International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 5 Issue 5, July-August 2021 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

A Survey on Content Based Image Retrieval System

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ABSTRACT
The increasing increase of picture databases in practically every industry, including medical science, multimedia, geographic information systems, photography, journalism, and so on, necessitates the development of an effective and efficient approach for image processing. The approach of content-based image retrieval is used to recover images based on their content, such as texture, colour, shape, and spatial layout. However, because to the semantic mismatch between the user's high-level notions and the image's low-level properties, retrieving the image is extremely challenging. Many concepts were presented in effort to close this gap. Furthermore, images can be stored and extracted depending on a variety of properties, one of which being texture. Content-based Image Retrieval has become a popular study area as a result of the growth of video and image data in digital form. Digital data, such as criminal photographs, fingerprints, and scene photographs, has been widely used in forensic sciences. As a result, arranging such enormous amounts of visual data, such as how to quickly find an interesting image, becomes a major difficulty. There is a pressing need to develop an effective method for locating photographs. An image must be represented with particular features in order to be found. Three significant visual qualities of an image are colour, texture, and shape. The search for images utilising colour, texture, and shape attributes has gotten a lot of press.

How to cite this paper: Preeti Sondhi | Umar Bashir "A Survey on Content Based Image Retrieval System" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-5 | Issue-5, August 2021, pp.66-71, URL: www.ijtsrd.com/papers/ijtsrd43777.pdf

IJTSRD43777

KEYWORDS: *CBIR, Feature Extraction, Fuzzy Logic, Texture and Pattern Classification*

INTRODUCTION
Today's world is moving toward a digitalized system, which is reflected in the fact that images are made in a variety of fields, including medicine, military, criminal prevention, architecture, art, and academics. Photographs, schematics, drawings, paintings, and prints are among the images in this collection. Text-based image retrieval has two drawbacks: manual picture annotation is time-consuming and thus expensive, and human annotation is subjective, which means that some photos cannot be tagged because describing their content with words is difficult. T. Kato, a scientist, invented the CBIR system in 1980 while working on an experiment for retrieving images from databases utilising the visual aspects of the image [1]. The CBIR system includes colour extraction, shape reorganisation, pattern matching, query generation, similarity comparison, and relevance ranking tools, techniques, and algorithms. There are various types of existing systems, but CBIR is capable of locating images with defined attributes or contents in a target image collection based on the image contents description. The fusion of colour, shape, and texture compares the image's colour, shape, and texture features to other picture features in order to find the requested images. CBIR (content-based image retrieval), also known as QBIC (query by image content), is the method of retrieving images from a database using features extracted automatically from the images themselves. The term "content-based" refers to the search engine's analysis of the image's actual contents.

Image Retrieval
The introduction of the World Wide Web (WWW) and the development of low-cost technologies for taking, storing, and sending photos has resulted in the development of massive image libraries. As a result, we are faced with the unavoidable [2] problem of efficiently and effectively retrieving meaningful

information from large datasets. As a result, image retrieval and its practical applications have reawakened interest.

Text Based Retrieval
Text was formerly used to represent and retrieve images from databases in traditional image retrieval.

Images were saved with string attributes, which were keywords created by an annotator that expressed the image's content in a broad sense. Despite the fact that text-based image retrieval drew on well-established information retrieval techniques and mechanisms, its shortcomings as an effective tool for retrieving images quickly became evident.

Colour Based Retrieval
Few CBIR systems use colour as the image retrieval feature since colour is a low-level image characteristic that does not appear to classify images distinctly. Colour, on the other hand, has advantages when it comes to image retrieval. It allows categorization without the requirement for complicated spatial decision-making by providing several measures at a single pixel of the image. Colour content is also independent of view and resolution, making it simple to extract and edit from images.

Content Based Retrieval
The results of preliminary study on retrieving photos based on their inherent properties have been published. Content-based image retrieval makes use of feature representations that are automatically retrieved from the images. Almost all contemporary CBIR systems support querying-by-example, a technique in which the user selects an image (or a portion of an image) as the question. The system extracts a feature from the query image, searches the database for images with similar features, and presents the user with relevant[3][4] photos in order of query similarity. Content-based image retrieval systems try to take advantage of the visual information in images, resulting in a more realistic perceptual representation of the image. Perceptual qualities such as texture, colour, shape, and spatial relationships are included in content in this context.

Components of CBIR System
The CBIR system is made up of the following parts:

1. Look up an image.
It is the image that will be found in the image database, whether or not a similar image exists. And how many similar photographs are there or aren't there?

2. Image repository
It consists of n photos, depending on the user's preference.

3. Feature extraction
It extracts the image's visual information and records it as features vectors in a database. For [5]each pixel, the feature extraction finds picture detail in the form of a feature value (or a series of values termed a feature vector). These feature vectors are used to compare the query image to the other photos and to retrieve the information.

4. Image matching
For the computation process, information about each image is saved in its feature vector, and these feature vectors are compared to the feature vectors of the query image, which aids in determining the similarity.

5. Resultant retrieved images
It searches the database for matched photos using previously stored information. The results will be similar photographs with the same or comparable features as the query image.

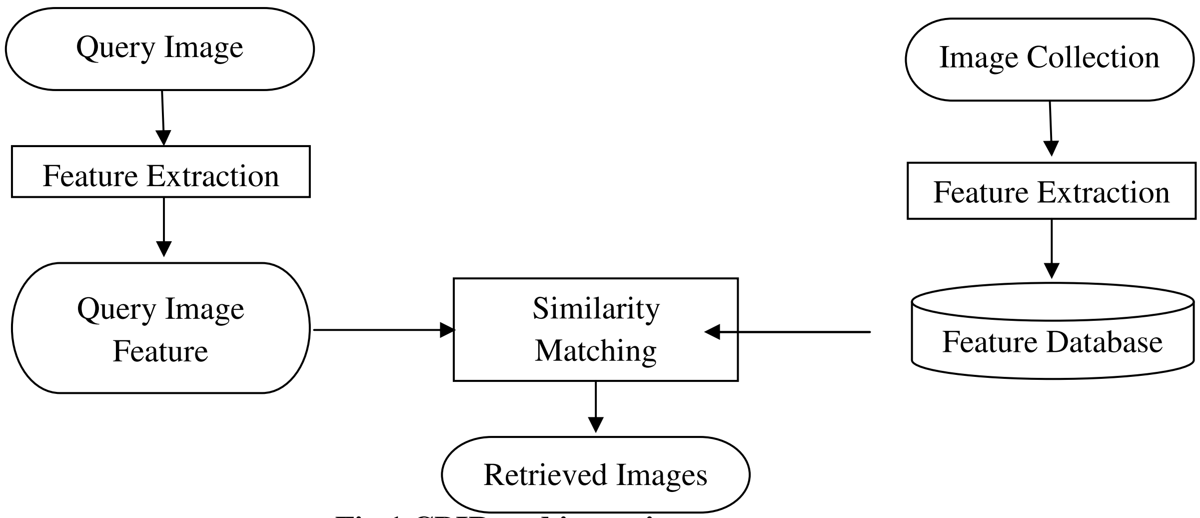


Fig.1 CBIR and its various components

APPLICATIONS OF CBIR SYSTEM

- Architectural and engineering design
- Art collections
- Crime prevention
- Medical diagnosis
- Military
- Photograph archives
- Retail catalogs
- Industrial area
- Fashion and graphic design

Related Work

Yanzhi Chen and colleagues (2012) presented a discriminative criterion for increasing the quality of results. This criterion lends itself to the inclusion of more query data, and they demonstrated that numerous query photos can be comb index to generate improved results. Experiments compare the method's performance to the state-of-the-art in object retrieval, demonstrating how the inclusion of additional query photos improves performance.

ReljaArandjelovi c et al. (2012) made the following three contributions (i) a novel method for query expansion where a richer model for the query is learned discriminatively in a form suited to immediate retrieval through efficient use of the inverted index; (ii) an improvement of the image augmentation method proposed by Tu, which yields superior performance without increasing processing or storage requirements; (ii) a novel method for query expansion where a richer model for the query is learned discriminatively in a form suited to immediate retrieval through efficient use of the inverted.

Sreedevi S et al. (2013) suggested feature levels, a quick picture retrieval approach. The feature levels algorithm compares the query image to database images by classifying image features into distinct categories or levels, extracting features in terms of levels, and comparing feature similarity.

Soundararajan Ezekiel et al. (2013) investigated contourlet transformation in conjunction with a Pulse Coupled Neural Network (PCNN), whereas Rescaled Range (R/S) Analysis was used in the second methodology. Both approaches are ideal for picture fusion and allow adjustable multiresolution decomposition and directional feature extraction.

HuiXie et al. (2013) propose a CBIR method based on analogy-relevance feedback (analogy-RF) that uses many features but only requires one. When users input the query image, the approach allows them to select the type of object, and their system can find several analogy-RF photos in the sample database.

Khadidja et al. (2013) primarily evaluates and compares various RF-based CBIR techniques. Its ultimate purpose is to give information about image database characteristics and image feature settings in order to assist in the selection of the best CBIR with RF Techniques.

Sandeep Kumar et al. (2014) presented and showed a parallel approach to the morphological feature extraction procedure, which resulted in a significant increase in processing speed. Remote sensing images are known for their continual incrementing and the size of each image.

KomalJuneja et al. (2015) conducted a survey on low-level feature description strategies for Content Based Image Retrieval and its different applications. With the increasing growth of picture databases and the massive number of picture and video archives available in the current day, a new study and development of efficient methods for searching, locating, and retrieving images has emerged.

GhanshyamRaghuwanshi et al. (2015) offer a new tetrolet transform-based texture image retrieval methodology. Because of its unique analytical method, tetrolets provide fine texture information. At each decomposition level of an image, tetrominoes are applied, and the optimal combination of tetrominoes is chosen to better display the geometry of an image at each level.

Nitika Seth (2018) looked into it. We have discussed the current techniques in the field of image retrieval for image processing in this study. Image retrieval involves recovering the original image from a rebuilt image. CBIR (Content-Based Image Retrieval) is one of the most intriguing and rapidly increasing fields of image processing research. Boosting image retrieval, soft query in image retrieval systems, content based image retrieval using metadata encoded multimedia features, object based image retrieval, and Bayesian image retrieval are among the strategies mentioned.

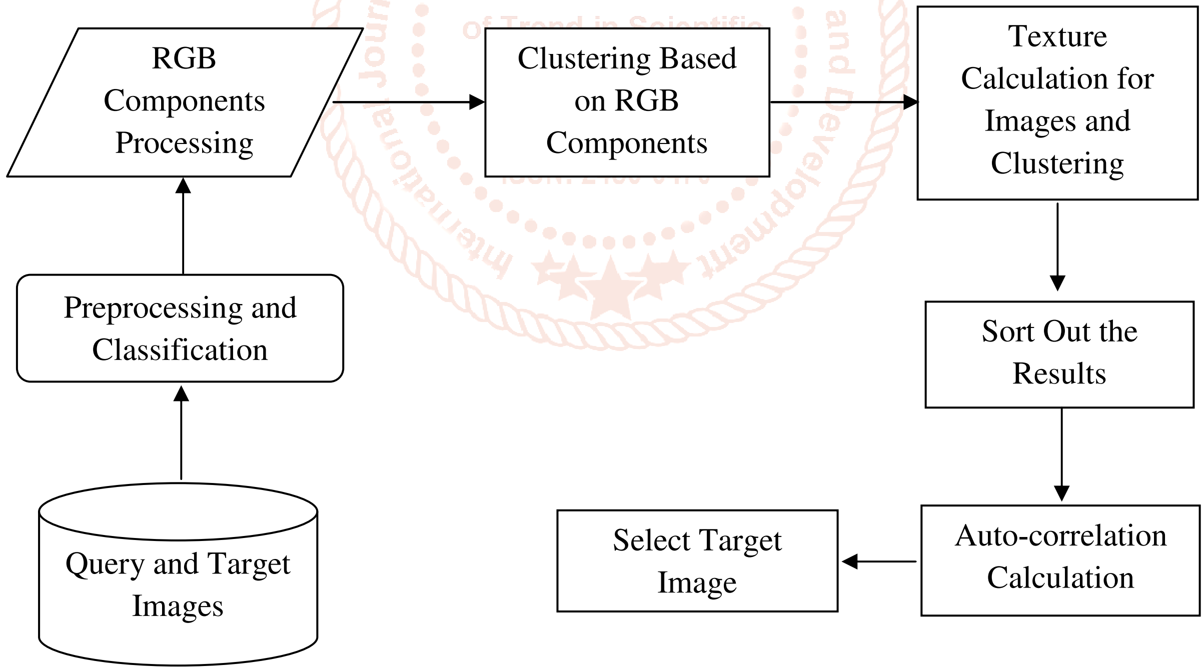
AfshanLatif (2019) looked into it. Digital images make up a large proportion of multimedia data, and multimedia content analysis is used in a variety of real-world computer vision applications. The complexity of multimedia items, particularly photos, has increased tremendously in recent years, and more than millions of photographs are uploaded everyday to various archives such as Twitter, Facebook, and Instagram. High-level picture views are represented in CBIR and image classification-based models as feature vectors, which are numerical values.

K.S. Aiswarya (2020) was put into action. The query image space elements' features are compared in a weighted manner to the characteristics of images in a global dataset (target images from cloud space, servers, and so on), and the target images are sorted based on the similarity scores. The top ranking photos from the global dataset are then chosen based on similarity score thresh-holding. The performance of the proposed CBIR method is compared to state-of-the-art image retrieval algorithms using typical public datasets.The results indicate considerable gains in overall precision, recall, and time cost, justifying the use of picture search on mobile devices with limited compute capabilities.

Abeer Al-Mohamade (2020) developed weight-learner, a novel multiple query retrieval system that uses visual feature discrimination to estimate distances between query images and database images. This discrimination entails learning the best relevance weight for each visual feature/descriptor in an unsupervised manner for each query image. The purpose of these feature relevance weights is to close the semantic gap between the retrieved visual characteristics and the user's high-level semantics.

Proposed Work

There is a lot of information in an image that can't be expressed in words. Every photograph has a wealth of information that can be mined for profit. Researchers have offered a variety of methods[6]. The photos are pre-processed before being placed in the database using this way. This pre-processing improves image quality while also removing noise. These images are then clustered using various RGB model components, and the top-ranked photos are then clustered again using the texture feature. The query and target photographs are then compared using these attributes, and the most similar image is found.



Research Objectives

The major goal of this project is to get photographs from a database in a quick and effective manner, as well as to assist people in many disciplines such as medical and clinical diagnostics, education, and researchers in efficiently searching the database. The texture and colour properties of the image are used to retrieve the image based on its content, without influencing retrieval performance. Here, we test an approach for reducing the amount of storage space necessary for texture and colour content while also improving retrieval performance. Here,

- All photos' RGB components are computed and saved.
- The top-ranked photos are regrouped based on texture attributes and divided into texture groups.
- Retrieval of the target image from the Query image's contents.

Research Methodology

1. Image Database

We must first construct an image database. To do so, we must look for RGB components in photos.

2. RGB Components

The RGB Colour Model is utilised in colour-based picture retrieval. The majority of colour photographs are three-dimensional. Every image's RGB colour components are extracted.

The mean value of the target images' Red, Green, and Blue components is calculated and stored in the database. Images are classified as Red, Green, or Blue component classifications based on RGB component mean values. Each image's three mean values are deposited and considered features.

3. Feature extraction

The top-ranking photos are reorganised based on their textural feature. The parameters are acquired using a statistical methodology in the texturing feature-based technique. Grey level statistical features are one of the systematic ways for classifying texture. The textural characteristics of both the query and target images are determined, including auto-correlation, dissimilarity, entropy, contrast, standard deviation, mean, and variance.

4. Similarity Comparison

By picking a query image and comparing it to all of the photos in the database, a similarity comparison can be performed. The most relevant photographs are listed first. The database's top-ranked photos are then obtained.

Conclusion

The goal of this survey is to provide you an idea of how Content Based Image Retrieval works. The majority of the system makes use of colour and texture. Few systems make use of the form feature, and even fewer make use of the layout function. CBIR approaches have been widely employed in a variety of fields to improve system performance and obtain better results in many applications.

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