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Feature Extraction From Video Using Ordered Dither Block Truncation Coding(ODBTC) And RGB Color Space Model

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Abstract— **Content Based Image Retrieval is most recently used technique for image retrieval from large image database. The reason behind using CBIR is to get perfect and fast result. There are many technique of CBIR used for image retrieval. A Block Truncation Coding technique is the famous method used for image retrieval. BTC is an image compression method uses two stages namely encoding and decoding. BTC is also used to index the images in database. BTC further has been inspired by many coding techniques for achieving its stability and simplicity. In proposed system the advanced technique of BTC is used that is Ordered Dither Block Truncation Coding (ODBTC). In this approach the CBIR is applied on video instead of images. ODBTC technique is used as an indexing scheme for indexing the images from video and as the video is a collection of image frames so the ODBTC technique is directly applied on it. Results shows the easily extraction of an object from an input image frame using similarity computation between the features of trained object and input image frame object.**

Index Terms— ***Bit pattern feature, color co-occurrence feature, content-based image retrieval, and ordered dither block truncation coding.***

I. Introduction

Content Based Image Retrieval (CBIR) is the method of retrieving images from the large image databases as per the user demand. It is also called as Query By Image Content (QBIC) and Content Visual Information Retrieval (CBVIR). In CBIR, content based means the searching of image is proceed on the actual content of image rather than its metadata. The Content Based Image Retrieval System is used to extract the features, indexing those features using appropriate structures and efficiently provide answers to the user's query. To provide the satisfactory answer to the user query, CBIR provides some flow of work. Firstly CBIR system takes the RGB image as an input, performs feature extraction, performs some similarity computations with the images stored in database and retrieves the output image on the basis of similarity computation. There are some basic CBIR fundamentals and are divided into three parts such as feature extraction, multidimensional indexing and Retrieval system architecture[1].Figure 1 shows the basic block diagram of Content Based Image Retrieval.

A. *Feature Extraction:*

Features are divided into two categories respectively text based and visual based. Textual features are keywords, tags, annotations etc. Visual features are color, space and texture etc. Visual features are the important features of an image for pattern recognition [2].

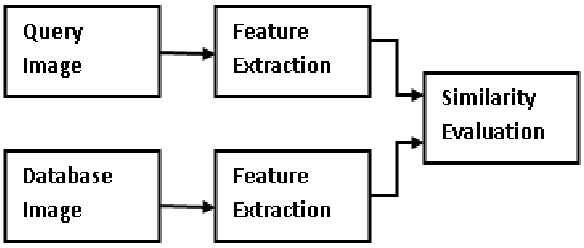

Figure 1 : Block Diagram of CBIR

Color:

This is one of the most important feature of CBIR. Histogram, Block based, Color histogram moments are some examples where color features are used to retrieve images. It is widely used for image representation and independent of size of an image. Color feature extraction uses color space, color quantization and similarity measurement key components. RGB and HSV are two color based and hardware based color models used for feature extraction.

Texture:

Texture describes visual pattern and it contains important information about structural arrangement of the surface including cloud, trees, bricks, hair and fabric and its relationship to the surrounding environment. Some methods of classifying texture include:

i) Color Co-Occurrence Matrix
ii) Low Texture Energy.
iii) Wavelet Transform.

3. Shape:

Shape refers to the shape of a particular region that is being sought out. Descriptors of shape may also need to be invariant to translation, rotation and scale. Some shape descriptor includes:

i) Fourier Transform
ii) Moment Invariant

B. *Multidimensional Indexing:*

Multidimensional indexing techniques are mainly used to make the CBIR truly scalable large size image collection. Most of the images are having high dimensionality. So the best way to index such images is to reduce the dimensionality and then indexing the images. For dimension reduction, clustering is used. Clustering can be used in various forms like pattern recognition, speech analysis and information retrieval. Clustering can be performed row wise as well as column wise to perform recognition or grouping [2].

C. Retrieval System Architecture and Similarity matching:

Images are indexed after feature extraction and then similarity measurement is performed. Similarity evaluation is done between the features of the query image and the features of the target image in the database. Similarity measure computes the degree of similarity between a pair of images. It represents the distance between feature vectors representing the images. Similarity images should have smaller distance between them and different images should have large distance.

II. LITERATURE SURVEY

In previous work CBIR system is developed using BTC [3]. Here two image features have been proposed namely block color co-occurrence matrix and block pattern histogram[3], to index a set of images in database [4]. In [4] RGB color space used for the generation of image feature whereas the image indexing scheme in [5] used YCbCr color space respectively, the BTC encoding is performed only for Y color space, By employing VQ, two image features (contrast and visual pattern co-occurrence matrix and color pattern co-occurrence matrix[5]) are generated from a YCbCr image. Some improvements on the BTC-based image retrieval system can also be found in [6] and [8] in which both methods utilize the RGB color space for the extraction of the image feature descriptor.

In [6], the BTC encoding is performed on each color space (Red, Green and Blue) separately. The traditional color histogram and bit pattern codebook are subsequently extracted from each color channel.

In [7] Mr. Vishwas Udpikar and Jewan Raina has proposed new method for Content Based Image Retrieval using Block Truncation Coding . They have used Vector Quantization method to reduce the Bit Rate and information overhead.

Nowadays this CBIR technique is applied on video retrieval. In [9], a new approach is introduced to facilitate the searching and browsing of large image collections over WWW. In this Paper, low level visual properties extracted from video frame and then video analysis is done on these video frames. In this technique multiple features from video frames are extracted for indexing. In [10], new approach is introduced in which multimedia retrieval framework focusing on video objects, which uses MPEG-7 standard. This approach mainly used for bandwidth limited web applications in which it provides the content based retrieval interface.

In [11] SVM (Support Vector Machine) technique is used to combine all relevant or irrelevant features such as color, shape etc. This method gives fast and optimal results. In [12] new feature detector and feature descriptor is used called as micro-structure descriptor. It is based on the edge orientation similarity. In [13], sparse representation based approach is introduced to encode the information content of an image using information of other image. In [14], halftoning based block truncation coding is used to index images from database. Here two image features are used to generate feature descriptor namely color co-occurrence feature (CCF) and Bit Pattern Feature (BPF).

In [15], Gaussian Copula and Wavelet Decomposition techniques are used. Here two new multivariate models using, respectively, generalized Gaussian and Weibull densities are introduced. These models capture both the subband marginal distributions and the correlation between wavelet coefficients. In [16], spatial context spatial context of local features converted into binary codes, and achieve geometric verification by efficient comparison of the binary codes. In [17], HSV color space is used for Content Based image retrieval. In this system combination of multi resolution color and texture feature is used.

III. METHODOLOGY

In real-time applications set of similar images or images from videos get easily access, browse and retrieve using image retrieval system. Image retrieval system returns the set of images from the collection of images in the database. It provides similarity evaluation like content similarity, edge pattern similarity, color similarity etc. to meet users demand. To reduce the storage space requirement most of the images or videos are recorded in compress format in the storage device. So it became a need to design a system which extracts the image features descriptor from the compressed data stream. This system uses the feature extractor that generates an image feature for the CBIR task for videos from compressed data stream without performing decoding. These image features are used to detect an object in the video. In this system the video is treated as a sequence of image frames and each image frame is considered as individual image.

IV. SYSTEM DESIGN

System Architecture:

Figure 2 shows the architecture of proposed system. In proposed system, the CBIR technique is applied on videos. As the video is a collection of image frame each individual image frame is considered as an input for feature extraction. In this the system is trained using different objects with their size and colors. Then these features are extracted from the input image frame using feature extractor. Similarity computation is performed between the features extracted from input image frame and trained object image frame and related information is given as an output. Image frames from an video are already in predefined sequence hence the ODBTC indexing is directly applied on image frames rather than sequencing them. ODBTC data stream is used to generate the image feature descriptor. The ODBTC decomposes an image into a bitmap image and two color qantizers which are subsequently used for deriving the image feature descriptor. For this two image features are used

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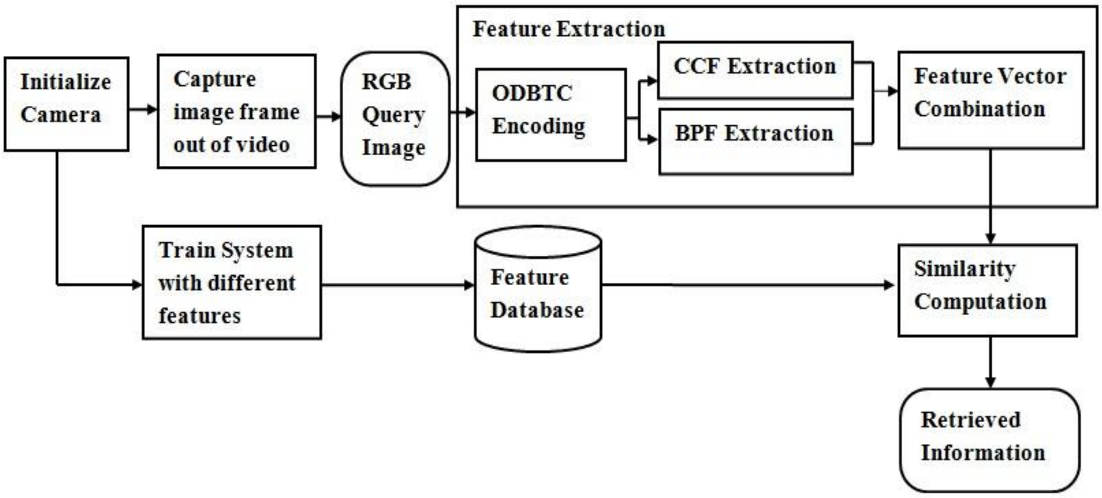

Figure 2: Architecture of Proposed System

namely Color Co-occurrence Feature (CCF) and Bit pattern Feature (BPF) in which CCF is derived from the two color quantizers and BPF is from bitmap image.

1. Color Co-occurrence Features (CCF):

Large amount of information about the image contents are contained in the color distribution of the pixels in an image. The attributes of an image can be derived from color co-occurrence matrix. This matrix gives the specific color information by calculating the occurrence probability of a pixel along with its adjacent neighbors. Two ODBTC color quantizers are used to compute CCF namely minimum and maximum color quantizers. Specific color codebook is used to index the two color quantizers and the color co-occurrence matrix is subsequently constructed from these indexed values.

2. Bit Pattern Feature (BPF):

This feature characterizes the edge, shape and image contents. The ODBTC generates the set of training bitmap images and then the representative bit pattern codebook is produced by binary vector quantization using the set of training bitmap images. BPF need simple computation making it suitable for real application where quick response is required.

Proposed system is worked in two phases as given below:

a. Training:

In this phase the system is trained with object color and size using different object images. This trained color and size are stored in feature database and later extracted in execution phase for similarity computation.

b. Execution:

In this phase actual execution is performed by the system. In this phase the system performs the similarity evaluation between the given input object image frame features and the object features stored in the database and the respected result is returned as an output. As the input is a video so the similarity evaluation is performed for every image frame from video. Each single image frame is considered as an image.

- **Mathematical Model :**

Given, original RGB Color image frame of size M×N.
Each image frame is then divided into image blocks of size m×n.

Let S be the closed system.
$S = \{B, X_{min}, X_{max}, D\}$
Where,
$B = \{b (i, j); i=1, 2, ...M/m; j=1, 2, ...N/n\}$
-set of image blocks of size m×n.
b (i, j) = original image block.
$X_{min} = \{x_{min} (i, j); i=1,2.....M/m; j=1,2,.....N/n\}$ -set of minimum quantizer.
x_{min} (i, j) = minimum value over RGB color channels on corresponding image block (i, j).
$X_{max} = \{x_{max} (i, j); i=1,2.....M/m; j=1,2,.....N/n\}$
-set of maximum quantizer.
x_{max} (i, j) = minimum value over RGB color channels on corresponding image block (i, j).
$D= \{D^0, D^1,.....,D^{255}\}$
-set of scaled version of dither array.

V. IMPLEMENTATION AND EXPERIMENTAL SETUP

The proposed system will work on the live streaming of video of .avi format. Live video is generated using camera and that video is converted into image frames. Each image frame is processed independently and image features are extracted from each image frame.

VII. EXPERIMENTAL RESULTS

In proposed system RGB color space model is used to calculate the color descriptor. System is trained using different object with different colors. RGB to Gray conversion is performed on the image frame from video to identify the object within the video.

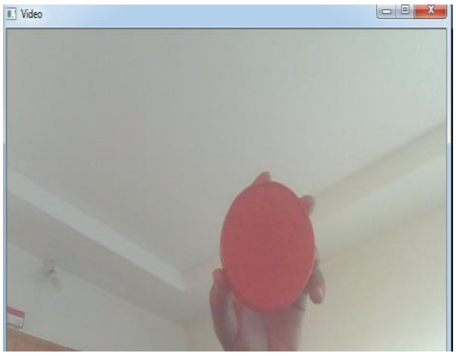

Figure 3: Train color to the system using red object.

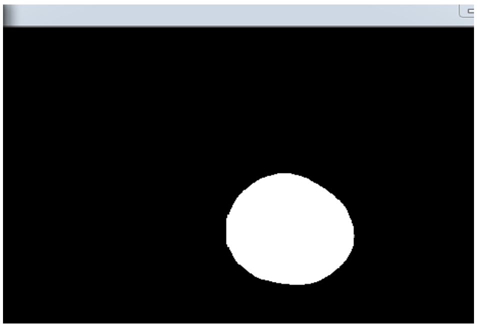

Figure 4: Converting color image into gray image

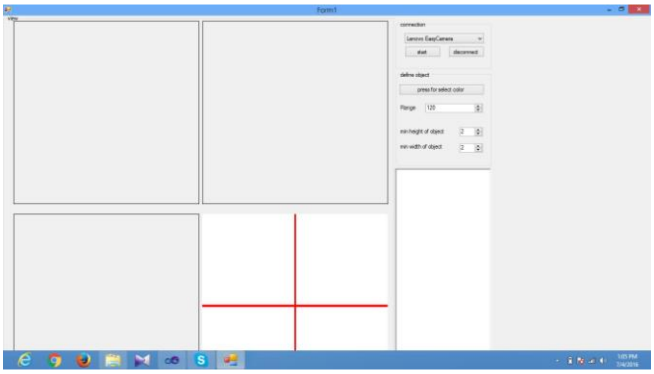

Figure 5: Initial Frame to detect an Object

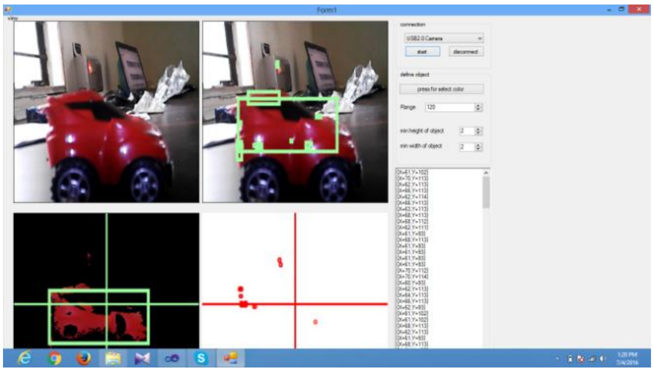

Figure 6: Actual Detection of an Object Using trained object Features

In Figure 3, red color trained to the system using red color object. When the camera detects the red object within the video it converts the pixels within the particular object to white color and other pixels to black and generates the gray image from color image frame and detect object as shown in Figure 4.

Figure 5, shows the initial frame to detect an object. Figure 6 shows the red color object is detected using the the features of an trained red color object.

CONCLUSION

As the Content Based Image Retrieval technique is applied only on images, in proposed system this CBIR technique is applied on videos. Video is a collection of image frames so each individual frame is considered as the single image. Feature extraction is done on each image frame. This approach is used only for the live streaming video of .avi file format.

In this approach the ODBTC indexing technique is used for indexing the images but in video, the image frames are already in sequence so ODBTC is directly applied on the predefined sequence of image frames in video for generating image descriptors. This system is designed for live streaming of video but future this system can be extended for the any type of video and also can be applied for stored videos.

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