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Review Paper on Content Based Image Retrieval System

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Abstract – *Desired image retrieval has been a challenging problem due to large amount of data resides on web. Image retrieval means to recover the original image from the reconstructed image. With the growth of the number of images in digital format, modern image retrieval system follows content-based image retrieval. Since decades, image retrieval system research has been popular and is widely used in market nowadays. Therefore, it becomes necessity for fast retrieval search engines that retrieve documents and images. In this paper, we discussed a comprehensive review and characterize the various problems of image retrieval techniques. This paper aims to evaluate meaningful models for one of the most challenging problems in image understanding, for effective and efficient mapping between image visual features and high-level concepts. Latest classification, clustering and interactive methods have been discussed here. Content based image retrieval is the latest technique for image retrieval. Content based image retrieval (CBIR) is one of the most exciting and fastest growing research areas in the field of image processing. Finally based, on existing technologies and the demand from real world, a few future work directions also suggested.*

Key Words: Image Retrieval, Content Based image retrieval, Scale Invariant feature Transform, Feature Extraction, Segmentation

1. INTRODUCTION

Digital image processing is use of computer algorithms to perform image processing on digital images. Digital image processing has many advantages over analog image processing such as it allows much wider range of algorithms to be applied to input data and can avoid problems like noise and signal distortions during processing. Content

Based image retrieval is defined as a process which requires a visible content to search an image from a huge image database as per the requirement of the user. Images can be classified into two categories: - one is texture image and other is non-texture image [3]. In texture images, pattern object within image is repeated, and in non texture image, the object is not repeated and its feature value differs from region to region.

Huge increase in digital data such as images, audios, videos is being generated per second. A user required to find their relevant information (images) from large multimedia databases. In order to handle such a large number of images an efficient image retrieval technique need to be addressed. To have better results of retrieval we need to use methods of content-based image retrieval. Based on the similarity of textual annotations given to images the retrieval was done but the results were poor, so content-based image retrieval technique is introduced. There are many methods in Content Based Image Retrieval such as feature extraction, segmentation, clustering etc.

1.1 Content Based Image Retrieval

A content based image retrieval is an interface between semantic gaps which can be explained as the difference between human brain(which is capable to perform complex visual perception at a very fast rate) and a computer system (which cannot perform the complex image perception at a faster rate).Content-based image retrieval (CBIR), also known as query by image content (QBIC) and content-based visual information retrieval(CBVIR) is the application of computer vision techniques to the image retrieval problem, that is, the problem of searching for digital images in large databases (see this survey[1] for a recent scientific overview of the CBIR field). Content-based image retrieval is opposed to traditional concept approaches. In CBIR, visual image contents are represented as image features, which are extracted using feature extraction methods [4]. Image feature extraction is usually done on the basis of color, shape, texture which are low level feature representing the image and many methods have been implemented for the same.

The term "content" refers to colors, shapes, textures, or any other information that can be derived from the image itself. There are numbers of methods based on CBIR using diverse methods such as color feature, shape feature, texture features are some of the features. The recent approaches in CBIR use hardware and software approaches to retrieve appropriate images. The parallelized image search algorithm requires high memory storage device and cluster computing power to access large number of images from data. The CBIR system have two main steps, the first step involves the per-processing of images from the image database. The image features are extracted from the database images and are stored as a feature database of images. This step is challenging step as how to extract the features of the images and therefore involves large number of calculations and requires a lot of time. The other step involves the similarity measures, which is an important step as our results are retrieved after the similarity measure check.

The user query image features are matched with the stored feature database that gives us the best possible match as per the user query image. There are some methods for matching of features of image such as by calculating the distance between the query image and the database images. Scale invariant feature transform (SIFT) is one of the methods which gives us better results than other feature extraction techniques [6]. In testing phase, we check the image in the

query training set and detect or retrieve the image and calculate the performance parameters. Evaluate the performance parameters like accuracy, false acceptance rate, false rejection rate and mean square error rate etc. The scale invariant features transform consists of four stages:

- scale-space extreme detection
- keypoint localization
- orientation assignment
- Keypoint description

2. RELATED WORK

There are numbers of techniques related to CBIR used in various methods. Such as color feature, shape feature, texture features etc. The related work of CBIR is discussed here:

Haiyu Song et al, 2018 discussed the adaptive image segmentation and feature extraction approach according to different category image for image retrieval system. To improve performance, adaptive segmentation approach according to different category image. To accurately describe feature of region, we propose weight assignment method for centroid pixel and its neighbor by convolution with normal distribution when image segmentation by Gaussian Mixture Model (GMM). To improve generalization, we propose adaptive number of fourier descriptors of shape signature which depends on the energy distribution of Fourier descriptors, instead of fixed number by experience. To simply and efficiently describe the spatial relationships of multiobject in same image we apply simplified topological relationships [5].

Aasia Ali, Sanjay Sharma, 2017 discussed content-based image retrieval technique in order to search the user based query images from the large databases. The key idea of their work is to use Sift feature extraction algorithm to use feature extraction. But as SIFT image feature algorithm give a set of image features that are not valuable so BFOA (Bacteria foraging optimization algorithm) technique has been used. BFOA method reduces the complexity, cost, energy and time consumptions [2].

Vishal Lonarkar, Ashwath Rao B, 2017 discussed an approach for content- based image retrieval of both texture and non-texture images. Many systems use automated segmentation techniques followed with region-based feature extraction. The system employs clustering of images to speed up the retrieval process. The result shows that searching of an image is fast and accurate [3].

Jurandy Almeida, Ricardo da S. Torres and Siome Goldenstein, 2009 discussed that common approaches use only low-level features. But CBIR solutions fail to capture some local features. Many techniques in image processing and computer vision can capture these scene semantics. Among them, the scale invariant features transform has been widely used in a lot of applications. In this paper they had discussed the results obtained in several experiments proposed to evaluate the application of the SIFT in CBIR tasks [6].

3. PROPOSED METHODOLOGY

CBIR is a retrieval technique of images from large database on visual features of an image such as color, shape, texture. The features of image are extracted using SIFT algorithm which results in an image that are invariant to scale and rotation [4]. Color and texture data have been the primitive picture or image descriptors in content based image recovery or retrieval systems. For better enhancement, number of features increased for comparison with related work and value of parameters calculated for comparative analysis and time is also calculated when feature comparing with stored database. The SIFT method extracts the visual features but there was a problem of time complexity and memory usage arises.

Algorithm used is:

- Read the image datasheet.
- Extract the features using SIFT method.
- Optimize the feature set by using optimization algorithm BOFA.
- Classify the optimized data using DNN.
- Extract the features of the query image RGB.
- Optimize the query image features.
- Classify features from the feature database.
- Categorize the calculations based on both the images query image and database image.

4. IMPLEMENTATION AND RESULTS

The data consists of images of humans, animals, butterflies, flowers. Then these images are divided into different categories and after that MATLAB programming interface. First of all, the edge detection is calculated by canny method. The image filtering is done and the feature extraction algorithm is applied which extracts the features based on rotation, scaling, assignment, and orientation and key point distributor.

Afterwards, the bacteria foraging optimization algorithm is used to reduce the extracted feature matrix. Then, the neural network is trained which starts with initialization of datasheet and is based on iterations, time taken, performance, gradient value and mutation, validation process [2]. The performance of accuracy with DNN and BFOA.

The steps involved in testing phase are – upload test image, convert it into black and white, calculate edges based on regions and check the noise level and filter it.

5. CONCLUSIONS

In this paper the problem of image retrieval will be solved using combination of SIFT, BFOA, and DNN.
In the beginning feature extraction will be done using SIFT. Then, firstly, the neural network is trained based on the features of images in the datasheet. BFOA algorithm is used to optimize the feature set to initialize the set of size called as population. Problem solutions from individual populations are used a reserved to new population. Results

which are particular to form novel solutions i.e. data stream bits are selected with the help of best cost function [2].
BFOA techniques techniques used are:

- Rotation
- Dispersal and eliminate
- Reproduction

The features of images we have considered are of average value, minimum value and maximum value. The training of images using DNN, when presented with a query image retrieves and displays the images which are relevant and similar to query from the database. There is an improvement in terms of FRR, FAR and accuracy of image retrieval.
In future, with the help of CBIR system, more low-level image descriptors and highly efficient deep learning neural network could be verified to be quite fast and more accurate one.

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