A Modified Approach for Content Based Image Retrieval System

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ABSTRACT

Content Based Image Retrieval (CBIR) overcomes the traditional text-based image retrieval technology where search is based on automatic or manual explanation of images. For Image retrieval it's an active research field. Content Based Image Retrieval is a methodology that allows a user to extract an image based on a query from the database. Here, in this work, K Nearest Neighbor (KNN) classifier is used with Jaccard coefficient to find the relevant images. With the use of Jaccard Coefficient the result found are far better than the previous work.

Keyword: - *CBIR, QBIC, TBIR, MATLAB.*

1. Content-Based Image Retrieval (CBIR)

The earliest use of the term content-based image retrieval in the literature seems to have been by Kato [1]. In CBIR, images are indexed by their own visual contents such as color, texture, and shape. Visual contents are extracted from the images as automatically as possible [2]. Thus, CBIR systems have two main advantages over TBIR systems. First, they minimize the human effort. Second, due to reduced people intervention, subjectivity is also reduced. This feature makes CBIR systems more useful in many areas, such as search and browse large image collections.

1.1 Architecture of CBIR

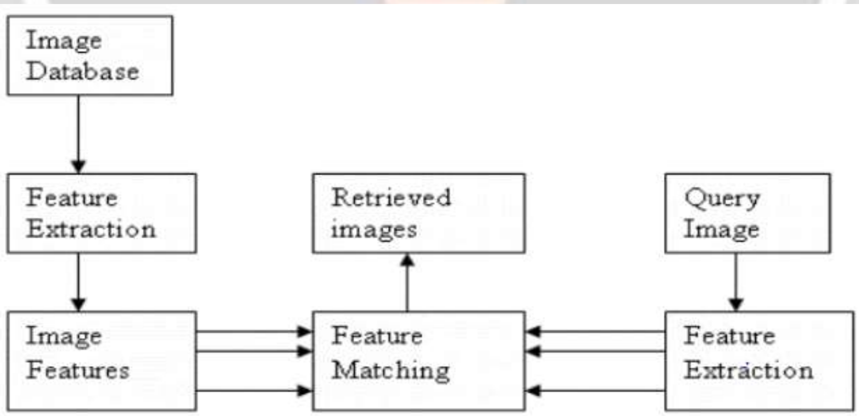

Figure 1.1: Architecture of a typical CBIR system

In a typical CBIR system (Figure 1.1), image low level features like color, texture, shape and spatial locations are represented in the form of a multidimensional feature vector. The feature vectors of images in the database form a feature database. The retrieval process is initiated when a user query the system using an example image or sketch of the object. The query image is converted into the internal representation of feature vector using the same feature extraction routine that was used for building the feature database.

The similarity measure is employed to calculate the distance between the feature vectors of query image and those of the target images in the feature database. Finally, the retrieval is performed using an indexing scheme which facilitates the efficient searching of the image database. Recently, user's relevance feedback is also incorporated to further improve the retrieval process in order to produce perceptually and semantically more meaningful retrieval results. In this, we discuss these fundamental techniques for content- based image retrieval.

1.2 Applications of CBIR

Detailed applications for CBIR technology can be found in [3]. Some of them are listed below:

- Web searching: A large number of digital images are accessed by the Internet users. CBIR systems can help the users to effectively and what they are looking for.
- Medical diagnosis: A large number of medical images have been stored by hospitals. Thus, CBIR systems can be used to aid diagnosis by identifying similar past cases.
- Journalism and advertising: Articles, photographs, videos of the newspapers, journals or televisions are queried by using CBIR systems.
- Military: Databases of all images in military applications; such as remotely sensed data, weapons, aircrafts, automatic target recognition, etc.
- Intellectual properties: Most of the companies have their own trademark image. Whenever a new trademark image is to be registered, it must be compared with existing marks to eliminate duplications.
- Crime prevention: After a serious crime, law enforcement agencies search their archives for visual evidence. Such archives include photographs, fingerprints, tyre treads, shoeprints, and etc. of the past occasions.

Thus, a CBIR system may help those agencies in finding related evidence.

1.3 Characteristics of Image Queries

CBIR systems can be evaluated according to the queries they handle. The queries are classified into three levels [4, 5]. Queries of the level 1 consist of primitive features such as color, texture, shape, or location of certain image elements. Queries of the level 2 and level 3 are composed of logical and abstract attributes, respectively. Logical features require some degree of logical inference about the identity of the objects depicted in the image, whereas abstract attributes involve a significant amount of high-level reasoning about the meaning and purpose of the objects depicted. Example queries for each level are listed below.

- Level 1
  - -Retrieve images that look like (or similar) to `this' image".(This type of queries are also called query by example).
  - -Retrieve images with blue rectangle at the top of the image"
  - -Retrieve images that contain yellow squares"
- Level 2
  - -Retrieve images of a woman"
  - -Retrieve images of the Eiffel tower"
- Level 3
  - -Retrieve images depicting suffering"
  - -Retrieve images of Turkish folk dancing"

When interpreting and executing the queries of Level 1, a CBIR system uses features, which are both objective and directly derivable from the images themselves. Unlike Level 2 and 3, there is no need to refer any external knowledge base. Some researchers prefer to use the terms lower-level approaches for Level 1 and higher-level approaches for Level 2 and 3 [6], while the others call Level 2 and 3 together as semantic image retrieval [3].

Most of the higher level queries require automatic object recognition and classification, which are still among the unsolved problems in computer vision and image understanding literature [7]. Moreover, the queries of Level 2 and 3 cannot be interpreted and executed, unless underlying primitive (low-level) features are sufficient, effective, and accurate. The major problem in CBIR systems is that the lack of a direct link between
the high-level human concepts of images and the low-level features used by the CBIR systems. This fact is called the semantic gap problem. The available CBIR systems, whether commercial or experimental, operate at Level 1 [8]. More specifically, most of the CBIR researches, including this dissertation, have been focused on \query by example". In query by example, the user does not have any particular target in mind, but selects an image or draws a sketch and asks to retrieve similar images. Thus, the basic operation is ordering a portion of image database with respect to a similarity metric [9].

The performance of a CBIR system is measured by precision, which is the number of relevant images retrieved relative to the total number of retrieved images and recall, which is the number of relevant images retrieved, relative to the total number of relevant images in the database.

2. RELATED WORK

Ms. Kiran Gotmare & Ms. Priyanka Fulare (2015) [10] proposed novel approach identifies contents of the image using provided tags and each tag is associated with class. Annotation is made based on vector values. Here whole image is considered as one segment and then extraction process is employed. LabelMe database is used to annotate the image. It provides functionality such as drawing polygons, querying images and browsing the database.

Bin Xu, Jiajun Bu, Chun Chen, Can Wang, Deng Cai & Xiaofei He (2015) [11] proposed Graph-based ranking models. Here, they focused on a well-known graph-based model - the Ranking on Data Manifold model, or Manifold Ranking (MR). It has been successfully applied to content-based image retrieval, because of its outstanding ability to discover underlying geometrical structure of the given image database. However, manifold ranking is computationally very expensive, which significantly limits its applicability to large databases esp ecially for the cases that queries are out of the database (new samples).

Devyani Soni , K. J. Mathai (2015) [12] proposes an efficient color space Based Approach for Image Retrieval Using fusion of Color Histogram and color correlogram. During experimentation, both HSV color model as well as RGB color model is used for the same process of retrieval. She developed this mechanism for image retrieval based on color features of image with the help of MATLAB tool.

A. A. Khodaskar and S. A. Ladhake (2015) [13] proposed innovative framework for effective, intelligent and efficient content based image retrieval is based on three soft computing techniques such as Artificial Neural Network, Fuzzy Logic and support vector machine. In this framework, the SVM based re levance feedback is introduced, that will provide feedback to the system that whether the retrieved image is relevant or not.

Sushant Shrikant Hiwale, Dhanraj Dhotre & Dr. G.R.Bamnote (2015) [14] proposed a CBrn system which extracts the features of digital image to retrieve similar images from huge databases. We have used Color Histogram, Color Auto-Correlogram, Color Moment, Gabor Wavelet and Discrete Wavelet transform to extract image features. The images are classified using Support Vector Machine (SVM) classifier which effectively distinguishes between relevant and irrelevant images. The results depict that proposed method has better precision and recall rate compared to other methods.

Kommineni Jenni, Satria Mandala, Mohd Shahrizal Sunar (2015) [15] presented a Content Based Image Retrieval approach based on the database classification using Support Vector Machine (SVM) and color string coding feature selection. In SVM method, the feature extraction was done based on the basis of color string coding an d string comparison. Here, they succeed in transferring the images retrieval problem to strings comparison.

Manoharan Subramanian and Sathappan Sathappan (2015) [16] proposed a new mechanism for CBIR systems which is based on two works. The first work is based on filtering technology which includes anisotropic morphological filters, hierarchical Kaman filters and particle filters. The second work is based on the feature extraction which includes color and gray level features and after this the results were normalized. Finally, the experimental results shows that this proposed technique of CBIR using advanced filter approaches is much better than the existing system GLCM and color feature extraction for CBIR process.

Priyadarshini Patil and Bhagya Sunag (2015) [17] proposed and implemented an efficient image retrieval technique using both color and texture features of an image. In real time applications, we need for developing efficient techniques to find images form huge databases. To find an image from database, every image is represented with certain features. Color and texture are the two important visual features of an image. Here we compare and analyze performance of an image retrieval using both these features.

Lei Zhu, Jialie Shen & Liang Xie (2016) [18] propose a novel unsupervised visual hashing approach called semantic-assisted visual hashing (SAVH). Distinguished from semi-supervised and supervised visual hashing, its core idea is to effectively extract the rich semantics latently embedded in auxiliary texts of images to boost the effectiveness of visual hashing without any explicit semantic labels.

Yeong-Kang Lai, Shu-Ming Lee, Jian-Wen Li, and Thomas Schumann (2016) [19] proposed an improved dynamic gamma correction method to enhance contrast and image quality for Liquid Crystal Displays (LCD) with Multi-Phosphor White Light Emitting Diodes (MPW LED). In order to reduce the hardware cost and improve contrast and edge strength, the proposed gamma correction method uses content based analysis to red uce computational complexity.

3. PROPOSED WORK

3.1 Problem Definition

The term "content" in the context of CBIR might refer to colors, shapes, textures, or any other information that can be derived from the image itself. In the existing approach, a new content based image retrieval approach based on the database classification using Support Vector Machine (SVM) and color string coding feature selection was presented. By the use of database classification, performance of the content based image retrieval can be enhanced as compared with normal CBIR.

With the large dataset, SVM approach is not perfect as it search on the whole dataset and results are not good in terms of precision, recall, time complexity.

3.2 Objectives

Following are the objectives of proposed work:

- To study the existing Model.
- To improve the existing model using improvement in classified database.
- To improve the values of Precision, Recall value and F-measure and Time Complexity.

3.2 Planning or Work

We propose a new approach named "A New Approach for Content Based Image Retrieval Using KNN". The proposed work is used to improve the results carried out in the previous work.

Our approach works in the following three steps:

1. Database Classification
   a. The learning process
   b. Classification using KNN
   c. Similarity Measure using Jaccard similarity coefficient
2. Feature Extraction
3. Similarity Measures

3.4 Implementation

Implementation of Content based Image Retrieval System on the colored images is done with our own dataset using MATLAB. The Dataset is divided into two categories: Train Data and Test Data. Test dataset contain the images which we want to Query and Train dataset contain the images that the user wants. The steps involved are:

- The Query image is given by user corresponding to which user want the results.
- Read that particular Query image.
- Extract features from the Query image on the basis of color and relatively find the Prediction class using **K Nearest Neighbor (KNN)** classifier. Prediction class is used to find out the relevant images.
- Now to order these relevant images we use **Jaccard similarity coefficient** to calculate the distances of each relevant image with Query image**.** It will sort all these relevant images and fetch top-n images (top-n < size of Dataset) and print these images for the user.

As we have Test Dataset (Dataset of different flowers) in which we place those images to which we want to test or we can say Query images are placed there. This test data is compared with the rest according to the particular category.

Firstly, the results of Existing approach are shown below from figure 4.1-4.5:

Figure 4.1: Query image & Results of dahlia flower to be searched in existing work

Figure 4.2: Query image & Results of lotus flower to be searched in existing work

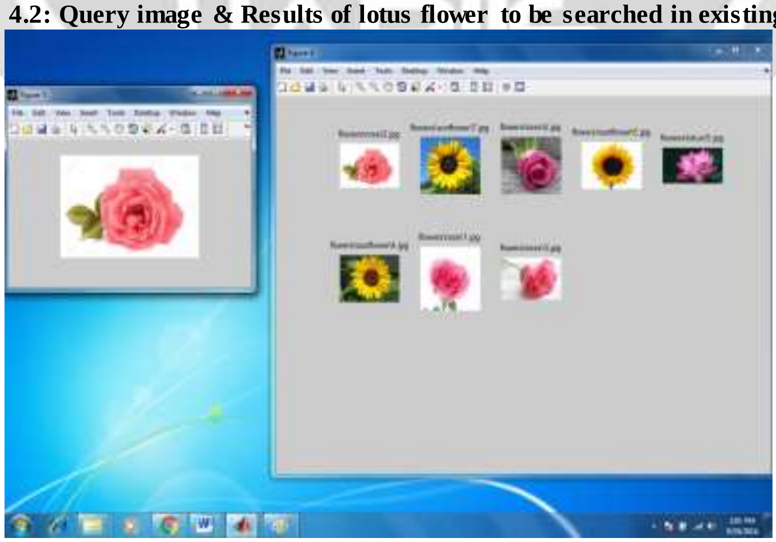

Figure 4.3: Query image & Results of rose flower to be searched in existing work

Figure 4.4: Query image & Results of sunflower to be searched in existing work

Figure 4.5: Query image & Results of tulip flower to be searched in existing work

We can see from these screenshots that existing result is not 100% accurate. As we are searching for a particular flower, but in results we are getting some extra type of flowers. So we can say that Existing approach does not give the accurate results. To overcome the limitations of existing approach, we proposed a model that will give 100% results to the user.

The validated proposed results are shown below from figure 4.6-4.10:

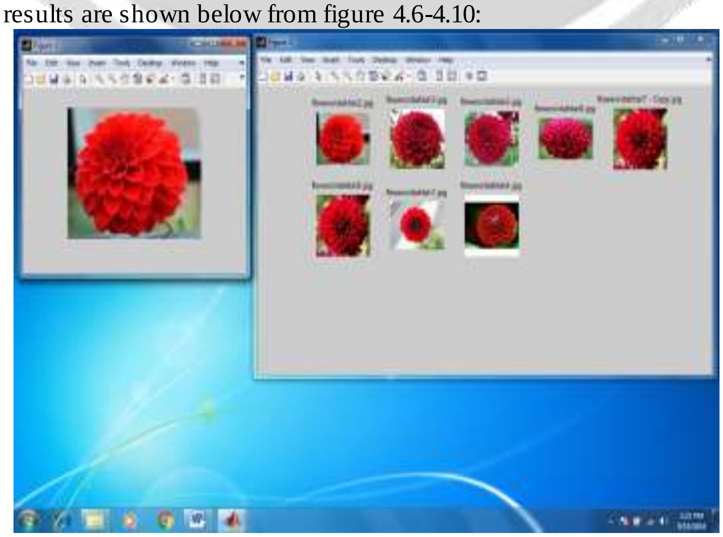

Figure 4.6: Query image & Results of tulip flower to be searched in proposed work

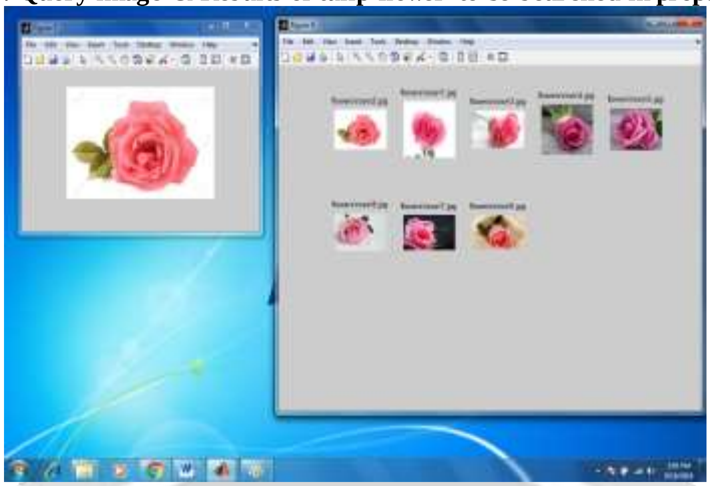

Figure 4.7: Query image & Results of tulip flower to be searched in proposed work

Figure 4.8: Query image & Results of rose flower to be searched in proposed work

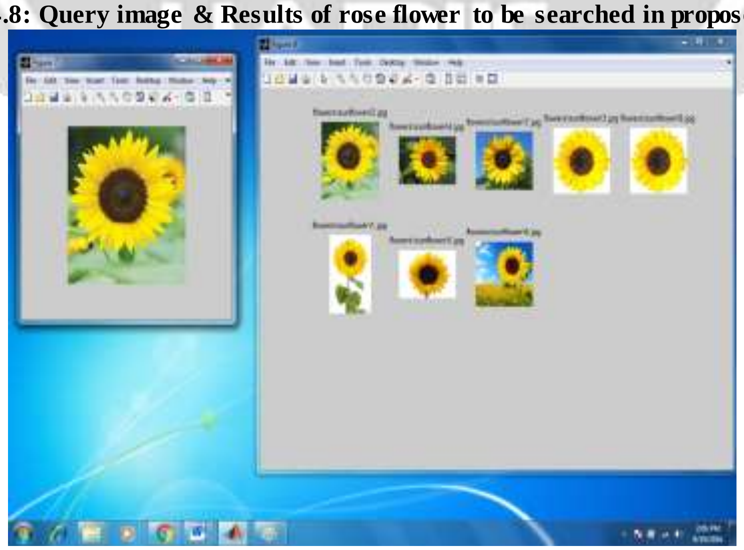

Figure 4.9: Query image & Results of sunflower to be searched in proposed work

Figure 4.10: Query image & Results of tulip flower to be searched in proposed work

4 RESULTS

Results of our proposed work are shown here in the form of table and graph. The results are different values of precision, recall and f-measure and Time Complexity. The results in the form of graph and description of results are shown below:

Table 5.1: Comparison of Existing and Proposed approach

Approach	Precision	Recall	Fmeasure	Time Complexity
CBIR-euclidean	0.35	0.35	0.35	0.5246
CBIR-Jaccard	1	1	1	0.5433

From this table it is clear that proposed work reduces the time complexity and improves accuracy as work is done only on the Trained Dataset.

5 CONCLUSIONS AND FUTURE SCOPE

5.1 Conclusion

From above discussion we conclude that the with the use of Nearest Neighbor (KNN) Classification (to calculate the relevant images from Dataset) and Jaccard similarity coefficient (for calculating the distances and sorts them according to their relevancy) the proposed approach perform better than existing approach with reduced value of precision, recall, f-measure and improved time complexity value.
There is no need to check the whole dataset as we have the concept of Test dataset and Train dataset, so the time to retrieve the image will be less. So it helps in reducing the time complexity.

5.2 Future Scope

As we have used our own Dataset here which contain limited number of images but in future we can use a large Dataset. Also KNN classifier can be used with any other new similarity function which can give better results.
Introduction related your research work Introduction related your research work

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