^2 \quad (6.8)$$

$$\phi_4 = (\eta_{30} + \eta_{12})^2 + (\eta_{21} + \mu_{03})^2 \quad (6.9)$$

$$\phi_5 = (\eta_{30} - 3\eta_{12})(\eta_{30} + \eta_{12})[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2] + (3\eta_{21} - \eta_{03})(\eta_{21} + \eta_{03})[(3\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2] \quad (6.10)$$

$$\phi_6 = (\eta_{20} - \eta_{02})[(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2] + 4\eta_{11}(\eta_{30} + \eta_{12})(\eta_{21} + \eta_{03}) \quad (6.11)$$

$$\phi_7 = (3\eta_{21} - \eta_{03})(\eta_{30} + \eta_{12})[(\eta_{30} + \eta_{12})^2 - 3(\eta_{21} + \eta_{03})^2] - (\eta_{30} - 3\eta_{12})(\eta_{21} + \eta_{03})[3(\eta_{30} + \eta_{12})^2 - (\eta_{21} + \eta_{03})^2] \quad (6.12)$$

The first one, $\phi 1$, is similar to the moment of inertia around the image centroid, where the pixels' intensities are analogous to physical density. The last one, $\phi 7$, is skew invariant that able to distinguish mirror images or identical images [21].

Hu moments take every pixel into account. The computational cost is much higher than boundary based invariants. To overcome this problem, Teague [25] suggested the use of orthogonal moment.

2) Zernike moments

Zernike moments [25] [26] are evaluated by using Zernike orthogonal polynomial. An orthogonal polynomial is present in the unit circle. It has less information redundancy as compared to the other method. It shows good rotation invariance. It is one of the most widely used shape descriptors.

Zernike moment is defined as:

$$Z_{mn} = \frac{m+1}{\pi}\iint_{x^2+y^2\le 1} f(x,y)[V_{mn}(x,y)]^*\,dx\,dy \quad (7.1)$$

Where, m = 0, 1, 2,……,∞, $f(x,y) =$ image function, * represents hetero conjugation, n is an integer such that (m-|n|) is even and (|n|≤m).

Zernike moment can also be represented in the polar co-ordinates as follows:

$$Z_{mn} = \frac{m+1}{\pi}\int_0^{2\pi}\int_0^1 f(r,\theta)V_{mn}(r,\theta)\,r\,dr\,d\theta, r \le 1 \quad (7.2)$$

Where, $r = \sqrt{x^2+y^2}$ and $\theta = \tan^{-1}\left(\frac{y}{x}\right)$

Assume $V_{mn}(x,y)$ as a Zernike polynomial in polar co-ordinate and is defined as:

$$V_{mn}(r,\theta) = R_{mn}(r)\exp(jn\theta) \quad (7.3)$$

Where, $j = \sqrt{-1}$ and (r,θ) values are defined in the unit circle.

Orthogonal radial polynomial $R_{mn}(r)$ is defined as:

$$R_{mn}(r) = \sum_{s=0}^{\frac{m-|n|}{2}} (-1)^s \frac{(m-s)!}{s!\left(\frac{m+|n|}{2}-s\right)!\left(\frac{m-|n|}{2}-s\right)!} r^{m-2s} \quad (7.4)$$

The integration can be converted into summation in case of digital image:

$$Z_{mn} = \frac{m+1}{\pi}\sum_x\sum_y f(x,y)\,[V_{mn}(x,y)]^* \quad (7.5)$$

Where, $x^2 + y^2 \le 1$

3) Interest point detection using surf

SURF [27] [29] is the most efficient shape-based feature extraction technique which is not only scale but also rotation

invariant. Scale invariance and rotation invariance implies that an object can be distinguished despite the fact that if the representation of object gets scaled in size or it is rotated around an axis in its representation of an image. Invariance is a very important property of image features, as a measurement of similarity is possible only with respect to those features between two images which can't be duplicated.

The SURF feature technique is based on the Hessian matrix. To extract the scale and location of the descriptor, the determinant of Hessian matrix is used. The Hessian matrix is represented by $\mathbf{H(x,\sigma)}$ for a given point $\mathbf{x = (x,y)}$ in an image as follows:

$$\mathbf{H(x,\sigma)} = \begin{bmatrix} L_{xx}(x,\sigma)L_{xy}(x,\sigma) \\ L_{xy}(x,\sigma) \quad L_{yy}(x,\sigma) \end{bmatrix} \tag{8.1}$$

Where, $L_{xx}(x,\sigma)$ is the convolution of the Gaussian second order derivative $\frac{\partial^2}{\partial x^2} g(\sigma)$ with the image I in the point x and similarly for $L_{xy}(x,\sigma)$ and $L_{yy}(x,\sigma)$.

The speed up robust feature approximates second order derivatives of the Gaussian with box filters. By using the integral images, the image convolutions can be calculated with these box filters. The determinant of the Hessian matrix is given as:

$$\mathbf{Det(H_{approx}) = D_{xx}D_{yy} - (0.9D_{xy})^2} \tag{8.2}$$

4) Convex hull

Basically, the convex hull [13] [28] or convex envelope of a set X of focuses in the Euclidean plane or Euclidean space is the littlest convex set that contains X. Formally, the convex hull may be described as the intersection of all convex sets holding X or as the set of all convex combinations of points in X. Here, convex hull descriptor is used to create Region of Interest (ROI) in an image.

There is some more shape-based feature technique such invariants, shape signature, contour segments, breakpoints etc. Some operator such as Sobel, Prewit, Cany edge detector etc. are also used to extract the edge features from the image.

III. SIMILARITY MEASUREMENT

Normally, Similarity Measurement [31] [32] [36] [40] can be defined as a matrix distance. Some efficient similarity measurements are given below.

A. Minkowski distance metrics

This distance can be measured as:

$$D^k(P,Q) = (|x1-y1|^k + |x2-y2|^k) \tag{9.1}$$

Where, P(x1, x2) & Q(y1, y2) are two points to calculate the distance.

B. Manhattan distance

Manhattan distance is the most common metric which is used to evaluate the distance between two points in multi-dimensional space. The distance between two images P and Q with n-dimensional features vectors can be found as follows:

$$D(X,Y) = (\sum_{i=1 to\ n} [X_i - Y_i]) \tag{9.2}$$

Where, D(X,Y) = Manhattan distance between query image X and each image Y in the image database.
X_i = feature vector of the query image.
Y_i = feature vector of database images.

C. Euclidian Distance

The Euclidian Distance is frequently used in CBIR for similarity evaluation because it has greater accuracy as well as effectiveness. It measures the distance between two feature vectors of the image by following this equation.

$$D(X,Y) = (\sum_{i=1}^{n} (X_i - Y_i)^2)^{1/2} \tag{9.3}$$

Where, D(X, Y) = Euclidian distance between query image X and each image Y in the image database.
X_i = feature vector of query image.
Y_i = feature vector of database images.

A number of other metrics which are used in CBIR like Mahalanobis, Earth Movers, Proportional Transportation, relative deviation, city block etc. matrix have been proposed for specific purposes.

IV. PERFORMANCE METRICS

The performance of CBIR system can be expressed with these formula's [34] [35] [36] [37].

$$\text{Precision} = \frac{\text{(Number of relationally retrieved images)}}{\text{(Total number of retrieved images)}} \tag{10.1}$$

$$\text{Recall} = \frac{\text{(Number of relationally retrieved images)}}{\text{(Total number of relevant images in the database)}} \tag{10.2}$$

$$\text{Error Rate} = \frac{\text{(Number of nonrelevant image retrieved)}}{\text{(Total number of image retrieved)}} \tag{10.3}$$

The recall is the ability of the system to represent all relevant images. The measure of ability of the system to represent only relevant images is called precision. Error rate can be measured as the number of the non-relevant images present in total number of image retrieved. There are various types of image database available such as wang database, sift database, mnist database etc. [12]. On that we can perform various experiments.

V. CONCLUSION AND FUTURE WORK

CBIR is a very active area where various active researches are going on. If, we are considering text based retrieval or searching then a text or keyword may not reflect or describe the whole image properly. In case, if an image having geographical representation then manual description (text or keyword or tags etc.) can't represent an image properly. So, here we can't say keyword matching is best retrieval technique of image. In this paper, a study of various pixel level feature retrieval technique for the image retrieval is performed as well as various similarity measurements

techniques are studied. The performance of retrieval system may depend on the different type of database. It is impossible to get an appropriate as well as efficient result from single technique or algorithm because only a feature vector can't reflect the result more appropriately. So, it is required to combine two or more than two techniques and develop a hybrid approach. There is the considerable increase in efficiency when two or more than two feature extraction techniques or algorithm are combined. In image processing retrieval technique, Performance degradation is the major problem so for this we should have to use some mining technique so that we can reduce our database or can improve the efficiency of retrieval of the image. By the help of clustering and classification technique, the set of images is trained or grouped using supervised or unsupervised learning to enhance the retrieval efficiency and timing performance. For finding the best research, the modern approach is to focus on the high level as well as salience features with the descriptor of color, texture as well as shape at the processing stage. In CBIR, various optimization techniques as like fuzzy, support vector machine, ant colony optimization, the k-mean algorithm can be applied to get user corresponding results.

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