A New Algorithm for Patient Data Retrieval in EMR System Using Wavelet

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***Abstract*—A new algorithm has been developed using wavelet based block processing for indexing and retrieval of digital images. In E-health monitoring system which provides a comprehensive solution for personal health care through remote monitoring of vital signs and management of medical data for diagnosis and treatment patient images can be captured and stored in the database. This paper aims at patient's data retrieval through the patient image enrollment and identification process. Enrolled patient's images are processed and stored as feature parameters. In identification process, the distance vector between each region is computed using feature parameter and the corresponding patient's record is retrieved. This approach decreases the patient data retrieval time and improves robustness.**

***Index Terms*—Wavelets, data retrieval, image segmentation.**

I. Introduction

There is an increasing need for multimedia usage in medical field. Patient's records are maintained in the image databases. Not only patient's identification images, patient's scanned records are also maintained in the image format and archived. For such applications, we need a proper search and data retrieval of patient's records. We can find numerous systems [1]-[3], available for image retrieval. But the common amongst all is they are in accurate in segmentation as well as feature extraction results to in accurate similarity comparison of images. In the suggested approach, the segmentation and clustering of images is done in the wavelet domain [4], [5] so it is not distracted due to linear operations like shift, translation and rotation etc. A multi-dimensional feature vector in wavelet domain is extracted for every image and stored in the database. While searching for an image, the feature vector for the target image is also extracted in the same format and compared against the database vectors. Matched vectors are sorted and presented in the decreasing order.

II. Methodology

A. Image Segmentation

The digital image can be represented in many ways like in RGB or HSV co-ordinates. Representing image in HSV co-ordinates has an advantage of it is not distracted to camera operations and illumination changes of images [6]. So in this method the image as shown in Fig. 1 is represented in HSV co-ordinates as shown in Fig. 2.

Fig. 1. Original image to be searched in RGB format.

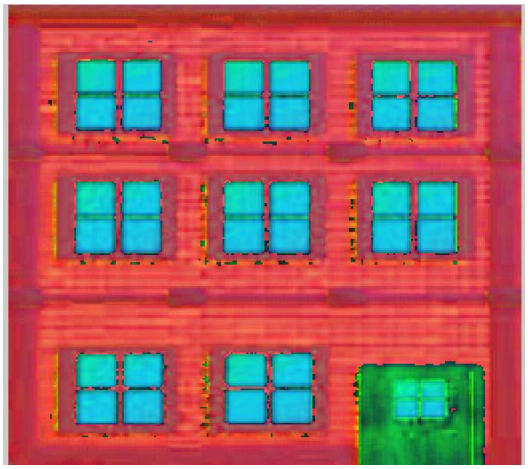

Fig. 2. HSV form of the original image to be searched.

The image is converted into 4x4 blocks [7] of pixels and by using 'Daubechies' wavelets, wavelet transform is applied [8], [9] to each block up to 3rd level. Approximation co efficient is extracted for H, S, V planes and detailed co efficient is extracted for H plane. From every image one vector will be extracted and stored in the database for later querying purpose. This vector consists of 6 values extracted from these co-efficients. First 3 values of the vector are H, S and V plane approximation co-efficients. The remaining 3 values are detailed co-efficients extracted from H plane alone. A K-means algorithm with suitable K value is applied on these 6 valued vectors and they are clustered in groups. This is the part of segmentation of the images in wavelet domain. Every cluster is known as one segment for an image. By experiments the optimum value for K (number of segments)

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is identified as 3. The Fig. 3 shows one such segmented image for the original image shown in Fig. 1 and its HSV form is shown in Fig. 2

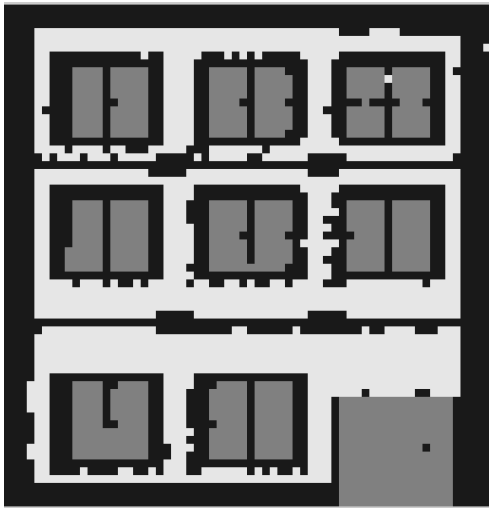

Fig. 3. Segmented form of the original image to be searched.

B. Feature Vectors and Search

Energy co-efficients are extracted in wavelet domain for every segments of an image. For every block present in every segment, a 10 valued energy vector is calculated. The 10 valued energy vector is framed by combining the following co-efficients. First, second and third level detailed co-efficients in H, S and V plane and one 3rd level detailed co efficient for the H plane. The distribution ratio followed for H, S and V plane is 1:2:1 and the 10 valued vector is calculated. Finally the energy vectors are calculated for every region and log values of these energy values are stored in the database.

When we want to search an image from the database with a reference image the same process is used to extract the 10 valued vector for the target image as well. During search, this vector is compared against all the vectors stored in the database. A weighted distance function is used for this comparison. For comparison, instead of considering the. whole image, regions are considered. For every region segmented in the target image, each region available in the database is compared with the distance function. To make this comparison more accurate, all decomposition levels are considered in the distance function. A similarity function is evaluated for query image against all images available in the database. Based on the similarity values calculated, the matched vector's images are listed in the decreasing order

III. Results

Fig. 4 shows the image comparison results. Left side displayed is the target image to be searched and in right side pane the similar images listed. For testing purpose, a database consists of 100 images is created and processed image vectors are stored in the database. For the example image search shown, the relevant image ratio and retrieved image ratio was 50%. To evaluate system efficiency "Elif Albuz et al" proposed method is used. The quality and the efficiency can be assessed in two methods. The ratio between the number of relevant images returned and the number of relevant images stored in the database. Second one is the ratio between the number of relevant images returned and the number of images returned by the system. Results obtained with 55% for the former one and 50% for the later one. The response time was 20 to 50 ms in an environment of 2GB RAM and 2GHz operating frequency. The system efficiency can be improved by optimizing the number of segments and the distance function.

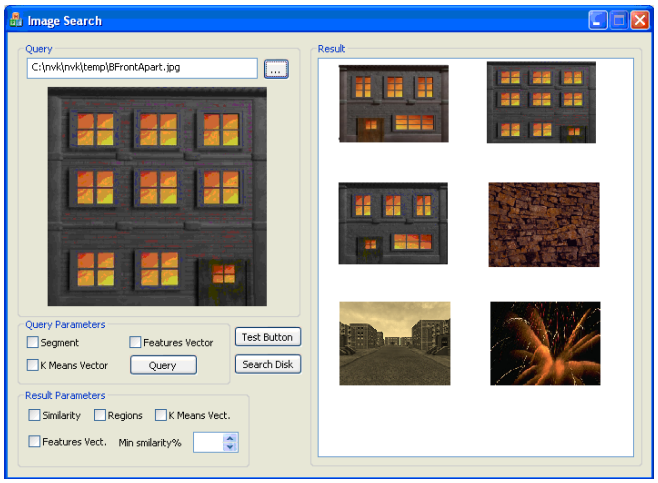

Fig. 4. Sample image to be searched and the retrieved results.

IV. Conclusion

An image search system is developed using wavelets for Patient Data Retrieval in EMR system in the approach. It uses block processing instead of pixel processing, which avoids the increased time complexity and reduces the processing time to a greater extent. K means algorithm is used for segmentation and energy function is used to calculate the vectors. By selecting suitable K value and appropriate distance function, the accuracy can be improved.

V. Future Work

The image database can be implemented in any of the commercial database systems available like ORACLE. The image indexing features available with these databases can be used to enhance the response time for the image retrieval system.

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