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Comparitive Study of Image Features, Color Models and Classifiers for Image Retrieval

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Abstract- Invention of digital technology has lead to increase in the number of images that can be stored in digital format. Content Based Image Retrieval (CBIR) is an important step in addressing image storage and management problems. CBIR systems often analyze image content which are called low-level features for indexing, classification and retrieval such as color, texture and shape and Color spaces provide a rational method to specify order, manipulate and effectively display the object colors taken into consideration. In this paper, Comparative study of various techniques, color models and classifiers are presented and their advantages, disadvantages and limitations are discussed.

Keywords: Content-based Image Retrieval, Image feature, Color Space Model, Classifier

I. INTRODUCTION

CBIR is the process of retrieving images from a database or library of digital images according to the visual content of the images. In other words, it is the retrieving of images that have similar content of colors, textures or shapes. Images have always been an inevitable part of human communication and its roots millennia ago. Images make the communication process more interesting, illustrative, elaborate, understandable and transparent.[5]

In CBIR system, it is usual to group the image features in three main classes: color, texture and shape. Ideally, these features should be integrated to provide better discrimination in the comparison process. Color is the most common visual feature used in CBIR, primarily because of the simplicity of extracting color information from images with the help of specific color space models[3], [4]. To extract information about shape and texture feature are much more complex and costly tasks, usually performed after the initial filtering provided by color features[2].

II. EXITING WORK

J. Kumar, N. Gupta, N. Sharma, P.Rawat(2013) : In[6]" An Efficient Technique for Color Image Classification Based On Lower Feature Content" author proposed classifier technique for theclassification of data .In this paper we used an efficient classification technique as radial basis function. For classification of data support vector machine (SVM) is used as binary classifier. The some approaches commonly used are the One-Against-One (1A1), One-Against-All (1AA),and SVM as Ant Colony Optimization(ACO). SVM-ACO decrease unclassified data and also decrease noise with outer line of data. Here SVM-RBF reduce noise with outer line data and complexity more than SVM-ACO. Another classifier techniques like decision tree, k-NN and SVM give comparative result in weed detection[7].

Rajdeep kaur , Kamaljit kaur(2015) : In[5]" Study of Different Techniques for Image Retrieval"Author reviews about different feature extraction techniques that is helpful for retrieval of images from a giant database.

Harmeet Kaur Kelda,et al.(2014) : In[3] this paper author reviews about different color space models, their description, comparison and evaluation results is presented. These models used various components of an image to display on specific hardware platform.

B.S.Manjunath,J.R.Ohm,Vinod.V.Vasudevan,A.Yamada(2001):In [11]author presents overview of color and texture descriptors that have been approved for the Final Committee Draft of the MPEG-7 standard. these descriptors is explained their semantics, extraction and usage. It also covers the different color space like RGB,HSV, YCrCb and new HMMD model.

III. RELATED WORK

A. Feature Extraction:

Feature Extraction may be a technique of extracting helpful info from a picture. This info is employed to unambiguously establish a picture. Similar reasonably pictures have similar signatures. The extracted features of image like as color, shape and texture form a feature vector. This feature vector retrieves the similar images from large database similar to query image[4] , [5]. Several image feature are used in CBIR will be discussed in the next subsection.

Table 1 Comparison of Image Features

Feature	Advantages	Limitations
Color	• Decrease in selection time • There is high percentage of relevance between query image and extracted matching image. • Completed without regard to image size or orientation • Low storage requirements	• Color histogram are not efficient in handling noise because they are sparse. • Cannot consider fully spatial information
Texture	• Helps in decreasing the high level semantics for image retrieval. • It is effective when used in combination with color histogram.	• Increase in selection time because various tasks like degree of contrast, regularity, coarseness are needed for texture analysis. • Higher recall rate as compared to histogram technique. • Challenging for various natural textures primitives due to presence of irregularity in primitives.
Shape	• Zernike moments of image is more robust to noise. • Fourier descriptors can be used for efficient results.	• It is invariant to translation, rotation and scale so that performance is degraded and computational complexity also increases. • It is not good for matching purpose. • It is invariant to size and location of object.

B. Color Models:

To utilize color as a visual cue in multimedia, image processing, graphics and computer vision applications, an appropriate method for representing the color signal is needed. The process of selecting the best color representation involves knowing how color signals are generated and what information is needs from these signals.[11]

Table 2 Comparison of Color Models

Color Modal	Advantages	Limitations
RGB(Red Green Blue)	Easy to implement but non-linear with visual perception.	• It is not suitable because it is perceptually non-uniform and device dependent system. • The distribution of rgb-values will change proportionally with illumination,thus giving different histogram
HSV(Hue Saturation Value)	• High recall and precision than RGB color model. • Extremely intuitive manner of specifying color.	In HSV saturation attributes corresponds to tinting,so desaturated colors have increasing total intensity.
CIE L*a*b* or CIE LUV	more perceptually linear than other color space models.	Device independent but suffer from being quite unintuitive.
CMYK(Cyan Magenta Yellow Black)	Subtractive based color space. it is dependent and non linear with visual perception.	Transfer from RGB to CMYK is difficult.
HMMD(Hue Min Max Difference)	It is effective than HSV by MPEG-7 core experiments.	
YCbCr(Y-luminance, Cb-blue,Cr-red chromaticity)	Helpful in MPEG video compression standards	Unintuitive and device dependent.

C. Image Classifiers:

Classification of remotely sensed data is used to assign with homogeneous corresponding levels with respect to groups with homogeneous characteristics, with the aim of discriminating multiple objects from each other within the

image. In general,the definition of classification simply means the grouping together of alike things according to common qualities or characteristics. Classification has essential part to play especially in assisting in the search process. By classifying things into different segments it enables us to retrieve things or information that we needed to look for, without the risk of too much time consuming in retrieving that particular things or information.[6]

Table 3 Comparison of Different Classifier

Classifier	Advantages	Limitations
SVM(Support Vector Machine)	Goodgeneralization ability, fast learning, flexibility and assessment of relevance feedback.	• It treats core point and outlier equally if it is used directly. • It doesnot take into account the unlabled samples.
CNN(Convolutional Neural Network)	• It works on lar scale video and classification.	• It requires large amount of training data and time. So, it is computationally insensive.
KNN(K-Nearest Neighbour)	• Used for small database. • Euclidean distance used to distance metric.	Not support for large database.
Decision Tree	• It have simple structure. so, easy to implement and visualization. • Computing time less than maximum likelihood classifier and statistical errors are avoided.	• They easily overfit,but that's where ensemble methods like random forests come in. • Accuracy depends on design of decision tree and the selected feature.
Naïve Bayesian	• It needs less training data. • Naïve bays learners and classifiers can be extremely fast compared to more sophisticated methods. • It helps to that problems stemming from the cause of dimensionality	Works strangely on unbalanced class.

IV. CONCLUSION

After comparing various image features, color models and classifiers it is conclude that overall the performance of content based image retrieval depends on features, feature extraction techniques, similarity measures and the size of database. Several feature extraction techniques have been developed for the task of image retrieval. Color space has also helpful for describing color descriptor [3] and classifiers give effective results so that image recognition, accuracy, retrieval of CBIR achieved.

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