

Comparative Study of different algorithms in CBIR technique

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ABSTRACT

In this era of technology advancement, the challenges with respect to delivering right content with accuracy to the user as quick as possible has also extended to some other level. The amount of data which is originated by millions of users in multiple forms like text, video, images has always been a tough task to collaborate at a location and generate information from those data generated at a huge amount. These millions of data require large databases to store them at a location for further usage. In this paper the most prominent of these types of form of data transfer is being discussed i.e. Image. The process of Image Retrieval has become an active research topic because of its application in many fields like Biometric systems, Image Search Engines, Digital Libraries, Medical Records etc. Large databases are also been built in order to store these images. Origin of these images are from multiple equipment tools that are in use in industries like Graphic Design, crime prevention medicine, engineering design and architectural, etc. In order to process these images, image processing tools and techniques are applied. The mechanism used to fetch images from large database of images is called Image Retrieval. Multiple algorithms are being implemented for multiple problems which are faced by users at the time of fetching the precise results. If talking in terms of Correlation coefficient which explains about the closeness between the actual image and modified image. The Color being the most important ingredient in identifying and generating the correct result back to the user. The Color histogram generates a graph which shows the proportion of pixels in the image. The Histogram plays an important role when it comes to aspects like transition, rotation of image. CBIR (Content based image Retrieval) technique is one of the most prominent technique which is very effective in the process of Image Retrieval. Images being combination of pixels comprises of multiple aspects like texture, rotation, color combinations that help in generating the image as per user requirement. Multiple algorithms are being implemented and evolved in the technique in order to generate results depending upon the queried image. The processes that are carried out in CBIR technique helps in easing of work with respect to images in multiple arenas like medical, crime detection, agriculture, Search Engines and many more.

Keyword: - CBIR, Image, Image Retrieval, Wavelet Transformation, LCV (Local Color Histogram), Medical Diagnosis, Average RGB

1. INTRODUCTION

In this era of technology advancement, the challenges with respect to delivering right content with accuracy to the user as quick as possible has also extended to some other level. The amount of data which is originated by millions of users in multiple forms like text, video, images has always been a tough task to collaborate at a location and generate information from those data generated at a huge amount. These millions of data require large databases to store them at a location for further usage. In this paper the most prominent of these types of form of data transfer is being discussed i.e. Image. The process of Image Retrieval has become an active research topic because of its application in many fields like Biometric systems, Image Search Engines, Digital Libraries, Medical Records etc. Large databases are also been built in order to store these images. Origin of these images are from multiple equipment tools that are in use in industries like Graphic Design, crime prevention medicine, engineering design and architectural, etc. In order to process these images, image processing tools and techniques are applied. The mechanism used to fetch images from large database of images is called Image Retrieval. There are multiple problems in order to fetch images from large databases like accuracy, response time etc. In order to solve these problems in Image Retrieval, there is a technique evolved in 1992 named as Content based Image Retrieval (CBIR) technique which after being evolved has proved to be one of the most prominent technique in order to solve this problem. The importance of this technique can easily be identified by the fact that Google also uses this technique along with multiple techniques in order to provide better and accurate results to the user in its own product named as "Google Search Engine". There are many implementations of this method, such as eBay, Pinterest, Alibaba, Bing and many other popular the websites, which scan for images from a variety of large datasets in order to produce correct information as demanded by the person using the program.

2. EXISTING WORK

2.1 Literature Review

In this paper, the author has proposed a unique content material-based retrieval set of rules MCBIR (Content-Based Image Retrieval algorithm for Medical picture databases) to study and understand the translation and scaling of gadgets within an image. MCBIR employs a singular approach in which every photo is first decomposed into components. In MCBIR with respect to traditional processes which based totally on a single signature for each image, builds a collection of 8 signatures for a photo, generates a set of signatures as feature vectors in a grid structured document [1]. The author discusses various aspects that need to take into consideration while fetching accurate results back to the user. The author explains about aspect like Feature extraction, Image Segmentation, Color Feature, Texture, Shape. Each aspect has its own criteria and methodology to be adopted in order to process the image efficiently. The author also explains about Color Features like RGB color space, CMY (Cyan, Magenta, Yellow) color Space which plays an important role in finding the segmented gap between images [2]. The author has discussed a branch of CBIR technique that is RBIR (Region-based Image Retrieval) technique in which the user has to provide information related to the region of the image in order to ease the work of fetching the accurate result back to the user. The RBIR technique, depending upon the features that comprise of multiple pixels forming an image. The author proposes a technique which comprises of multiple aspects of traditional Zernike moments (which helps in pattern recognition problems) and robust image segmentation. The Author through multiple experiments came to a conclusion stating that the proposed methodology is fast and accurate than the existing mechanism [3]. Over segmenting the pictures, the usage of an automated set of rules, and letting the man or woman institution the smaller areas into objects, can be observed as an alternative partitioning technique. In this manner, The Author may additionally reap a larger right partitioning compared to our guide coarse segmentation over a square grid. The state-of-the-art characteristic set might also be extended to cover a broader class of descriptors, alongside with a higher diploma of texture and shape descriptors. Lastly, the attribute mapping of our sliding areas can be more desirable through allowing the purchaser formulate queries in the form "look for this on this shape of historical past" to advantage from the background's vicinity of understanding [4]. The color and form functions The Author re decided on for the picture retrieval. The characteristic choice is an important project to be performed. Hence the function selection is given significance in this paper. The functions had been extracted by using the proposed method Daubechies4 wavelet rework. The output of the algorithm may be expected with the precision cost. The effectiveness of the algorithm may be analyzed with Corel Image Gallery. The Corel photograph gallery includes about 10,800 images divided into distinct concept companies [5]. Content-based Image Retrieval System is a machine to find out the identical photo in the image database whilst the question picture is given. In this paper, The Author use color feature extraction, shade feature is extracted by way of the use of three-technique inclusive of coloration Correlogram, shade moment, HSV histogram. The predominant attention of this paper, the KNN algorithm, and relatively preferred derivation. Here the Author use KNN classifier for the classification of the picture and Relative present-day derivation to degree similarity among images [6]. This paper find out about affords a quick and strong coloration indexing for CBIR systems. The purpose was once to lessen the computational time of the shade correlogram technique but stay strong efficiency. The most fulfilling spatial coloration descriptors, specifically; auto coloration correlation (ACC) and car coloration correlogram and correlation (ACCC), are proposed. The precision as hostile to do not forget about measures are used to verify the performance of photograph retrieval as in contrast to current color descriptor algorithms together with coloration correlogram and auto correlogram. The coloration descriptor improves the accuracy of retrieving graphics and decreases the computational time from $O(m^2d)$ to $O(MD)$ [7]. This paper categorizes the numerous standards in photo retrieval techniques and a set of 36 papers changed into studied and various photo retrieval techniques and their types and techniques are classified along with the textual content based and content based totally and the Semantic primarily based image retrieval [8]. In this paper, the RGB correlation index of the query image and retrieved image can effectively retrieve images. The RGB correlation index method is often wont to make a correct retrieval decision and features a maximum precision and recall rate. The proposed image retrieval system features a high detection rate with an RGB correlation index. This method may be a new image retrieval model that maximum precision rate for top detection. However, the images must be resized before computing the correlation of them. There have been reduced to the matrices of equivalent size [9]. In this paper, the author explains about some of the aspects of image that are neglected in analysis in order to reach out for the correct solution in CBIR technique. One of such factors is Redundant Factor (RF). The author also explains about aspects of different histogram techniques like LCH (Local Color Histogram), GCH (Global Color Histogram), HSV (Hue, Saturation and Brightness value). The characteristics like Average RGB (Red, Green, Blue) helping in feature extraction makes the process of reaching out for result is generated with ease. The author also explains about an optimized technique which will help in increasing the accuracy in generating the results on basis of all features of the image and not tampering the quality of the image [10].

2.2 Objective

- The percentage of image queried by the user with respect to the complete image.
- To identify various algorithms applied to solve the problem.
- To find the optimized way to reach the solution.

3. TOOLS AND TECHNOLOGIES REQUIRED

- **MATLAB:** MATLAB is one of the most prominent tools used for image processing, enrich with libraries for performing all kind of operations like (create histograms, and manipulate regions of interest (ROIs)). It provides libraries like Image Processing Toolbox, multiple models inbuilt in it. It also helps in removal of noise, adjust contrast, performing convolution and correlation, enhancing multispectral color composite images, color blurring caused by out-of-focus.
- **Python 3:** Python supports libraries like matplotlib, pandas, numpy, scikit-learn which helps in template matching using match template function, image filtering. numpy is for masking the image, PIL/Pillow contains basic image processing functionality, removing noise, color space conversion.
- **OpenCV:** OpenCV for Image Processing in Python includes multiples processes like changing colourspace, changing RGB to binary format, smoothing the image like blurring the image all such functionalities are supported by OpenCV.
- **Google Colaboratory (Colab):** Google Colaboratory (Colab) is one of the new services offered by Google in cloud in order to start the process of training a deep learning network from scratch for the problems faced in real world scenarios. Colab provides free GPU and CPU accelerations. It supports multiple python libraries like Keras, TensorFlow, PyTorch for training deep learning models for image processing.

4. ARCHITECTURE DIAGRAM

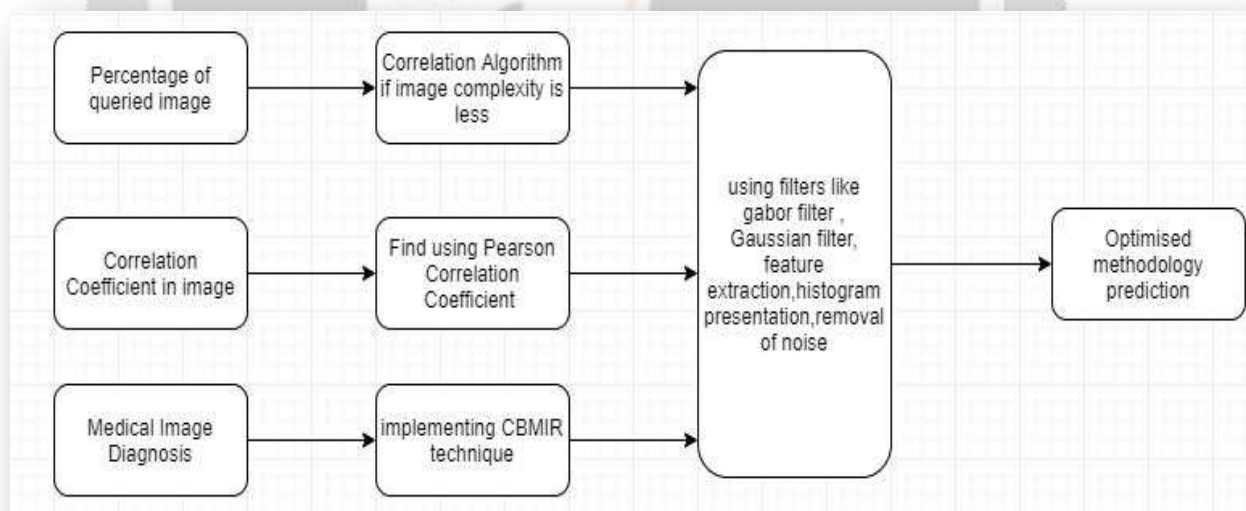


Fig-1: Architecture Flow

Figure 1 explains about the architecture of the system. There are three aspects that are considered in this paper that is percentage of queried image, correlation coefficient in image, medical image diagnosis as they all play an important role in displaying enhanced image to the user. For different situations different algorithms are applied in order to generate results back to the user. Like for situation if 40%-45% percentage of image is given by the user then in order to fetch the result by the user, correlation algorithm will be applied for images that are not in complex (means texture, contrast) in nature. If the image is inverted, cropped in nature then this algorithm pixel by pixel matching will be done. In case of medical images, in order to ease the process of medical diagnosis, the images will be identified using

Content based Medical Image Retrieval mechanism. In this mechanism, purely designed to tackle with medical related situation. Dots per inch (dpi) is also been enhanced in order to deal with enhancing the quality of image to be generated as a result to the user.

5. DETAILS OF UNSOLVED DOMAIN

Image Retrieval techniques has always been evolving better in order to solve the problems user faces while fetching the accurate image as needed. The image retrieval is done based on the visual contents. Contents that are in the form of visual are named as functions (coloration, shape, texture). The classifier performance can be tormented by the concession of a dimensionality of a characteristic and its miles a challenging mission. Images are more advantageous to the use of evaluation stretching process. There are multiple algorithms available in the CBIR technique. The goal is to identify the best algorithm for detection of image queried by user on various aspects. The methodologies vary in accuracy and consistency with respect to the type of image they are trying to detect. The goal is to identify the key aspects in order to apply precise algorithm to the image queried by the user. The concept also puts light on comparing the multiple algorithms designed to carry out the specific task. There are multiple techniques like feature extraction from image, processing the image using OpenCV libraries. Gray Level Co-incidence Matrices (GLCM) is a famous representation of the feel in photos. They contain a count of the number of instances, of a given features with respect to other images in the databases. There are as such multiple techniques and algorithms in CBIR technique. The main aim is to do a comparative study in understanding the different algorithms available in CBIR technique in order to meet the user’s requirements.

6. COMPARATIVE STUDY RESULTS

Table 1: CBIR System with Low Level Features and Learning Algorithms

CBIR Technique	Low-Level Features	Learning Algorithm	Similarity Measure
RETIN	1.RGB 2.Outline Variation	RGB Histogram Output of Gabor Transformation	Normed Vector space (Euclidean, Manhattan)
KIWI	1.RGB 2.Space	Gabor Filter (RGB Histogram)	Euclidean Space
iPURE	1.RGB 2.Outline Variation 3. Shape 4.Area (Spatial)	Average Color in CIE’s LUV space Wold-Van Neumann decomposition, Centroid Localization	Euclidean Space

Table 1 explains about CBIR Systems with low level features and learning algorithms and also explains about Similarity measure which in turn generated after observing the features in the different CBIR technique. CBIR techniques like RETIN, KIWI and iPURE plays an important aspect while it comes to the first phase of processing the image i.e. pre-processing of the image so as the process of generating result will be eased in order to generate result to the user.

Table 2: Explanation of CBIR techniques

S. No	Application	Applied algorithms	Disadvantages
1	Creation of database for pre-processing of image for efficient image retrieval mechanism	Genetic algorithm	The output can be generated in such a form which is not understandable by user

2.	Region and Content based image retrieval	K-means clustering	Number of clusters (k) should be defined in the first phase itself
3.	Classification of image in the pre-processing stage	Digital Video Libraries (DVL)	Struggle in segregating useful information from unusable dataset
4.	Relevance Feedback processing in CBIR: Query Decomposition	Query Decomposition	Involves user presence while execution. Need a lot of validation, optimization before execution.
5.	Parallel Processing implementation in CBIR technique	Map Reduce Framework	Some of the resources are wasted. Multiple factors of image are sometimes escaped because of large dataset processing.

The Table 2 explains about multiple CBIR techniques which are being implemented for accomplishing different aspects in order to generate results accurately for the user. Techniques used for pre-processing of image, parallel processing implementation, Feedback processing in CBIR, creation of database which will help in filtering in the different categories in order to reduce the response time taken by system in order to generate the result. The table explains about the drawbacks of the all the algorithm being implemented in order to solve the problems faced in order to categorize the image with respect of characteristics like texture, shape, feature, Wavelet Transformation.

Equation to find out precision in the Image Retrieval

$$\text{Precision} = \frac{\text{Number of relevant items retrieved}}{\text{Number of items retrieved}}$$

Fig 1: Equation for finding Precision in Image Retrieval

Figure 1 explains about the process how precision in image retrieval can be calculated if the variables like number of relevant items retrieved, number of items retrieved is known by the developer, then image accuracy will be increased and be set to some standards of precision to be maintained in the image.

7. CONCLUSION

CBIR technique is one of the most prominent techniques used for Image processing and retrieval techniques. There are multiple algorithms in this technique like Correlation Algorithm, Histogram Algorithms and many more used to generate the results that will meet the user requirements. Sustainability of the concept depends on aspects like accuracy, consistency, ability to handle any kind of normal or abnormal situation occurred. These situations can be considered on grounds Real time quality inspection and Quality management On the basis of the research work carried out during this process, future work in the area of research is like to implement Machine Learning algorithms in order to give a new vertical image retrieval mechanism, to work upon various formats of images and creating templates of images as much as possible which is collected from different sources, improve the accuracy and consistency of image as much as possible in order to produce result for the image queried by the user. Optimization of feature representation in terms of feature dimensions can provide a strong framework for the learning of classification-based model.

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