# SIMULATING FEATURE EXTRACTION IN CONTENT-BASED IMAGE RETRIEVAL

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**Abstract**

*According to the findings of this study, a method known as hybrid feature extraction should be used for the retrieval of pictures having to do with health care that is based on their content. Different feature extraction mechanisms are studied with their methodology in this research work. Then the issues related to conventional feature extraction systems are considered. Existing research faced accuracy and performance issues during simulation. An edge detection mechanism has been applied to reduce time consumption and improve accuracy. Simulation work is presenting the feature extraction in the case of a conventional CBIR system and a proposed CBIR system that is considering a hybrid CBIR model by integrating the CBIR technique with an edge detection mechanism.*

**Paper Identification**

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## I. INTRODUCTION

Applications such as satellite imaging, medical imaging, and other types of imaging depend largely on pictures. If these data are read properly, human users just could locate the information they're looking for. It is possible to do analysis on snapshot visual data and manipulate it to generate vectors that can be used in the function by making use of image processing technologies. More research is being conducted in the field of image processing to make it possible for visible picture content to be converted to their corresponding vectors as rapidly as is practically possible using feature vectors that are as short as is practically possible. [1].

According to the findings of this research, a hybrid feature extraction strategy is the most effective way to obtain relevant medical pictures based on the content of those photos. The research will simulate not one, not two, but three potential possible outcomes. In the first step of our research, we include DWT, PCA, and LCM in a single study. The second illustration of this is when all of these techniques— DWT, PCA, and GLCM—are used together. The grayscale photographs that are used in OKE's hybrid solution are converted into binary ones via the usage of the Otsu binarization technique. Following the conversion of the medical picture to grayscale, the clustering process was carried out. In the end, DWT, PCA, and GLCM are used to give the Canny Edge detection algorithm a thorough workout. The process of clustering pictures begins with the detection of edges, which is the initial stage. The information was grouped with the help of K-means, and the Euclidean method was used to compute the distances between the points. To isolate hybrid properties from the data, it has been recommended that we make use of DWT, PCA, and GLCM. In addition to that, MATLAB 2018a is used to simulate the offered techniques and conduct comparative evaluations.

CBIR is an image search and retrieval method that sorts through a vast database by using characteristics extracted from the subject matter of the pictures themselves. There is no hiding the fact that CBIR [1] is now a major topic of discussion in the scientific community. Because bandwidth is becoming more readily available, in the not-too-distant future users will have the capacity to search and examine remote video and photo libraries. Private content-based image recovery (PCBIR) is a well-liked technique for researching since there is an excess of digital video and picture data. This technique does not disclose any information on a specific image query.

In recent investigations, DWT, PCA, and GLCM have all been used, each time with positive results. The research process may be broken down into three stages. Feature extraction, feature reduction, and feature representation are the names given to these three processes.

### 1. Discrete wavelet transform (DWT)

The DWT algorithm, which is a component of the linear transformation, is used to perform a numerical transformation on a data vector, producing a new vector with the same length as the original. The DWT calculation, which contains a sub-sample factor of 2, makes use of cascade filtering as one of its components. The wavelet transform was used to perform a discrete transformation in two dimensions on the data representing the image. Using this method, we were able to differentiate between the many kinds of visual elements that are included inside an image. The details of graphical material are comparable to those of a sub-image. Sub-images have been created from one-fourth of the original photo. The 1-D DWT has been extended in both the horizontal and vertical directions to create the 2-D DWT. In the visual content, frequency bands have been broken up into a large number of detail pieces that make use of mother wavelets. The process of transforming and dilapidating an existing function might result in the creation of wavelets. The discrete wavelet transform (DWT) may be used to accomplish the separation of the signal into high- and low-frequency components. While information about the edge component is preserved at the high frequency, signals at the low frequency are once again segmented into high and low-frequency components. When you have finished running DWT in the vertical direction, it is time to move on to the horizontal direction. The LH1-HL1-LL1 range is comprised of these four subbands together. The creation of these bands is the consequence of the decomposition that occurs at the first level. To complete the breakdown of each succeeding level, the LL subband of the most recent level has been utilized as an input. To do a DL2 decomposition, the LL1 band is DWT-subdivided into four subbands. Utilizing DWT that is implemented in the LL2 band makes it easier to do third-level decomposition. This ring is then subdivided into four smaller rings by it. The numerals LL3, HL3, LH3, and HH3 are the ones in question here. As a consequence of carrying out such a technique, every component receives its very own sub-band. The bands in the picture with the greatest frequency are LH1, HL1, and HH1, while the band with the lowest frequency is LL3.

**2. PCA**

To carry out principal component analysis (PCA), the input feature space was compressed into a lower-dimensional feature space. This approach makes use of the biggest eigenvectors that may be derived from the correlation matrix. This information may be found shown in a linear, lower-dimensional manner with the data that is requested as well as with the information that has been provided. On the other hand, the discrepancies that were connected with the reconstructed data have been maintained [22, 23].

The use of principal component analysis is limited to the use of element-specific feature vectors when a feature-lessening model that is connected to PCA is utilized. It was discovered that the strategy led to the production of a classification system that is not only effective but also straightforward to use. As a consequence of this, the primary notion is that PCA is used to lessen the dimensionality of the wavelet coefficients. This classifier's reliability and effectiveness are both enhanced by the use of principal component analysis (PCA). The technique for the extraction of features is carried out. To complete this process, two stages must first be completed. In the initial part of the process, the DWT is used to extract the wavelet coefficients. After that, principal component analysis is performed to whittle down the list of significant coefficients.

The principal component analysis (PCA) has built a good reputation for being an effective technique of analysis. When used in conjunction with newly created or updated datasets, it helps minimize the dimensionality of the data. By utilizing variables that are not connected, one of the primary objectives is to cut down on the size of the initial dataset [24]. This technique is used to carry out an orthogonal transformation successfully. Its purpose is to modify a group of variables that have already been defined. This variable is significant since it relates to M. As a direct consequence of this, we now have a K-piece that is devoid of any connections. These variables are said to have primary components or eigenvectors denoted by the letters K and M. The design of this algorithm considers it while developing it.

**3. GLCM**

The primary purpose of GLCM is to evaluate the quality of the textures used in graphical material. It is well knowledge that GMCMs may be quite large and very uncommon. This is the method that is used to obtain the Features. By way of illustration, the GLCM method was used to determine the following picture characteristics: Correlation, contrast, smoothness, variance, mean, standard deviation, energy, skewness, kurtosis, root, homogeneity, and inverse difference moment are all words that may be used interchangeably with entropy.

## II. RELATED WORK

There is a lot of research being done in the field of image processing. R. Raja [1] researched the detection of colored objects. Their investigation was dependent on picture retrieval methods that made use of ROI dissection. M. K. Alsmadi [2] made a study proposal on the retrieval of images based on their content. In addition to the characteristics, the author describes things such as color, form, and texture. K. L. Education [3] centered on the process of detection via the use of X-Ray pictures and the Harris Corner Technique. J. Lee [4] was the one who was responsible for the implementation of the high-speed feature extraction method. Their investigation was predicated on the selection of energy-efficient threshold values. Alsmadi, M.K. reported their work on a content-based picture retrieval system in [6]. The author used a variety of descriptions and attributes, including color, form, and texture. The implementation of content-based picture retrieval was accomplished by Banharnsakun [7] through the use of an artificial bee colony method.

Renita [8] presented an innovative real-time CBIR technique for the retrieval of medical images that made use of GWO-SVM. Jyothi [9] conducted research aimed at improving the performance of Log Gabor Filters. The writer made use of a genetic algorithm. Knowledge-based Systems were first suggested by S. Unar [11]. This technique for content-based image retrieval was used for feature fusion in both visual and textual pictures. R. Ashraf [12] conducted research on the process of retrieving images based on their content. Both discrete wavelet transform and color descriptor were taken into consideration by the author. Prathyakshini [13] has contributed to the field of image processing research by suggesting a technique for classifying and grouping images. These processes, coupled with the K-Means Algorithm, were used in the analysis of the infected leaf plant. AtifNazir [14] undertook research and development on a content-based picture retrieval system. The authors were successful in accomplishing their goal by using an HSV color histogram, discrete wavelet transform, and edge histogram descriptor. Picture feature extraction and consideration of content-based image retrieval were both parts of K. T. Ahmed's [15] research.

R. Ashraf [16] concentrated on multimedia data to carry out a search for images based on the content of the images. In addition to programmes, the author took into consideration a variety of features and multimedia tools. A piece of work on an encrypted medical picture retrieval technique was done by S. Wang [17]. The DWT-DCT frequency domain served as the foundation for their scientific endeavor. J. Annrose [18] presented a technique for the effective retrieval of images. The author gave some thought to selecting features using a structured query and also filtered first-level photographs that were appropriate. Their study on content-based picture retrieval was continued by Guang-Hai [19], who made use of a computational visual attention model in their work. S. Agarwal [20] concentrated on content-based picture retrieval by using discrete wavelet transform in addition to edge histogram descriptor. He did this by using these two techniques.

## III. PROBLEM STATEMENT

There have been several types of research in the area of image processing. Different types of image feature extraction mechanisms are in existence but the issue with conventional mechanisms is time consumption and accuracy. There remains a need to improve performance and accuracy, thus there is a need to introduce a hybrid model that should be capable to provide a suitable solution.

## IV. PROPOSED METHODOLOGY

The proposed work is considering a hybrid approach that would be capable to provide better performance and accuracy during content based image retrieval. Existing research related to image processing, feature extraction, and CBIR has been studied. Then issues such as lack of accuracy and performance are considered. The proposed model has considered an integrated approach where GLCM has been integrated into the edge detection mechanism to reduce the time consumption. Moreover, this would also improve performance.

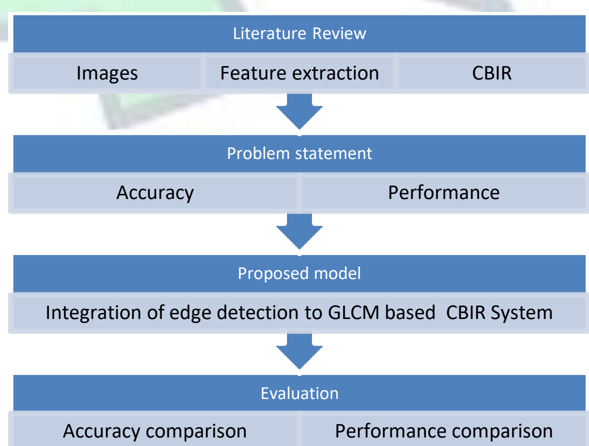


**Fig 1 Proposed methodology**

## V RESULT AND DISCUSSION

During simulation conventional has been compared to the proposed CBIR approach.

### 1. Simulation of Contrast

The dataset produced during the simulation of contrast in three cases has been shown below:

**Table 1 Comparative Analysis of Contrast**

| **Image** | **Conventional CBIR approach** | **Proposed CBIR approach** |
|---|---|---|
| 1 | 0.792808 | 0.596206 |
| 2 | 0.494392 | 0.822288 |
| 3 | 0.468706 | 0.764945 |
| 4 | 0.467745 | 0.709521 |
| 5 | 0.483243 | 0.693993 |
| 6 | 0.429638 | 0.67439 |

Figure 2 shows the contrast graph that was generated after simulating the aforementioned data.

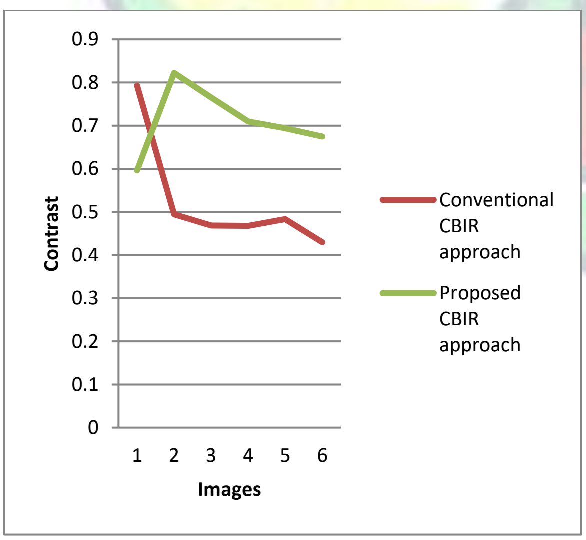


**Fig 2 Comparative analysis of Contrast**

### 2. Simulation of Correlation

Following is a look at the three different datasets that resulted from our correlation simulations:

**Table 2 Comparative analysis of correlation**

| Image | Conventional CBIR approach | Proposed CBIR approach |
|---|---|---|
| 1 | 0.08542726 | 0.2019546 |
| 2 | 0.1423657 | 0.134237 |
| 3 | 0.17259621 | 0.138203 |
| 4 | 0.13190592 | 0.1587965 |
| 5 | 0.10407941 | 0.2174722 |
| 6 | 0.22677802 | 0.1141039 |

As illustrated in fig. 3, a correlation graph was generated by simulation using the aforementioned data.

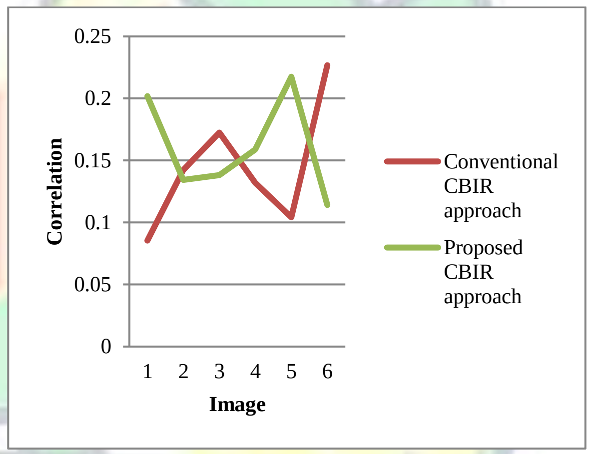


**Fig 3 Comparative analysis of Correlation**

### 3. Simulation of Entropy

In the following, we provide the three datasets that resulted from entropy simulations:

**Table 3 Comparative Analysis of Entropy**

| Image | Conventional CBIR approach | Proposed CBIR approach |
|---|---|---|
| 1 | 0.0868263 | 2.616728 |
| 2 | 1.7765978 | 2.296553 |
| 3 | 1.6583696 | 1.972584 |
| 4 | 2.4396543 | 2.735805 |
| 5 | 2.4843274 | 2.856172 |
| 6 | 2.2372553 | 2.688726 |

The Entropy shown in fig. 4 was generated by modeling of the aforementioned data.

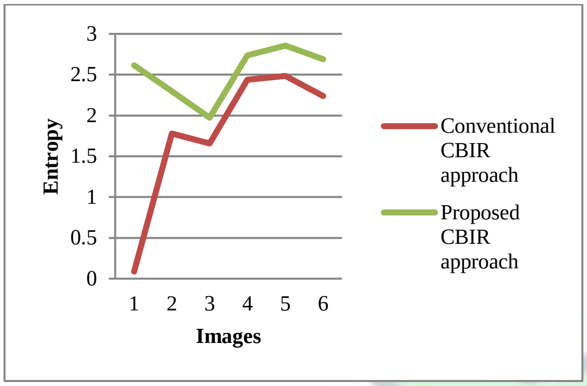


**Fig 4 Comparative analysis of Entropy**

### 4. Simulation of Energy

The following is a representation of the dataset generated from Energy simulations in three different scenarios:

**Table 4 Comparative Analysis of Energy**

| Image | Conventional CBIR approach | Proposed CBIR approach |
|---|---|---|
| 1 | 0.997146 | 0.747963 |
| 2 | 0.925488 | 0.852342 |
| 3 | 0.948937 | 0.799183 |
| 4 | 0.883728 | 0.771406 |
| 5 | 0.830919 | 0.739426 |
| 6 | 0.876304 | 0.713522 |

The simulation results are displayed in Fig. 5 below, which depicts a graph of Energy.

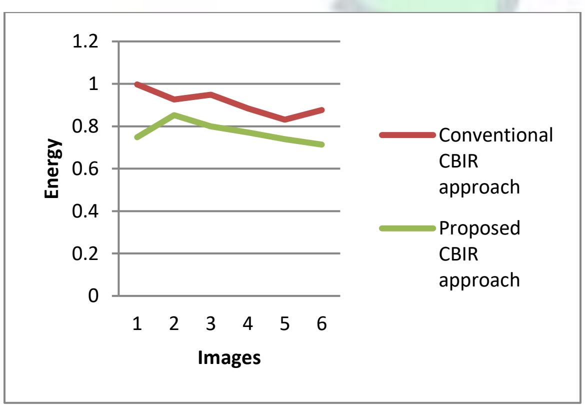


**Fig 5 Comparative analysis of Energy**

### 5. Simulation of time consumption

For three different scenarios, we provide the dataset generated from time simulations:

**Table 5 Comparative Analysis of performance**

| Image | Conventional CBIR approach | Proposed CBIR approach |
|---|---|---|
| 1 | 0.977391 | 0.913368 |
| 2 | 0.936375 | 0.911089 |
| 3 | 0.957747 | 0.871263 |
| 4 | 0.94119 | 0.927514 |
| 5 | 0.960313 | 0.927019 |
| 6 | 0.949994 | 0.923644 |

After running the simulation, the data was visualized as shown in fig. 6. This figure represents Time consumption.

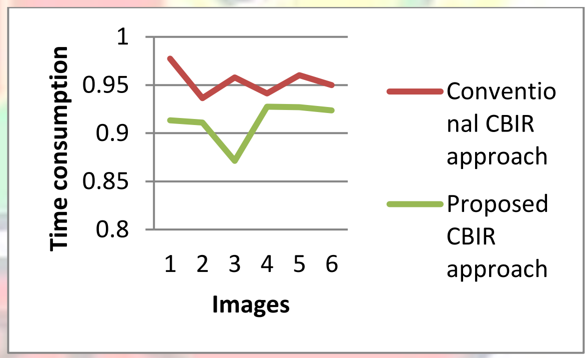


**Fig 6 Comparative analysis of Time Consumption**

## VII. CONCLUSION

The outcomes of this research suggest that an approach known as hybrid feature extraction should be used for the retrieval of photos associated with health care that is based on the content of those pictures. This study effort examines a variety of processes for the extraction of features along with their respective methodologies. After that, the problems that are associated with traditional feature extraction algorithms are thought about. Previous studies had problems with both its accuracy and its performance when it was simulated. A system for detecting edges has been implemented to cut down on the amount of time needed while also improving accuracy. The simulation study presents the feature extraction for the case of a traditional CBIR system as well as a suggested CBIR system that takes into consideration a hybrid CBIR model by merging CBIR technology with an edge detection mechanism.

## VIII. FUTURE SCOPE

CBIR is useful since searches that just employ metadata are reliant on the quality and completeness of the annotations. It is not only time-consuming to have people manually annotate photographs by inputting keywords or metadata into a big database, but it also raises the possibility that the keywords used to describe the image will not be captured. Such research works are supposed to provide a suitable solution to get high accuracy and performance.

## RÉFÉRENCIAS


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