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Review on Content Based Medical Image Retrieval System and Techniques

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Abstract: The rapid expansion and improvement in medical science and technology which generates the amount of image data more and more in its regular activity such as CT-image, X-ray, MRI etc. Due to scalability of image data, it has been increased in size of database and containing millions of images. For the proper management of medical image and requirement of efficient retrieval system for clinical decision making and research activities, It emerges Content based medical image retrieval system for quick diagnosis of medical images. The review of CBMIR system has been analyzed the overview of currently available techniques useful for medical domain.

Keyword: CBMIR, Feature Extraction, Classification, SVM, GLCM Matrix.

1. Introduction

Today image play an energetic role in every field such as medical images, satellite images, web images and buisness images which are produced by different variety of sources. There is quick development in digital imaging technology that produce amount of images every day. However it needs the proper management of image dataset for efficient access and retrieval. The problem of searching desired image from large dataset on the basis of its features is a challenging task. As a corresponding search approach, the content based image retrieval presents as an active research area in the field of digital imaging. CBIR retrieves images from the dataset according to content of query image such as texture, color and shape. In medical field, all data and information are stored in image as visual information for diagnosis and monitoring purposes. The retrieval process is used to find anticipated image from huge collection of images and analyzes the outcome as "relevant", "not relevant"

2. CONTENT BASED IMAGE RETRIEVAL

CBIR is a one of the most active research area in the field of computer vision and image processing. It is the process of searching and retrieving images from large dataset using features of image such as color, texture and shape. The number of features required to represent images are very huge. So it is necessary to develop an appropriate information system which manages large dataset. CBIR is used to extract potential and hidden information from the images and this information represents in the form of color, texture and shape.

2.1 Color Feature: Color similarity is achieved by color histogram for each image which gives description about proposition of pixels and holding a specific value that express as color.

2.2 Texture Feature: Texture feature is initiating the relationship between surface and its surrounding environment. It represents some primary primitives which describes the structural arrangement of regions.

2.3 Shape Feature: Shape refers as particular region of image. Shape have many contents which are used to absorbing visual information such as circle, boundary , region ,partition and other shape.

3. CONTENT BASED MEDICAL IMAGE RETRIEVAL

This article represents an overview of currently available literature on content based medical image retrieval. [1] (CBMIR) system and its techniques especially for diagnosis and detection of disease. The main aim of the medical system is to provide right information to right person. The retrieval process of medical images is basically based on visual feature of image in form of high level features and low level features. CBMIR is retrieving most similar images from large dataset according to content of given query image. The process of CBMIR basically depends on two methods [13].

3.1 Feature Extraction Method: Feature extraction process is an independent orientation of CBMIR system, in which visual features of image are extracted and it is described by feature vector. The features of image are in form of low level features and high level features. Here low level feature are general .[13] and domain specific which include color, texture and shape of image and high level feature give description about the semantic level of image in detail. Therefore each element of feature represent as signature of image. In CBMIR system, it is necessary to extract the feature before retrieval of images.

3.2 Image Retrieval Method: This method depends on feature extraction process in CBMIR system, it uses extracted feature for retrieval process to. [8] check similarity between query image and dataset images. Retrieval process depends on computation of visual and semantic patterns of images .it retrieve medical images from large dataset which are nearly equal to query image and used for diagnosis process and monitoring therapy. The working of Content Based Medical Image Retrieval system as shown in figure 1.

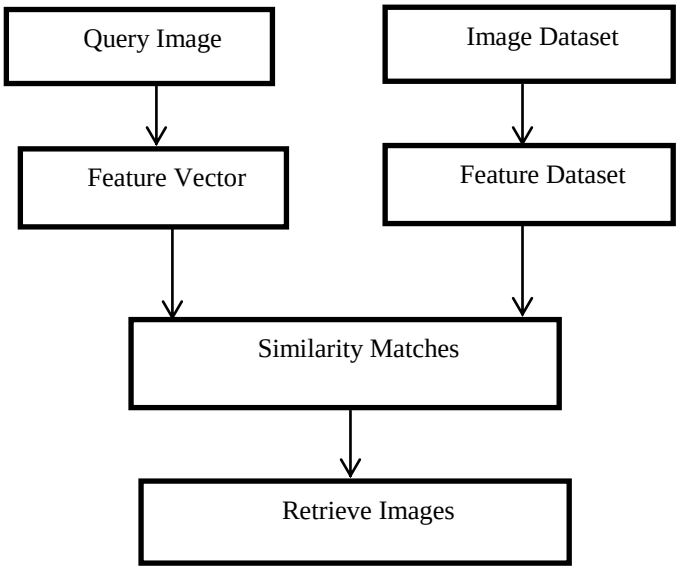

Figure 1: CBMIR System

4. REVIEW ON CBMIR SYSTEM

The main approach of CBIR system in medical applications represents the general information structure for semantic image analysis. [1] and gives the description about an architecture which describes efficient implementation of medical images. There are such systems described as.

4.1 IRMA System: IRMA system presents an information model of semantic layer. It is described. [6] image retrieval process in seven sections including categorization, registration, feature extraction, feature selection, indexing, identification and retrieval. Each layer describes higher level of abstraction and reflecting image content level. It uses heterogeneous dataset (CAS image dataset). [9] to find similar images on the basis of high level feature of image. It is exclusively developed for medical applications. The design of system depends on automated features of images and the system records the relational features that contain information about images.

4.2 ASSERT System: ASSERT is standalone retrieval system for HRCT lung image dataset which describe the high resolution computed temography image [7]. ASSERT is automated search and selection engine with retrieval tool. It has two phases of system. There are image archiving phase and image retrieval phase. This system has been integrated with PACS (picture archiving and communication system), HIS (hospital information system), RIS (radiology information system).

4.3 IMAGE MAP System: IMAGE MAP is one of the surviving systems. [10] which handle multiple organs. The medical image consist multiple organs in form of tissues, tumors etc. Sometimes it is retrieved images with unexpected organs, but the main problem of system is to find desired organs from retrieved images, therefore it is necessary to used spatial similarity function for finding exact image from retrieve images and to get accurate medical organ information.

4.4 SPRIS System: SPRIS system is considering the metadata information which is associated to digitized spine x-rays .it is a standardized system. [11] that contains metadata information about image retrieval system and spine pathology of SPRIS system. It has been developed for diagnostically delicate retrieval of digitized x-ray image.

5. REVIEW ON CBMIR TECHNIQUES

Advances in medical technology, visualization have initiated many methods, techniques and ways in medical imaging. CBMIR technique represents an efficient retrieval system to control and analysis of medical images. It mainly depends on spatial data relationship. There are various techniques among which the feature extraction, segmentation, classification and clustering. In CBMIR system features are extracted in the form of low level feature and high level features. Low level feature are color, texture and shape. The visual features of images have been considered to retrieve images. In medical field all data and health information stored in form of scanned images. However the visual inspection of image is very tedious task; in which image contain poor contrast and different types of noises. Therefore it is necessary to develop an efficient retrieval system using various types of techniques such as segmentation, classification, clustering etc. X-rays images contain. [5] poor contrast and different additive noises with poor quality results. It is not an easy task for monitoring and examining the disease using x-ray image. It is necessary to considered three main phases for developing CBMIR system. First is modeling phase that give explanation about de-noise method is used to improve the enhance visibility of bone structure and the active shape model (ASM) segmentation

process of x-ray image is discovered the anterior, superior and inferior edges. Second is indexing phase which involves feature extraction method used to characterized fraction based region and contour approaches using (GLCM) gray level co-occurrence matrix on segmented regions and third is retrieval phase for retrieving similar images from large dataset and perform rapid diagnosis for vertebral irregularities of x-ray image. Magnetic resonance imaging (MRI) is used as valuable information image interpretation for clinical and surgical environment. It contains soft tissue differentiation, high spatial resolution and contrast. MRI image scanner is storing magnetic field and radio waves where it removes brain tumors, bleeding, injury and blood vessels disease. The representation of brain MRI image in CBMIR system is used for detect abnormality of image and retrieve similar images from large dataset using feature extraction and retrieval method . The outcome of such system depends upon accuracy, speed and robustness of the system; hence there is a need for system analysis, classification and efficient retrieval of brain MRI images. [4] The feature extraction process is used to distinguish between normal and abnormal image using GLCM and principal component analysis (PCA) where the extracted features are classified by (SVM) support vector machine. The hybrid methodologies of feature extraction and retrieval process give effective and efficient result. [15] The hybrid methodology involves training and testing phases it has been used skull stripping and GLCM and DWT (wavelet transform) for feature extraction and training phase it uses k nearest neighbor for similarity measures in terms of specificity and sensitivity. The human brain classified via supervised techniques. [17] such as artificial neural network, support vector machine (SVM) and unsupervised techniques using hybrid approach [14] of fuzzy-c means, self-organization map (SOM). The results has been displayed the flexible classification of MRI image. The computed temography (CT) image have better clarity, low noise and less distortion. The diagnosis process of lung CT image strongly depends on texture of lung tissue. The feature extraction block contains the collection of extracted texture features. [2] which is calculated by GLCM matrix and selected feature are used for classification. For accurate classification it is need to be mapping of features obtained by support vector machine (SVM). For achieve better orientation of lung CT image segmentation process can be used. In medical imaging segmentation process is important for region of interest (ROI) extraction for measurement of image. It classifies image pixels into regions, bones, muscles, and blood vessels [3]. Segmentation comes under the process of feature extraction and image analysis which gives description about various texture patterns of image. [16] In lung CT image texture feature is used to quantify the different –different nodules. It is also analysis the characteristics of textures of lung nodules. They are categorized into four sections first is hierarchical structure approach of image, second is statistical approach for numerical analysis of pixels using GLCM matrix, third is transform approach for modification of image using Gabor filter and fourth is mathematical model of image using markov random fields. This categorization improves the performance of CBMIR system. [12] The differential diagnosis of lung cancer improves the performance of retrieval system and identify suspicious tumor from lung CT image. It is classified lung nodules using segmentation method and the extracted visual content check the similarity to dataset images. The retrieving images are used to check system performance in terms of precision and recall where it measures system accuracy.

6. CONCLUSION

This paper is focused on CBMIR system and review of its various techniques. It describes techniques of CBMIR for retrieving medical images from huge collection of medical images or large dataset. It is further optimized by combining various techniques to give better performance and better results in minimum time with efficient result.

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