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Content Based Image Retrieval using CMM+GWT and SVM Classifier

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***Abstract*—**Content based Image Retrieval Process Depending on New Matching Strategy. In this paper Proposed Model composed of four Major Phases: feature extraction, Dimensionality Reduction, ANN Classifier and Matching Strategy. feature extraction phase, it extracts a color and texture features, respectively, called color co-occurrence matrix (CCM) and difference between pixels of scan pattern(DBPSP). Dimensionality reduction technique selects the effective features that jointly have the largest dependency on the target class and minimal redundancy among themselves. The artificial neural network (ANN) in our proposed model serves as a classifier so that the selected features of query image are the input and its output is one of the multi classes that have the largest similarity to the query image. Matching strategy that depends on the idea of the minimum area between two vectors to compute the similarity value between a query image and the images in the determined class.

Keywords*-CCM, DBPSP, Gabor Filter,SVM*

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I. INTRODUCTION

"Content Based" means Search dissects the Contents of the picture instead of the metadata, for example, Keywords, Tags or Descriptions related with the Image. "Content" means Context allude to Colors, Shapes, Texture or whatever other Information that can be gotten from Image itself. A "Picture Retrieval System" is a Computer System for Searching and Retrieving picture from a Database of Digital Image. Many Features of Content Based Image Retrieval yet Four of them are viewed as, for example, Color, Texture, Shape and Spatial Properties. "Low Level Feature" implies Image like shading, Texture, Shape can be separated from the Image.

Picture Retrieval Process rely on upon new coordinating technique. Picture Retrieval Process can be separated into two classes: explanation based Image Retrieval (ABIR) and Content Based Image Retrieval (CBIR). ABIR offers the most exact Information when Images are very much named or commented on. Drawbacks of ABIR manual picture comment are tedious. Human explanation is Subjective, a few Images couldn't be commented on in light of the fact that it is hard to depict their Content with Words. Shading highlight incorporate Color Histogram, Color auto-Correlogram, Color Dominant Descriptor, Color Co-event Matrix(CCM). Surface Feature incorporate Tamura Texture Feature, Steerable Pyramid, Wavelet Transform. Gabor Wavelet Transform. Shape Feature incorporate standardized latency, Zernike minutes, Histogram of edge Detection, edge map[1]. Shading Features are superior to Texture and Shape. Shading highlight are extremely steady and hearty in light of the fact that it is not touchy to turn, interpretation and scale changes. Shading highlight figuring is exceptionally basic.

Improving the retrieval of the images from database for a given query image in terms of displaying most visually relevant images by combining low level features like color and texture features gives good results. Query image means testing the image. Itis input image

Figure 1: Modern CBIR Architecture

Inquiry Image Means testing the picture of Image Database. Question Image is Input Image. Highlight Extraction has two classes: Global Feature and Local Feature [1]. Worldwide Features Consider entire picture. What's more, for the most part System utilized as a part of Global Feature like Color Histogram. Worldwide components Color Shape give a general thought however not detail of entire picture. Favorable position of worldwide element as extraction and coordinating is finished with rapid. Neighborhood Feature allude to the little pixel squares gotten by dividing the picture. Nearby Feature superior to the worldwide component in light of the fact that different spaces neighborhood highlights give a decent arrangement. Picture Database implies many pictures put away in database, for example, WANG Dataset as like pictures are Africa, Beach, Monuments, Busses etc[1].Feature Vector Database implies finding the element and highlight is created. Closeness estimation implies at least one picture is like the picture database. Furthermore, it is removed to the component vector. Recovering pictures implies recover the Image Similar to the Query picture like as Color, Texture or Shape.one or more comparative pictures are recovered.

II. TECHNIQUES OF CBIR

*A. **Query techniques**:*

Different implementations of CBIR make use of different types of user queries. Query by example is a query technique that involves providing the CBIR system with an example image that it will then base its search upon. The underlying search algorithms may vary depending on the application, but result images should all share common

 ISSN: 2321-8169
378 – 381

elements with the provided example Reverse Image Search. Options for providing example images to the system include:
A pre existing image may be supplied by the user or chosen from a random set.
The user draws a rough approximation of the image they are looking for, for example with blobs of color or general shapes.[5]
This query technique removes the difficulties that can arise when trying to describe images with words.

B. *Semantic retrieval:*

Semantic retrieval starts with a user making a request like "find pictures of Abraham Lincoln". This type of open-ended task is very difficult for computers to perform - Lincoln may not always be facing the camera or in the same pose. Many CBIR systems therefore generally make use of lower-level features like texture, color, and shape. These features are either used in combination with interfaces that allow easier input of the criteria or with databases that have already been trained to match features (such as faces, fingerprints, or shape matching). However, in general, image retrieval requires human feedback in order to identify higher-level concepts.

C. *Relevance feedback (human interaction):*

Combining CBIR search techniques available with the wide range of potential users and their intent can be a difficult task. An aspect of making CBIR successful relies entirely on the ability to understand the user intent. CBIR systems can make use of relevance feedback, where the user progressively refines the search results by marking images in the results as "relevant", "not relevant", or "neutral" to the search query, then repeating the search with the new information. Examples of this type of interface have been developed.

D. *Iterative/machine learning:*

Machine learning and application of iterative techniques are becoming more common in CBIR.

E. *Other Query Methods:*

Other query methods include browsing for example images, navigating customized/hierarchical categories, querying by image region (rather than the entire image), querying by multiple example images, querying by visual sketch, querying by direct specification of image features, and multimodal queries (e.g. combining touch, voice, etc.)

F. *Features Used In Cbir*

There are two types of features used in CBIR Systems i.e. Low Level Features and High Level Features.

i. Low Level Features:

The Visual Content of the Image like Color, Texture, and Shape which can be extracted from the image are termed as Low Level Feature. Important Features that can be extracted for CBIR include:
Color: This feature refers to the color of different parts of the images. This feature can be extracted by methods such as Histogram method Arithmetical method Color/ Shade model.
Texture: Texture refers to visual patterns in images. Texture is used to represent texture in images. Texture is also one of the important kind of an image. This feature refers to the visual patterns including the surface of clouds, trees, bricks, hair, and fabric. A variety of algorithms have been proposed for texture testing: Gray Level Co-occurrence, The Tamura Texture Feature, The Model of Markov Random Field, Gabor Filtering, Binary Local Patterns.
Shape: Shape refers to shape of particular region in the image. Shapes can be determined by applying segmentation of the image. Shape Descriptors are used to translate, rotate and scale the images. Boundary based and Region based Shape Representation is used to represent the image.

ii. High Levelfeatures:

High level features are based on the Semantic understanding of the Image and derived attributes are from low level features.
Semantic features: Semantic refer to the meaning of the image Content. This is a high-level concept when compared to low-level Visual Features likeColor, Texture, Shape. To improve the accuracy of Semantic retrieval, Relevance Feedback is used where the user evaluates the result.
Metadata: Meta data is data about data that are related to the process of the image creation. The Meta attributes include image acquisition date, image identification number and name, image modality device, image magnification, etc. Due to manual annotation in images retrieval following limitations exists.
1. Excess time consumption.
2.Expensive task for large image database.
3.Retrieval of non-subjective, context sensitive and incomplete data.

III. PROPOSED WORD

A. *Training*

Input:Many Images is stored in Image Database.
Output:One Class is selected using Feature Vector.

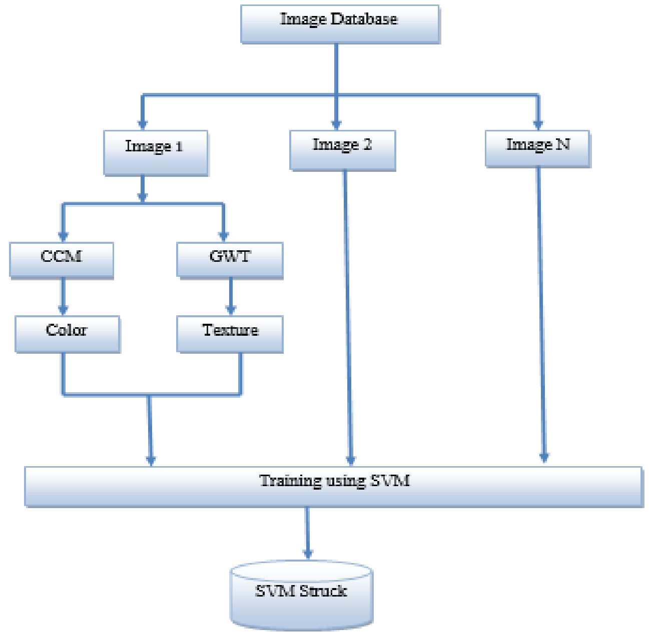

Figure 2 Flow of Proposed System

ISSN: 2321-8169
378 – 381

B. Testing

Input:Testing Image as in WANG Dataset.
Output:Retrieving the Image.

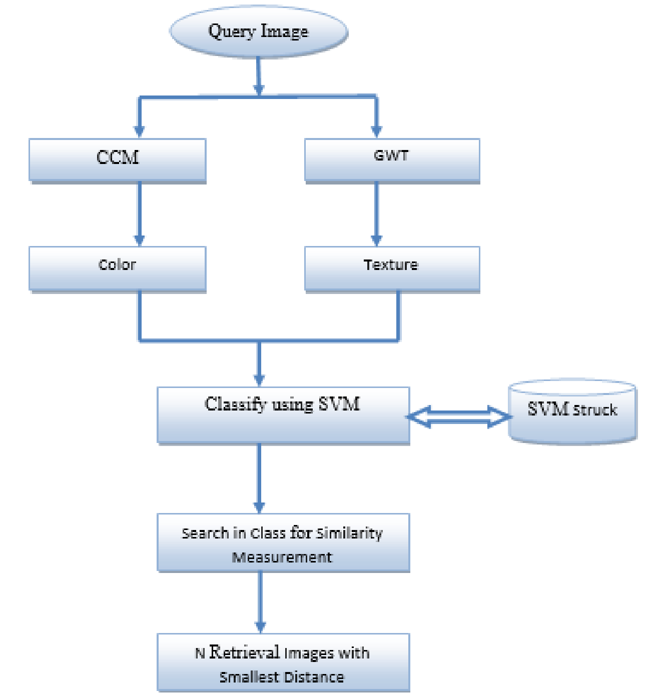

Figure 3 Flow of Proposed System

COLOR CO-OCCURRENCE MATRIX (CCM)

The image is processed and converted into four images of motif of scan pattern based on overlapping 3 × 3 windows scanning from top to bottom and left to right. Each 3 × 3 window is divided in to four grids with the central pixel G(x,y) located at four different corners as shown in Fig. 1. These 2 × 2 grids are then replaced by motifs of scanning pattern traversing the grid in the optimal sense. The optimality of the scan is achieved by traversing the path with respect to the incremental difference in intensity along the scan path by minimizing the variation of the intensities at a local neighbourhood. Peano space filling curves are used to traverse pixels along a specific local path made out of the seven primitive scans as show in Fig. 2. One of the seven possible motifs will represent the 2 × 2pixel grid optimally with respect to a suitable criterion. Generally, there are 25 different scan patterns in a grid if the traversal goes from four different corners along the paths. If we only consider the scan starting from the top left corner, then the number of motif patterns are reducing to only 7 including motif number "0" as shown in Fig. 2 which signifies the special situation where a motif can-not be formed due to the two or more adjacent pixels that have the same value in a grid. Fig. 3 illustrates an example of various patterns of motif "0". The patterns can be classified into ascending and descending patterns based on whether the values of scanning sequence are increasing or decreasing.

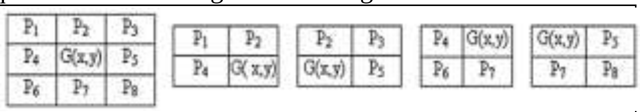

Figure 4 The 3 × 3 window divided into four 2 × 2 grids.

The CCM considers the probability of the co-occurrence between the two adjacent motifs of scan pattern. This probability is used to capture the color variations in the image.

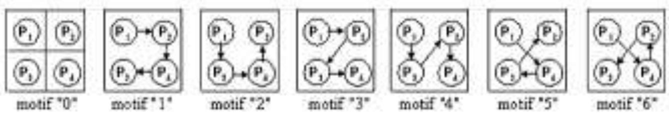

Figure 5The seven scan patterns

GABOR WAVELET TRANSFORM

One of the most popular signal processing based approaches for texture feature extraction has been the use of Gabor filters. These enable filtering in the frequency and spatial domain. It has been proposed that Gabor filters can be used to model the responses of the human visual system. Turner first implemented this by using a bank of Gabor filters to analyze texture. A bank of filters at different scales and orientations allows multichannel filtering of an image to extract frequency and orientation information. This can then be used to decompose the image into texture features. The featureis computed by filtering the image with a bank of orientation and scale sensitive filters and computing the mean and standard deviation of the output in thefrequency domain.

SVM CLASSIFIER

Image Classification Methods Are Categorized Into Two Types Supervised And Unsupervised Method, Support Vector Machines Is A Type Of Supervised Learning Method Which Uses Training Set Of Images To Create Descriptors For Each Class. High Dimensionality Of The Feature Space In Content Based Image Classification Is One Of The Reasons Why Sym Is Preferred Over Traditional Classification Methods. SVM Classification Is Performed By Generating A Hyper Plane Which Separates All Points With Same Label On One Side Of The Hyper plane. Vectors Near To the Hyper plane Are Called Support Vectors. Optimal Separating Hyper plane Is the One Having Maximum Distance from the Closest Point. The Perpendicular Distance between the Separating Hyper plane and the hyper plane Through the Closest Points Is Called the Margin. The Region between the hyper planes On Both Sides of the Separating Hyper plane Is Called The Margin Band. Support Vector Machines Can Be Used For Text Categorization, Image Classification, Particle Identification, Database Marketing And Bioinformatics.

IV. IMPLEMENTATION RESULTS

Figure 6 Results of CCM+GWT+SVM

ISSN: 2321-8169
378 – 381

Table 1 Result of SVM classifier

Confusion Matrix									
17	1	0	0	0	1	0	0	0	1
0	14	1	1	0	1	0	1	1	1
2	2	14	1	0	0	0	0	1	0
1	1	0	18	0	0	0	0	0	0
0	0	0	0	20	0	0	0	0	0
2	0	0	0	0	16	0	0	2	0
0	0	0	0	0	0	20	0	0	0
0	0	0	0	0	0	0	20	0	0
0	2	1	0	0	2	0	0	14	1
2	0	1	0	0	0	0	0	0	17

Table 2 Experimental Result of CCM+GWT

Classes	CCM+GWT	
	Precision	Recall
Africa	0.82	0.36
Beach	0.55	0.24
Monuments	0.45	0.19
Buses	0.45	0.25
Dinosaurs	0.88	0.39
Elephants	0.73	0.35
Flowers	0.86	0.41
Horses	0.92	0.51
Mountains	0.55	0.33
Food	0.42	0.29
Average of all classes	0.663	0.332

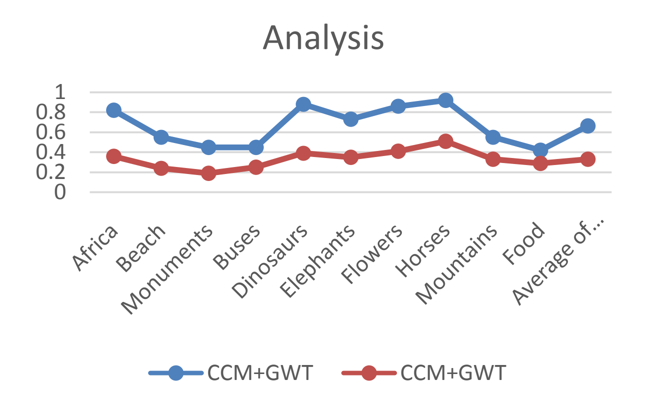

Figure 7 Analysis

CONCLUSION

The color co-occurrence matrix for shading highlight extraction can catch the shading variety productively. The gabor wavelet change for surface component extraction can give the great portrayal of the surface. These two strategies can enhance the recovery comes about. As we have connected Classification before recovery so if my characterization is genuine at that point no negative recoveries. Here we recover pictures on ordered class just so computational time likewise lessened.

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