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Medical Image Retrieval Using Content Based Image Retrieval.

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ABSTRACT

CBIR (Content Based Image Retrieval) has gained an importance mainly as a research domain over the past 20 years. CBIR systems are used to retrieve the images that are similar to the query image from the database. This can be done by retrieving the similar features of the content of the query image with the image in the database. Image content can be described using the features of Color, Texture, and Shape. Segmentation-based Fractal Texture Analysis (SFTA) algorithm is used to extract the texture feature, Speeded up Robust Feature (SURF) algorithm is used to extract the color features, and Canny Edge Detection algorithm is used for extracting the shape features of the images. The CBIR method is used in medical is to retrieve the images that are visually similar to the query. This paper focuses on CBIR from large medical databases.
Keywords: Content Based Image Retrieval (CBIR), Contrast Adaptive Histogram Equalization (CAHE), Speeded Up Robust Features (SURF), Canny Edge Detection.

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INTRODUCTION

Advances of data storage and image acquisition technologies created of large image data sets. In this scenario, it is necessary to develop exact information systems to efficiently manage these collections. The approaches use the so-called Content-Based Image Retrieval (CBIR). Basically, these systems try to retrieve the similar images to a user-defined specification (e.g., shape sketch, image example). CBIR is used to encode the content properties into image vectors (e.g., shape, color, texture). One of the main advantages of the CBIR approach is an automatic retrieval process, instead of the time consuming process like the traditional keyword-based approach, The historical researches, crime prevention medicine uses the CBIR technologies.

Image retrieval can be used to browse, search and retrieve the images from a large database of digital images .It is a computer based process. Many methods for image retrieval use keywords to retrieve the images, but, manual image notation is time-consuming, laborious and expensive; to address this, there has been a large research done on the automatic image identification. The Web Application has enforced the development of several image retrieval tools.

Banireddy Prasad, Amar Gupta, Hood-Min Tong, and Stuart Mad nick developed the first microcomputer-based image database retrieval system was developed at MIT, in the 1990s,. The search can be based on tags, attributes, color etc.

Content Base Image Retrieval (CBIR) the application of computer vision to the image retrieval. CBIR aims at avoiding the use of keywords-based approach and retrieve the images based on similarity in the features like textures, colors, shapes, etc. to a user-supplied query image or user-specified image features.

List of CBIR Engine- list of engines which search for images based image visual content such as color, texture, shape/object, etc.

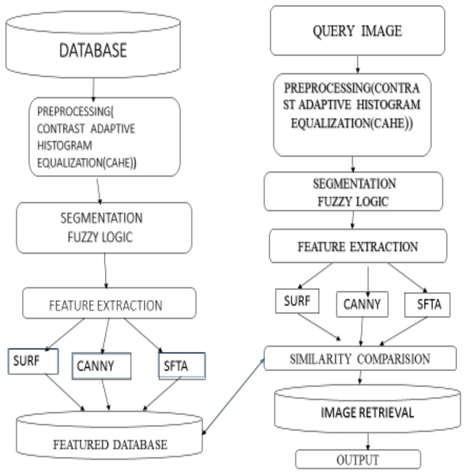
Content-based image retrieval (CBIR) is an opposed system of concept-based approaches.CBIR is also known as query by image content (QBIC) and content-based visual information retrieval (CBVIR).It is a computer based technique that is used to search for large relevant images from a large database.

"Content-based" means that the keywords or any other content that is associated with an image is analyzed. The term "content" can refer to the color, texture or the shape the detailed information that can be derived from the image. If humans annotate the images by entering the keyword it is time consuming and the information that is retrieved may not be relevant .CBIR is desired because the image search is based on the content of the image and the annotation quality of the image. In keyword based search there is no much effectiveness.

RELEATED WORKS

Brain tumors are mainly classified as benign and malignant tumors. Malignant tumors are cancerous and benign tumors are non-cancerous. The tests for identification of tumor require visual examination. But visual analysis is time consuming, so it requires computer-aided-development systems [1].An image retrieval system is used to browsing, searching and retrieving images from a large database of images [2].To retrieve the images related with MR images we use the Discrete Wavelet Transform(DWT). Discrete wavelet transforms does not yield superior results [3]. The texture captures the characteristics of image parts with respect to changes in directions and scale of the changes. Texture describes the structural arrangement of any region [4].For detecting the shape of the images we must detect the edges, that is a change in the gray level intensities. Shape information is extracted using Canny Edge Detection [5].Feature selection is used to find the optimal feature that is the most 'relevant' and 'irrelevant' image sets are separated [6].Gabor Filters are used for noise reduction. But these filters that are used for noise reduction, filters even the relevant images that are required for subsequent processes [7]. Combining both the positive images as well as the negative images in content-based image retrieval will minimize the dispersion. Here the relevant information is not retrieved [8].Combining ad-hoc Ranking Feature for Image Retrieval method brings little burden to the system. Here the indexing is not performed by looking into the number of visual image features [9].In future enhancement the visual features can be used to construct the ranking features. Neuro-Fuzzy control (NFC) gives greater robustness with larger changes and no tuning is required [10].

PROPOSED WORK



Architecture diagram for medical image retrieval using CBIR

Color is extracted using SURF algorithm
Shape is extracted using CANNY algorithm
Texture is extracted using SFTA algorithm

Contrast Adaptive Histogram Equalization (CAHE) Used For Enhancement Method

CAHE method is used in the enhancement method. Contrast Adaptive histogram equalization (CAHE) is an image processing method that is used to improve the intensity of the images. It is a computer based process .The difference between the ordinary histogram equalization and the adaptive histogram equalization is that, the later computes the histograms in distinct parts of the images, and the lightness values are redistributed throughout the images. Therefore, it is best suitable for improvising the contrast of the image as well as the intensity in the corner of an image. The adaptive histogram amplifies the noise in distinct regions of an image, but in this method some of the relevant information may not be retrieved and hence we use the CAHE method which retrieves all the relevant images .

Segmentation

Partitioning an image into segments which provides additional information about the image is called image segmentation. The main aim of segmentation is to simplify change an image into something that is easier to analyze and more meaningful. Image segmentation is typically used to locate lines and curves in images. In other words, in image segmentation every pixel of an image contains a label and the pixels containing the same labels have the same characteristics. Fuzzy set theory, means partial truth which extends the conventional set theory. The main aim of the fuzzy logic is used to improve the vagueness in complex systems. Presently fuzzy logic is also being used in image processing as well as at the Pattern Analysis and Machine Intelligence (PAMI).For object recognition and scene analysis expert human knowledge must be required. Fuzzy set theory provides tools in the form of fuzzy-if then rules that is equivalent to the human knowledge. The difficulties that arise in image processing are that the data and the tasks may be uncertain. The fuzzy sets use a simple logic for segmentation of images, sometimes, gray scales are necessary to increase or decrease the contrast. To perform image processing using fuzzy logic there are three steps. First, in order to modify the values in an image fuzzification is used. Secondly the images are transformed to membership plane using appropriate fuzzy techniques which includes the fuzzy combination; fuzzy integration.Defuzzification is used to decode the images which provide the required output. The main goal of fuzzy image processing is to modify the fuzzy membership values.

Feature Extraction

The resource required to describe large data sets must be less, and hence we use feature extraction When complex data are involved the number of variables used becomes one of the major issues, because the number of variables is directly proportional to the computational power and the memory requirement. Feature extraction is a general method that is used to solve the issue with the use of a large number of variables and also produces an accurate result[10].

Segmentation-based Fractal Texture Analysis (SFTA)

The Segmentation-based Fractal Texture Analysis, or SFTA, is used to extract the texture feature in which an image is decomposed into a set of binary images by using Two Threshold Binary Decomposition (TTBD).The fractal dimensions are calculated for all the binary images. This fractal dimension describes the texture features. The SFTA extraction algorithm extracts a feature vector from the resulting binary image size, mean gray level, and the boundary fractal dimension. The two-threshold segmentation is applied using the following representation

$$I_b(x,y) = \begin{cases} 1 & : t_l < I(x,y) < t_u \\ 0 & : otherwise \end{cases}$$

:

The fractal dimension is obtained by,

$$H = \sum_{S=K}^{2} \log(A(s)) * \log(N(s)) \Big/ \sum_{S=0}^{K=2} \log(A(s))^2 \quad \ldots (1)$$

Needed: Grayscale image I and number of thresholds nt.

Ensure: Feature vector VSFTA.

1: $T \leftarrow$ MultiLevelOtsu(I,nt)

2: $TA \leftarrow \{\{ti, ti{+}1\} : ti, ti{+}1 \in T, i \in [1..|T| - 1]\}$

3: $TB \leftarrow \{\{ti, nl\} : ti \in T, i \in [1..|T|]\}$

4: $i \leftarrow 0$

5: for $\{\{t\_, tu\} : \{t\_, tu\} \in TA \cup TB\}$ do

6: $Ib \leftarrow$ TwoThresholdSegmentation($I, t\_, tu$)

7: $\Delta(x, y) \leftarrow$ FindBorders(Ib)

8: VSFTA[i] $\leftarrow$ BoxCounting(Δ)

9: VSFTA[$i + 1$] $\leftarrow$ MeanGrayLevel(I, Ib)

10: VSFTA[$i + 2$] $\leftarrow$ PixelCount(Ib)

11: $i \leftarrow i + 3$

12: end for

13: return VSFTA

Symbol Definition

- Δ Border image.
- I Grayscale image.
- Ib Binary image.
- Nl Grey level range.
- T Set of threshold values.
- Nt Number of thresholds.
- D Fractal dimension.
- D0 Haussdorf fractal dimension.

Speeded Up Robust Feature (SURF)

Speeded up Robust Features **(**SURF) is used to identify the objects whose representation has been scaled in its size and also identify the objects that are rotated in its axis. In other words SURF algorithm is a descriptor feature and a invariant detector. Variance is due to the incompleteness that is occurring during capturing and also the way information exists in reality. In order to measure the similarity between two images Invariance is one of the most important properties[9]. The data point that is described is unique

Canny Edge Detection

The Canny edge detector uses the squared gradient magnitude. If the local maxima of the gradient magnitude are above the threshold value, then identified they are identified as edges. The peak detection method is called Non-Maximum Suppression (NMS). One of the main goal Canny edge operator is to find an optimum solution that minimizes the probability of detecting multiple irrelevant edged and also maximizes the probability of detecting relevant edges and minimizes the distance of the retrieved edge from the true edge. This favors the marking of true positives. Canny edge is also used to achieve perfect localization to accurately marked edges and also minimize the number of responses to a single edge. The number of responses helps in the identification of true negatives, that is, nonedges are not marked. The Canny edge detection algorithm involves can be 5 different steps:

1. To remove the noise that is present in the image we use the Gaussian Filter. This method is called Smoothening.
2. Intensity gradients of the image are found
3. To get rid of irrelevant edge detection the non-maximum suppression is used
4. To determine potential edges threshold
5. The weak edges are suppressed and the strong edges are connected. This method is called Track Edge by hysteresis.

Similarity Measurement

Similarity measurement retrieves the most optimal image from the database and is used in many data mining systems. The objects containing multiple attributes are compared and the similarity between the objects is retrieved. Similarity refers to the degree to which the two objects are similar. It is a non-negative numerical value which ranges from 0-1, where 0 represents that there is no similarity between the images and 1 shows that the two images are completely similar.

In order to deal with large number of data types and attributes, an appropriate similarity measurement algorithm must be chosen that provides the maximum proximity between the two images. For example, Euclidean distance and correlation are useful for two-dimensional data or the dense data. Jaccard and cosine are used to measure the similarities in documents.

Euclidean Distance

Murkowski distance metric gave the Euclidean Distance between two points. It can be used for any number of dimensions. The Euclidean distance formula is given as

$$\mathrm{d}(\mathbf{p},\mathbf{q}) = \sqrt{(p_1-q_1)^2+(p_2-q_2)^2+\cdots+(p_n-q_n)^2} = \sqrt{\sum_{i=1}^{n}(p_i-q_i)^2}. \quad \dots (2)$$

Where ‘n’ denotes the number of dimensions. ‘p’ and ‘q’ are the points whose distance is to be measured. Then it combines the square of differences in each dimension into an overall distance.

Image Retrieval

The query image is compared with the featured database and the most optimal image from the database is retrieved.

EXPERIMENTAL RESULTS

Sample 250 brain tumor medical images was taken and stored in the database. Query images given, the relevant image was retrieved from the database using Mat Lab.

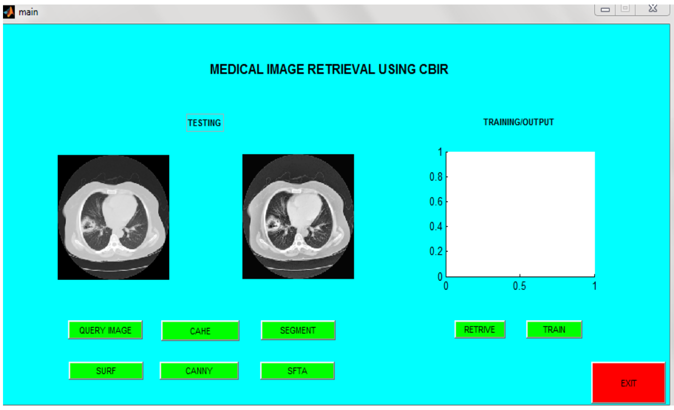


Fig 1. Image Retrieval for Contrast based Adaptive Histogram Equalization (CAHE)

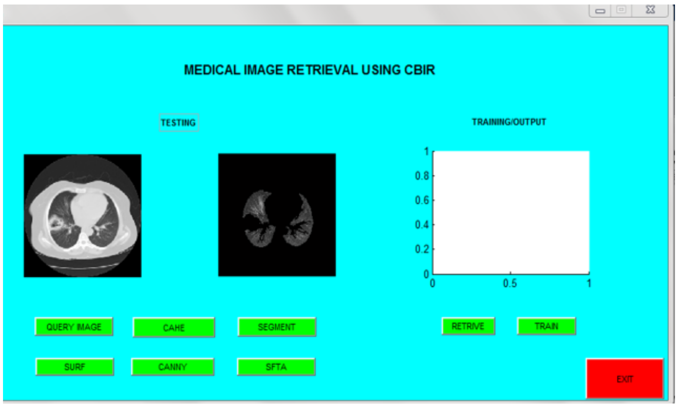


Fig 2. Image Retrieval for segmentation

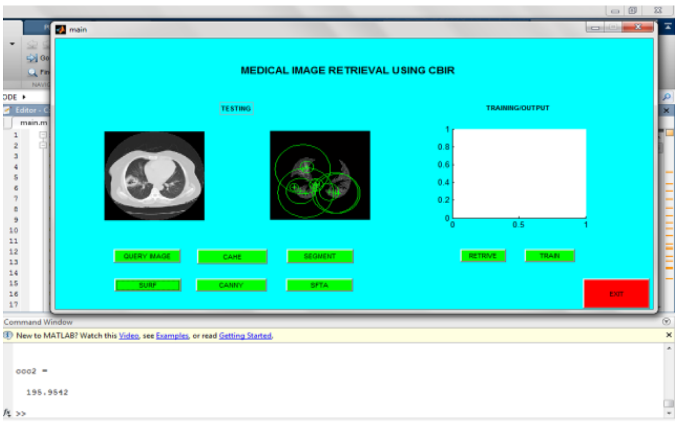


Fig 3. Image Retrieval for Segementation based futural textural analaysis(SFTA)

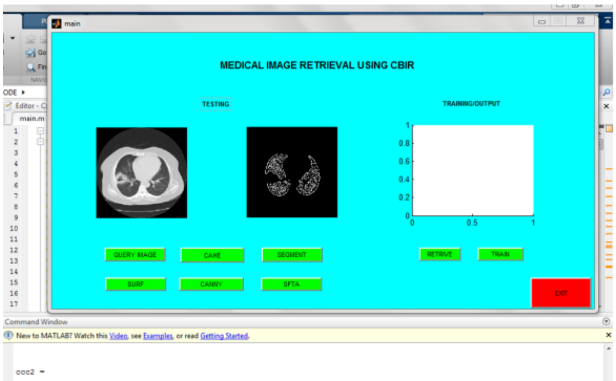


Fig 4. Image Retrieval for Canny edge detection

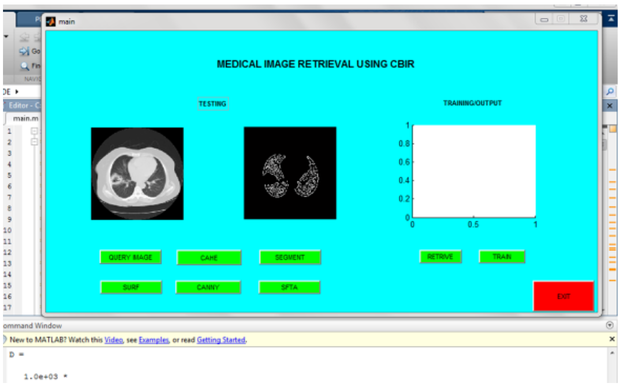


Fig 5. Image Retrieval for Segmentation based Fractal Texture Analysis (SFTA)

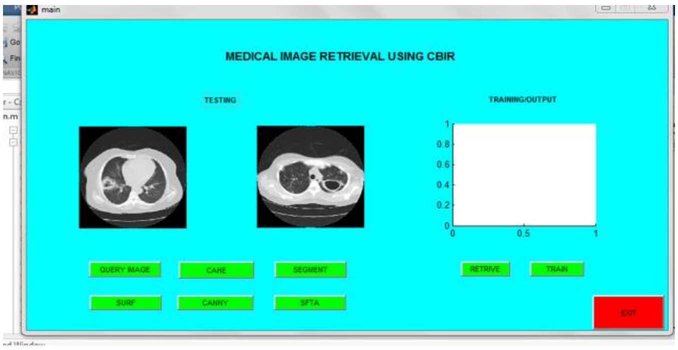


Fig 6. The best relevant image for the query image

CONCLUSION

The proposed image retrieval method has been successfully developed based on multiple features of the image (color, shape, texture).For the given query image, multiple similarity is listed based on different color feature extraction using SURF, texture feature extraction using SFTA and shape feature extraction using Canny Edge Detection. Our methodology gives the best relevant images from the database.

REFERENCES

[1] Priyatharshini R , Chitrakala S Springer-Verlag Berlin Heidelberge 2013; 17-26.
[2] Lawrence O Hall IEEE Transactio on neural networks 1992; 3(5).
[3] Wanjale K International Journal of Computer Applications 2010; 1(19).
[4] Ramamurthy , Chandran KR International Journal of Computer Applications 2011.

[5] Rahul Mehta , Nishchol Mishra Sanjeev, Sharma International Journal of Computer Applications 2011; 24(5).
[6] Paisarn Muneesawang, Ling Guan IEEE transactions on multimedia 2004; 6(5).
[7] Kherfi M.L, Ziou D, and Bernardi Elsevier journal 2003; .
[8] urugan M.V jeyanti P International Conference on Information Communication and Embedded Systems 2014 ;.
[9] Jeyanthi P Journal of Theoretical and Applied Information Technology 2015;.