iFeX - An Effective Search Tool for Content based Medical Image Retrieval

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ABSTRACT
The goal of the proposed system is to retrieve the corresponding image from the database based on the query image. Now-a-days images are stored in the database in the form of digital. Thus, retrieval of image from huge database become complex. Most of the existing system uses indirect method of retrieval and they have no methodology. Thus the major aim of our approach is to construct an effective and efficient search engine tool in order to retrieve image from a huge database based on the user query.

Keywords
iFex- Image Feature Extraction, Gray Level Co-occurrence Matrix, k-means clustering algorithm, Texture, Image retrieval, Precision, Recall.

1. Introduction
Many of the image retrieval systems are not domain specific one. In this study we have proposed a domain specific based search engine for medical images such as MRI-Scan, X-ray, and CT-Scan. Our approach will permit the radiologist to retrieve images of similar features that lead to similar diagnosis purpose from huge database. Thus the retrieved images are useful for various diagnostic purposes.

We use feature extraction technique, which is one of the important techniques for identifying the texture regions. This feature extraction was done with the help of Gray Level Co-occurrence Matrix (GLCM). This feature extraction technique is used to analyze the image and identifies the texture regions.

Grey Level Co-occurrence Matrix was one of the successful methods proposed by Haralick in 1970s [1]. Most of the existing approach follows this GLCM technique. This method is useful for texture rock pattern analysis, leaf analysis, identifying the disease infected area in skins, etc. In this process graycomatrix function in MATLAB is used to create Grey Level Co-occurrence Matrix.

K-means Clustering algorithm is used for clustering features. As its name implies, this is a process of combining the similar areas that is located in the image. It is a technique to detect the dissimilar texture regions.

2. Existing System
This section deals with some of the existing approaches of feature extraction process.

The ASSERT system [2] extracts 255 features of texture, shape, edges and grayscale properties in pathology-bearing regions. It has been implemented exclusively for lung images.

The IRMA system [3] is exclusively developed for medical image retrieval. But it doesn't retrieve the image effectively and also it consumes more time.

In this method [4], Content-based retrieval and classification of ultrasound medical images of ovarian cysts is carried out. Here, Fuzzy K-Nearest Neighbor (k-NN) classification method has been used. This method is efficient but it has own characteristics for classifying and retrieval of images.

In the SPIRS system [5], the images in the collection must be homogeneous. The Image Map is a system that considers how multiple organs of interest. But, the retrieved image will represent an unexpected organ.

This method [6], presents the framework for combining shape, resolution and texture in order to achieve high retrieval efficiency. Content based medical image retrieval is used to retrieve the most similar image to a given query from the database using grayscale resolution based on the query image. The texture analysis is used to identify different texture and non-texture regions and also to classify the texture regions. It is also used to extract boundaries between major regions. Finally retrieval efficiency can be measured using precision and recall. This approach provides 94% of efficiency on evaluation.

In this approach [7], feature extraction method for the TRUS prostate cancer is implemented. One of the methods used to detect the prostate cancer is Ultrasound Imaging which is suitable for diagnosis and prognosis. Texture features evaluation plays a major role in image processing applications. This approach explains the textural feature extraction from histogram, GLCM, Grey Level Run Length Matrix (GLRM) and their combinations. Here, GLCM and GLRM are used to extract the statistical texture features.

The objective of this work [8] is to generalize the concept of Co-occurrence matrices to n-dimensional Euclidean spaces. Here we used n-dimensional Euclidean space in order to extend the concept of co-occurrence matrices by using the four directional co-occurrence matrices. We also define a new feature from the normalized co-occurrence matrix that can be used to identify constant regions in an image. This is called TRACE. The goal of image retrieval is to compare a given query image with all potential target images in order to obtain numerical measures of their similarity with the query image. These retrieving results are evaluated by calculating average precision. This is a clear indication of the improvement of performance using the proposed feature.

This system [9] automatically recognizes the diseases in the human skin using GLCM. Images are scaled to 100x100 and stored in "*.jpeg" format and its resolutions should be 72

pixels per inch. This system is effective and cost efficient to find the skin diseases. Accuracy of this system mainly depends on the various features of GLCM components.

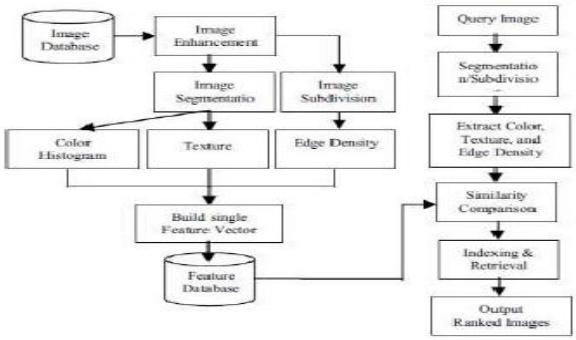
In this approach [10], rock images are evaluated using GLCM. It consists of dual databases, one with whole images and other with split images. Now-a-days, the role visual inspection is more important due to the increase in computational capability. This approach has the following limitations: (i) All images in the database are normalized. (ii) More textures are analyzed with the sub blocks of images. (iii) Euclidean distance is used to measure the dissimilarities between the textures.

3. Proposed System

The goal of the proposed system is to construct an effective and efficient search engine tool "iFeX" in order to retrieve image from a huge database. The main feature of this tool is the use of GLCM for extracting texture pattern of the image. K-means clustering algorithm is used to merge the similar texture patterns present in different location of the images. iFeX is capable of retrieving the images based on the texture feature of the image by feature extraction process. This feature extraction is achieved by GLCM. This proposed system consists of three stages (i)Image Acquisition and Segmentation (ii)Texture Feature extraction and Clustering process (iii) Matching Process, as shown in figure 1.

Fig 1: Model of Work

After the image acquisition, Segmentation process segments the require region of the image. Texture feature extraction is the process of extracting the texture feature like color, shape



of the image. Clustering process uses k-means clustering algorithm which combines similar texture patterns.

After these three stages, we have to check the similarity between the user query images and the images already in the database. For this Euclidean distance calculation is used. Retrieval efficiency will be calculated by Precision and Recall values.

Precision = Number of Relevant images retrieved/Total number of images Retrieved.

Recall = Number of Relevant images retrieved/Total number of relevant images in database.

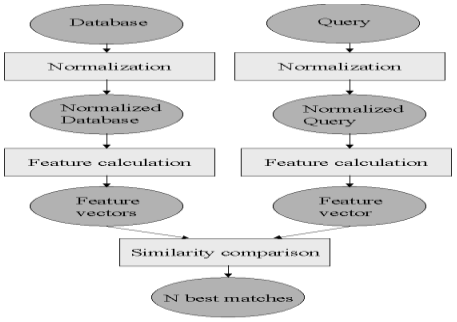


Fig : 2 Proposed System

This system provides a very good user interface (GUI) for retrieving the images. On evaluating with 1000 real time medical images, results in 65% to 70% of precision and the minimum recall value (around 25%). GLCM features are extracted using one distance d= {1} and four directions ɵ = {0, 90,180 and 270}. A texture is distinguished by a statically measurement value suggested by Haralick et al. The following formulas are used to calculate the features and they are:

Energy = $\sum_i \sum_j P^2(i,j)$

Entropy = $\sum_i \sum_j P(i,j) log P(i,j)$

Contrast = $\sum_i \sum_j (i-j)^2 P(i,j)$

Homogeneity = $\sum_i \sum_j \frac{P(i,j)}{1+|i-j|}$

4. Conclusion

This system provides a very Good User Interface for retrieving the images. The output produced in this proposed system is very accurate for medical image retrieval. The system is designed with a flexible and consistent flow of understanding.

The use of Grey Level Co-occurrence Matrix for feature extraction identifies the similarities between the query image and database images perfectly with the huge database. This proposed system permits the radiologist to retrieve images of similar features that lead to similar diagnosis purpose from large volume of databases. So that the retrieved images are used for various medical diagnostic purposes such as CT-Scan, MRI-Scan and X-Rays.

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