IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Effective Content Based Image Retrieval Technique using Color and Texture Features

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Abstract

To find an image from large database is implemented by CBIR technique. An image has three main features such as color, texture and shape. The proposed scheme is effectively searching images by using feature extraction. Dominant color descriptor is used in image indexing and dominant color extraction. By using Gray Level Co-occurrence Matrix (GLCM), texture of an image is obtained. Color and texture features are normalized. Using Gradient Vector Flow fields, shape information is captured in terms of edge images computed. A robust feature set for image retrieval is provided by using the combination of the color, shape and texture features. In retrieving the similar images, weighted Euclidean distance of color, texture and shape features are used. To classify relevant and irrelevant images in this retrieval process, support vector machine is used. This technique is simply displayed relevant images that are similar to a query image.

Keywords

CBIR, Dominant color descriptor, GLCM, GVF, SVM.

I. INTRODUCTION

Content-based image retrieval (CBIR) is effective retrieval technique that has been used to describe the process of retrieving desired images from a large collection on the basis of syntactical image features. In the earlier image retrieval systems are used image-based search instead of text-based search [1] since the images are required to be indexed. An important problem that needs to be addressed is fast retrieval of images from huge databases. To find images that are similar to a query image, image retrieval systems attempt to search through a database. Content-based image retrieval [1, 8] is used as an alternative and complement to traditional text-based image searching. For describing an image content [2], color, texture and shape features have been used. Color is one of the most widely used low-level visual features and is invariant to image size and orientation. In CBIR color histogram, color correlogram, and dominant color descriptor (DCD) as conventional color features are used. Content-based image retrieval system is based on Dominant color, GLCM texture and shape. Texture is described the structural arrangement of a region and the relationship of the surrounding regions and also considered of some basic primitives [2]. Texture features extracted by using gray-level co-occurrence matrix (GLCM). Shape feature has been extensively used for retrieval systems. CBIR system used dominant colors, Gray-level co-occurrence matrix [1, 2] and Gradient vector flow field in the concrete selection of color, texture and shape description. Following are the steps of CBIR system found relevant images from huge database:

- To understand image user's need and information-seeking behavior.
- To develop a technique which captured color and texture descriptors of an image, and has a shape descriptor in terms of invariant moments computed on the edge image.
- Identification of suitable ways of describing image content.
- To extract such features from raw images.
- To provide compact storage for large image databases.
- To match query and stored images in a way that reflects human similarity judgments.
- Efficiently accessing stored images by content.
- To provide usable human interfaces to CBIR systems.

The Support Vector Machine (SVM) [13] is used to classify the features of a query image by splitting the group such as color, shape and texture. Finally, the relevant images are retrieved from the database. Accuracy and error rate are found. This method is given much better performance than the traditional method of image retrieval.

II. LITERATURE SURVEY

In [1], R. Durga Prasad developed image mining technique that discovered meaningful correlations and formulations from previous collection of image data. He worked on Image clustering and finding the minimum distance among the images for better image output. In [2], Nilima R. Kharsan worked on the combination of the color and texture features of an image in conjunction with the shape features. The technique provided a robust feature set for image retrieval. The similarity between query and target image is measured from two types of characteristic features which includes dominant color and texture features. They found that the distances between visual features, efficient indexing of visual feature vectors were important for image retrieval. According to them, to set up an indexing scheme, dimension reduction is usually performed first to reduce the dimensionality of the visual feature vector. In [3], Zhijie Zhao presented a novel approach for image retrieval by combining color, texture and shape features. The simulation results showed that their method did well on precision ratio, when the scenes of query images are complex, the low visual features are insufficient to represent them. In [4], Web image search re-ranking approach introduced by Sonali Mathur. An online image search re-ranking approach that explored multiple modalities in an exceedingly graph-based learning theme. An information consists of various forms of pictures has enforced on the system completely different options like bar chart, color mean, Color structure descriptor texture is taken into thought for extracting similar pictures from the information.

In [5], Anil T. Lohar presented the content could be color, shape, texture or any piece of information, which was obtained from the image itself. The concept of retrieving images based on their content is called as CBIR. The process of CBIR consists of three stages are as follows:

- Image Acquisition
- Feature Extraction
- Similarity Matching.

Content Based Image Retrieval (CBIR) is different from the traditional database and text based image retrieval system. In [6], Neelima Bagri developed a technique in that an images resize according to the region of interest for the faster retrieval of images. Deleting and removing complicated background would be fast for further image processing. Very strong discriminative power feature made an essential component in image and video retrieval. Therefore, they found an effective method to compute the directionality of an image, and tamura used statistical measure to calculate statistical feature. And thus they extracted texture features and shape and fused these feature vectors of tamura and shape combinations for better result. In [7], According to S. Sasikala, Content Based Image Retrieval (CBIR) was a kind of Image Retrieval technique that could figure out images like sketch similar to querying images from image database. In Content Based Image Retrieval (CBIR) image can be retrieved by query known as Query by Image Content and also known as Content Based Visual Information (CBVI) which was the application of Computer Vision techniques for the problem of searching digital images from large image database known as image retrieval problem.

In [8], According to Aboli W. Hole, Content Based Image Retrieval (CBIR) has motivated the extensive research into image retrieval systems. From historical perspective, one should notice that the earlier image retrieval systems are rather text-based search since the images are required to be annotated and indexed. In [9], M. Babu Rao worked on that an images are manually annotated with keywords and then retrieved using text-

based search methods. The performances of these systems were not satisfactory. The goal of CBIR was to extract visual content of an image automatically, like color, texture, or shape. For efficient data management, a system is proposed which generated metadata for image contents. This system was using Content-Based Image Retrieval System (CBIR) based on Mpeg-7 descriptors. First, low-level features are extracted from the query image without metadata and the images with similar low-level features are retrieved from the CBIR system. In [10], X-Y Wang et al worked on an efficient image retrieval technique which used dominant color and texture features of an image. The proposed method yielded higher average precision and average recall with reduced feature vector dimension. In [11], Trademark image retrieval (TIR) system is proposed by FAN-HUI Kong to deal with the vast number of trademark images in the trademark registration system. They extracted an edges using the Canny edge detector, performed a shape normalization procedure, and then extracted the global and local features. It considered that the field experience a paradigm shift in the foreseeable future, with the focus being more on application-oriented, domain-specific work, generating considerable impact in day-to-day life. Dominant color descriptor (DCD) was one of the color descriptors proposed by MPEG-7 in [12] that Young Chun has been used this method for image retrieval.

In [11] and [12], According to author, content-based image retrieval method based on an efficient combination of multi resolution color and texture features. A detailed evaluation of the use of texture features in a query-by-example approach to image retrieval is presented. Color, texture and shape features have been used for describing image content. Color was one of the most widely used low-level visual features and was invariant to image size and orientation. As conventional color features used in CBIR, there were color histogram, color correlogram, and dominant color descriptor (DCD). Color histogram was the most commonly used color presentation, but it did not include any spatial information. Color correlogram described the probability of find color pairs at a fixed pixel distance and provides spatial information. Therefore color correlogram yields better retrieval accuracy in comparison to color histogram. Color auto correlogram was a subset of color correlogram, which captures the spatial correlation between identical colors only. Since it provided significant computational benefits over color correlogram, it was more suitable for image retrieval. Texture was also an important visual feature that referred to innate surface properties of an object and their relationship to the surrounding environment. Many objects in an image can be distinguished solely by their textures without any other information. Texture might be consisted of some basic primitives, and also described the structural arrangement of a region and the relationship of the surrounding regions. They have used the texture features using gray-level co-occurrence matrix (GLCM). Shape feature has been extensively used for retrieval systems. Shape signatures are computed from blurred images and global invariant moments are computed as shape features.

In [13] Katta Sugamya investigated more effective color, shape and texture feature extraction methods are required to improve the robustness of the system by increasing the number of categories in the database. They have used support vector machine (SVM) to search relevant images similar to query image from huge database. SVM also classified relevant and non-relevant images. It provided accuracy and recall rate precisely. In [14] Savita worked on extraction of texture features by GLCM matrix. They used Gabor filter, colour histogram and wavelet features with support vector machine for feature extraction.

III. CONTENT BASED IMAGE RETRIEVAL

Content-based image retrieval is also known as Query by Image Content (QBIC) presented the technologies allowing to organize digital pictures by their visual features. They are based on the application of computer vision techniques to the image retrieval problem in large databases. Content-Based Image Retrieval (CBIR) consists of retrieving the most visually similar images to a given query image from a database of images. To describe image from the different aspects for more detailed information in order to obtain better search results and to express more image information [2], we considered main features of an image such as the dominant color, texture and shape. The proposed method is based on dominant color, texture and shape features of an image.

- **Extraction of dominant color of an image**

The selection of color space is not a critical issue for DCD extraction. Therefore, the RGB color space is used for simplicity and without loss of generality. The RGB color space is uniformly divided into 8 coarse partitions. If there are several colors located on the same partitioned block, they are assumed to be similar. After the above coarse partition, the centroid of each partition is selected as its quantized color. Dominant color region [1] in an image can be represented as a connected fragment of homogeneous color pixels which is perceived by

human vision. Image Indexing can be based on this concept of dominant color regions present in the image. The segmented out dominant regions along with their features can be used as an aid in the retrieval of similar images from the image database.

- **Extraction of texture of an image**

A texture representation for image retrieval based on GLCM is used. Texture features are extracted from the statistics of this matrix. GLCM (Gray level co-occurrence matrix) [1, 2], method is used to examine texture that considers the spatial relationship of pixels is the gray-level co-occurrence matrix (GLCM), also known as the gray-level spatial dependence matrix. The GLCM functions characterized the texture of an image by calculating how often pairs of pixel with specific values and in a specified spatial relationship occur in an image, creating a GLCM, and then extracted statistical measures. Based on the GLCM four statistical parameters energy, contrast, correlation and homogeneity are computed.

- **Extraction of shape of an image**

Shape information is captured in terms of the edge image of the gray scale equivalent of every image in the database. We have used gradient vector flow (GVF) [2] fields to obtain the edge image. Gradient vector flow (GVF) is a static external force used in active contour method.

IV. CONTENT BASED IMAGE RETRIEVAL SYSTEM USING SVM

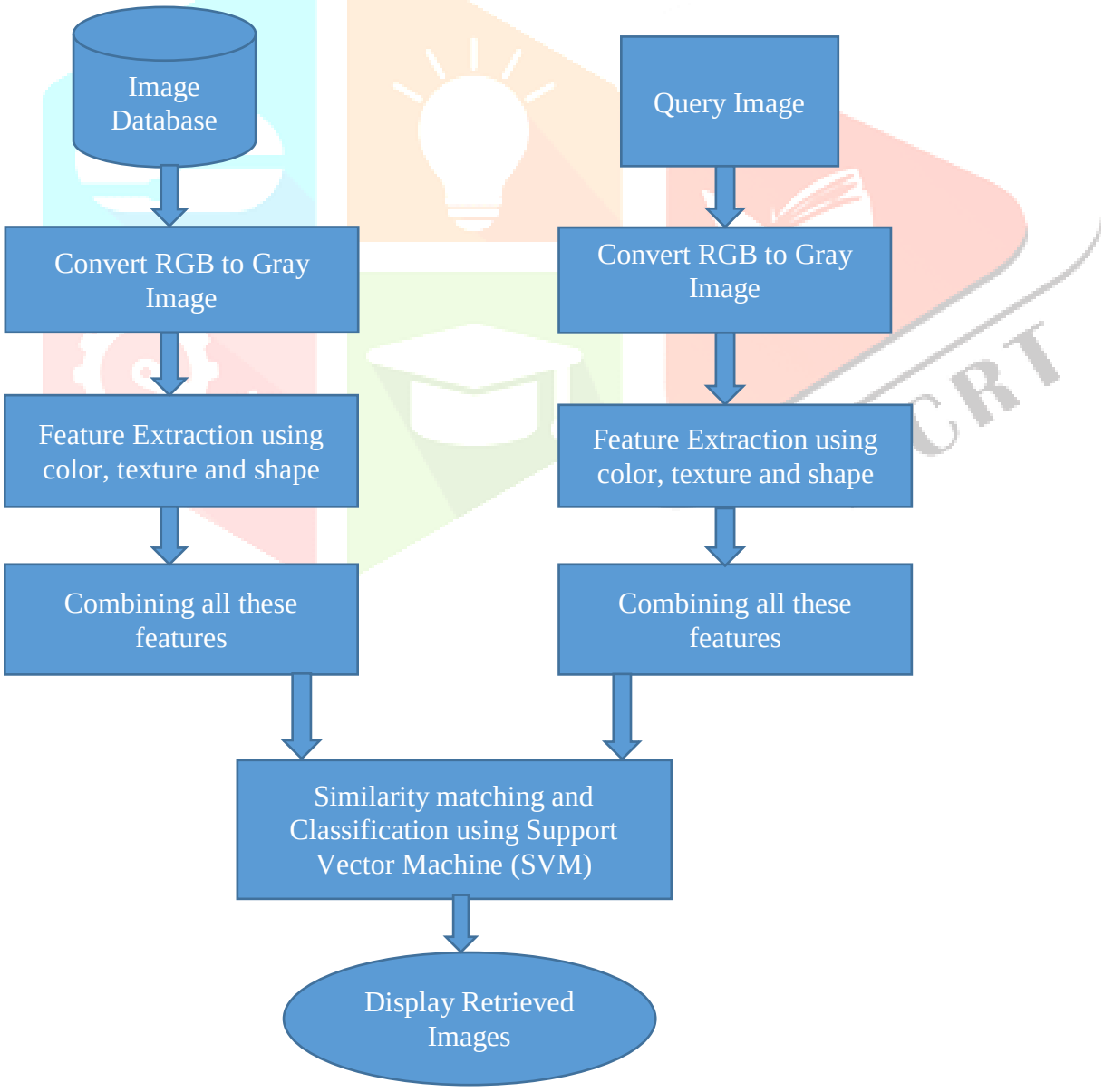

Fig.1 Block diagram of CBIR using Support Vector Machine

Block diagram of CBIR using Support Vector Machine (SVM) is shown in Figure 1. This system is used for retrieving an images from huge database. Initially we put query image for finding related images. Query image is converted from color image to gray image with the help of gabor filter. Thereafter extracted the features of an image using color, texture and shape. Dominant color descriptor is used to extract dominant color of an image. Similarly Gray Level Co-occurrence Matrix (GLCM) and Gradient vector flow (GVF) are used to extract texture and shape of an image respectively. System is matched the combination of color, texture and shape features with similar images stored in database. During similarity matching, various images in database are also gone through RGB to gray conversion and feature extraction. Support vector machine is used to classify relevant and non-relevant images. The similarity comparison between the feature vector dataset of a query image and feature image database are then measured and retrieved images are displayed.

V. SUPPORT VECTOR MACHINE

The objective of the support vector machine algorithm is to find a hyper plane in an N-dimensional space (N - the number of features) that distinctly classifies the data points.

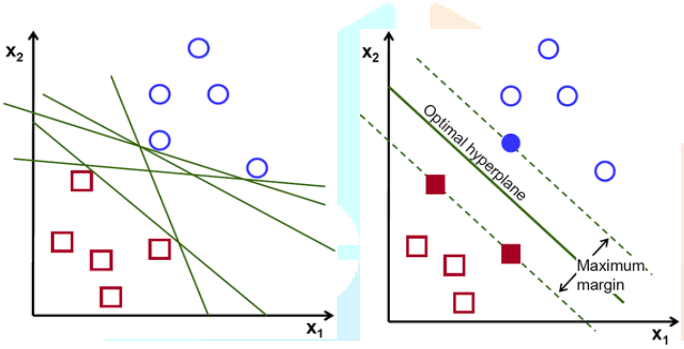

Fig.2 Possible hyper-planes

Support Vector Machine (SVM) is a supervised machine learning algorithm which can be used for both classification or regression challenges. However, it is mostly used in classification problems. In the SVM algorithm, we plotted each data item as a point in n-dimensional space (where n is number of features you have) with the value of each feature being the value of a particular coordinate. Then, we performed classification by finding the hyper-plane that differentiates the two classes very well. Support Vectors are simply the co-ordinates of individual observation. The SVM classifier is a frontier which best segregates the two classes (hyper-plane/ line).

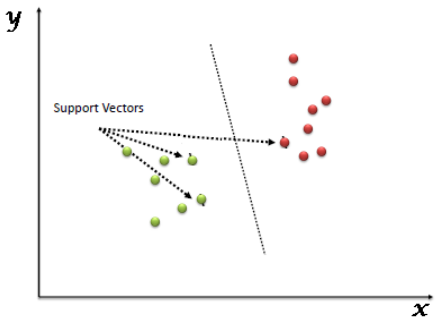

Fig.3. SVM's hyper-plane

CBIR established the efficient combination of color, shape and texture features [13]. The images in database are loaded. The resultant image is given as input to feature extraction technique which is transformation of input image into a set of features such as color, texture and shape. By using these features, the retrieval accuracy and recall rate is enhanced. The classification technique Support Vector Machine (SVM) [13] is used to classify the features of a query image by splitting features such as color, shape and texture. Finally, the relevant images are retrieved from the database. We have found more Accuracy and error rate in SVM classifier. The proposed work employs the use of hsv histograms, color moments and color auto-correlogram in extracting

the color features of images. This method is performed a simple feature-based search in an image database for an input query image, using extracted feature vectors. It then compared the hsv histograms of different images using the Quadratic Distance Equation. Further enhancing the search, the application performs a texture-based search in the color results. It then compared the texture features obtained using the Euclidean Distance Equation. By using SVM classifier, we can be improved an accuracy and a confusion matrix is generated which actually classifies relevant and non-relevant images.

VI. CONCLUSION

Database comprising of various images and the feature set consisting of color, texture and shape descriptors computed for an image. We have implemented a CBIR method which is used the combination of dominant color, texture and shape features extraction. Dominant color descriptor, Gray Level Co-occurrence Matrix (GLCM) and Gradient vector flow (GVF) are used for feature extraction. Similarity has been found between query image and images from database. SVM classifier has been used to find relevant images from large database. CBIR using SVM technique is very effectively retrieved required images while browsing.

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