Review Article

International Journal of Advanced Technology and Engineering Exploration,Vol 6(50)
ISSN (Print): 2394-5443 ISSN (Online): 2394-7454
http://dx.doi.org/10.19101/IJATEE.2019.650019

A computational study and meta-analysis of content based image retrieval

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Received: 15-October-2018; Revised: 20-January-2019; Accepted: 23-January-2019

Abstract
There is the need of efficient image retrieval in different areas including health industry and data processing. It is also important to fetch relevant data for the diagnosis, prediction and data correlation purpose. In the view of the above a study and analysis have been presented for the content based image retrieval (CBIR) methods and their approaches. The objective of this paper is to elaborate and explore the latest trend in this area for the purpose of discovering analytical and computational prospects. So different related and latest proposed and presented methods have been discussed along with the advantages and gaps. Based on the above, the limitations and the problem statements have been highlighted with the suggested solutions.

Keywords
Efficient image retrieval, CBIR, Computational analysis, Data correlation.

1.Introduction
In the field of image processing there are a number of researchers have been already published different procedures, method and algorithms for the efficient image retrieval. The researchers have proved their potential with different hybridization with the content based image retrieval (CBIR) system [1−5].

This paper main aim is to discuss and provide a computational and analytical view based on these methods and approaches. The current trend indicates the implications of CBIR system as it greatly shows the efficiency in the image retrieval. Due to the extensive demand of this type of system in different areas there is a huge demand of efficient system day by day [6, 7]. There are several methods and approaches in the CBIR system which deals the data retrieval efficiently [8−12].

However, the current scenario shows the demand for the more precise and accurate results as it are also helpful in medical data diagnosis [13, 14]. So the main objective of this paper is to highlights the problem statements along with the discovery of the possible solutions.

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2.Literature work
In 2018, Ma et al. [15] presented a new underwater image database. It contains 6240 images from the 40 objects. It is called NWPU underwater image database. They have considered the turbidity value as 0 for the ground-truth. Their method shows that the captured images are closer to the real. For image enhancement they have used multi-scale retinex with color restore (MSRCR) algorithms.

In 2018, Alsabahi et al. [16] discussed the impact of artificial intelligence in case of digital radiography images. They have suggested that the image classification in this case is more difficult than the other normal images. They have used transfer learning which is based on V3 model for the digital radiography images classification.

In 2018, Demirovic et al. [17] suggested that the image processing algorithms suited better in case of parallel architectures multicore central processing unit (CPU) and graphics processing units (GPUs). They have compared relative speedups for different algorithms. They have achieved the speedups range is 3.6 to 15 times.

In 2018, Altuncu et al. [18] discussed the use of field-programmable gate array (FPGA) in case of unmanned vehicles. They have working in the direction so that the cost can be reduced. They have developed IP core with the functionality of mirroring, inversion, negation, thresholding, brightness and contrast enhancement / reduction on the image. Their results indicate that the hardware cost is low because of their approach.

In 2018, Daniol et al. [19] discussed the use of different image processing applications on the mobile phones. This is also true for the hospital or the medical industry. More and more image processing applications areIntended to run on mobile devices. They have suggested that if the image processing is not efficient then it can affect the performance and the power consumption both negatively. They have compared and analyzed different algorithms used in iPhone. It is based on CPU and GPU. They have considered matrix multiplication, thresholding and Canny's edge detection operations. The results clearly indicates that the GPU based solution
can 4 times faster as CPU based.

In 2018, Deperlıoglu and Kose [20] discussed regarding the diabetic retinopathy. It is a serious eye disease. They have discussed the applicability of image processing and deep learning in the diagnosis of diabetic retinopathy. Their method is the combination of hue, saturation, value (HSV), V transform algorithm and histogram equalization technics. For the retinal fundus image Gaussian low-pass filter has been used. Classification has been done through the convolutional neural network. The result indicates the efficiency of the approach.

In 2018, Heide et al. [21] discussed and presented a local stereo matching method for hyperspectral camera data. It is used for the multiple usage of camera hardware and for the spectral analysis. The matching method uses the combination of correlation-based similarity. They have evaluated stereo-processing methods. Based on the esult evaluation of CPU and GPU this method has the capability of high speedups.

In 2018, Singh and Arora [22] discuss regarding the biomedical visualization. They have proposed an efficient framework for the abnormal tissue identification in MRI images. They have used texture feature extraction method. They have extracted contrast, correlation, energy, homogeneity and entropy from the gray-level co-occurrence matrix from the tumour images sample. It is inputted to support vector machine. Their approach outperforms in terms of efficiency and accuracy.

In 2019, Li et al. [23] discusses the image superresolution (SR), or the image compact-resolution (CR). They have proposed a convolutional neural network (CNN) for image CR. They have named it CNN-CR. It can be trained separately or jointly. Their approach outperforms in terms of reconstruction quality.

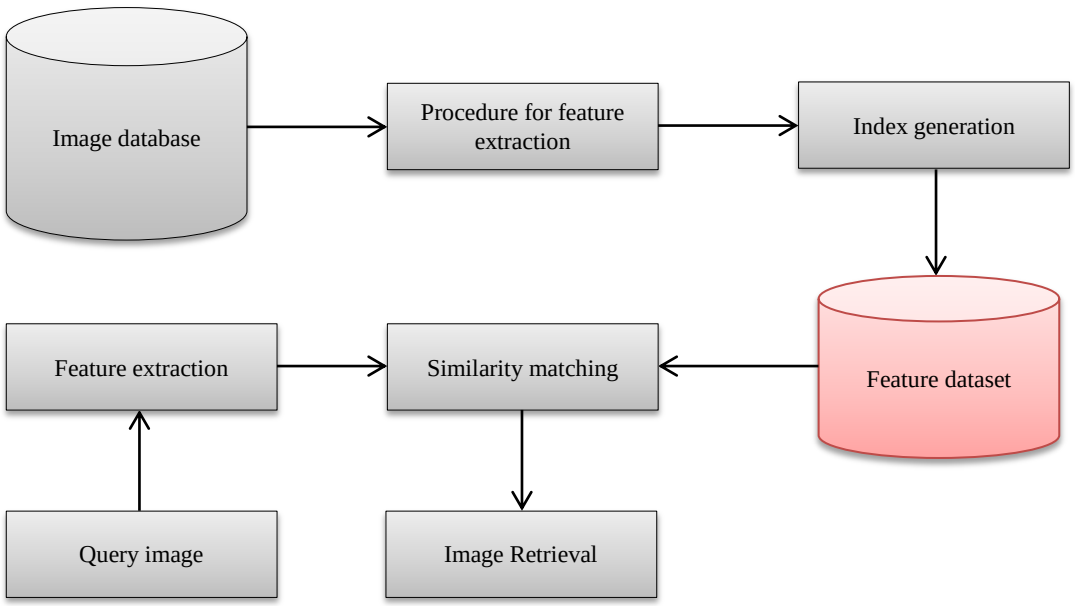

Figure 1 Procedure of content-based image retrieval system

Figure 1 shows the procedure of content based image retrieval system.

3.Problem statements

The study and analysis shows the following problem statements in the previous work:

1. There is the need of image retrieval based on the content as well as the other image features including the matching from the pixel index.
2. There is the need of clustering algorithms for the grouping of the alike properties based on the sub set and super set properties approach.
3. There is the need of higher, lower and average level thresholding for the similarity matching and mapping.
4. Evolutionary algorithms can be important in case of complex attributes and properties.
5. There is the need of hybridization of data filtering, grouping and threshold value mapping so that efficient retrieval is possible.
6. There is the need of the algorithms for the variable dimension and arity.

4.Study analysis based on method results

The method analysis based on the methods published earlier is shown in the below *Table 1*.

Table 1 Comparative analysis based on the results

S.No	Reference	Methods	Results achieved
1	[24]	Dual region based color channel registration	The results indicates that the method is efficient in generating accurate disparity map and a high-fidelity color-aligned image.
2	[25]	Learned nonlinear local descriptors	Their method results are as follows: The mean absolute error of 75.25±18.05Hounsfield units, Peak signal-to-noise ratio achieved is 30.87±1.15 dB, Relative mean absolute error is 1.56± 0.50%
3	[26]	Histopathological whole slide	Their results show the capability of recognizing the malignant regions efficiently.
4	[27]	Parallel content-based image retrieval system	Their results show that the speedup of the multi-node cluster is more significant than the single-node cluster.
5	[28]	Hybrid features based CBIR	Their results showthat the better precision accuracy in comparison to the previous methods.
6	[29]	CBIR based colour strings comparison	Their results based on database classification and colour string coding outperforms as comparison to the previous methods.
7	[30]	Query-sensitive similarity measure	The average precision and recall rates are better in comparison to the previous approaches.

5.Conclusion and future scope

In this paper different aspect of CBIR technique has been analysed and discussed. This paper explores the previous methods with their use and applicability in different areas. It also shows the future enhancements in terms of methods limitations. This paper also discusses the results of some latest works.

The future scopes in this area are as follows:

1. To apply the combination of the mining and soft computing for the better image retrieval with different datasets.
2. To extract the parameters which influence the efficiency and threshold based index calculation for the efficient image retrieval.
3. CBIR techniques can be enhanced with the clustering and classification techniques.

Acknowledgment

None.

Conflicts of interest

The authors have no conflicts of interest to declare.

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