

Extreme Learning Machine for Effective Medical Image Retrieval

*¹S.Vyshali, ²M.V.Subramanyam and ³K.Soundara Rajan

¹Research Scholar, JNTUA, Anantapuramu, A.P, India.

²Professor & Principal, SRE College, Nandyal, A.P, India.

³Retd. Professor, JNTUA, Anantapuramu, A.P, India.

*Corresponding author E-mail: surashali@gmail.com

Abstract:

This paper presents an adaptive methodology for medical image retrieval using varies rotations. Dominant rotated local binary pattern has been tested in last few years in matching the images and is good choice to check for retrieval of medical images. The dominant rotation direction is considered, when the index of difference in distance of central pixel and neighbouring pixel is maximum. The direction of dominant path is considered in circular path and assigned the weights with the help of the dominant path. Because of the having dominant path direction, this gives faster, easy and efficient results in retrieving process. Histogram of rotational features, gradients, curvature features and various features of the query image and data images have to be compared to conclude a best suited image or images to query image.

Keyword: Local Binary Patterns, Rotation, Dominant, Features, Image retrieval.

1. Introduction

The feature extraction, indexing, feature extraction of query image, extraction comparing the query image feature with feature data base for optimum, quality report by the user are the basic procedure for Content based image retrieval [1-2]. Feature extraction [3-4] is playing important role in content based image retrieval (CBIR). In CBIR system primitive feature [5-6] defines colour, shape on the other hand domain specific feature concentrates on texture features, face recognition, finger prints recognition etc.,

Multi-object images with Geometry-based image retrieval system are developed in [7]. In this curvature tree (CT) is used for the image objects to modelling the shape and topology. Maximum similarity sub tree isomorphism (MSSI) problem is used to find the similarity index. The image object relationships are depends on the hierarchy of the CT reflects. The similarity between two multi-object images is measured based on MSSI between their CTs. The respective nodes of CTs facilitate shape-based matching, triangle-area representation of each object. Dynamic programming algorithm used to measure the similarity between the attributed nodes and to solve the MSSI problem recursive algorithm is employed.

Many applications which use evidence based medicine for Image retrieval in medical applications (IRMA) is explored in [8-9]. The IRMA retrieval process concentrates on following procedure. Each image section imaging methodology is done by Categorization. Registration process explains transformation parameters arrangement relates to image probable classes and used at abstraction higher layers. Every pixel feature value is given in feature extraction. Abstraction process explains feature selection of image category and query context. Produced and selected

image features deliberation handled by indexing process, leads for a compact image description. The identification step provides linking of medical a-priori knowledge to certain similar clustered image parts generated during the indexing step. A general CBIR approach for medical images presented by IRMA. IRMA gives appropriate human image databases from consolidated central database which uses distributed system architecture.

2. Proposed Method

The general rotated local binary pattern is having the problem of deviations to rotations in local binary pattern comes with setting of the weights to a fixed value. Here it is proposed an adaptive method for weight arrangement with local or resident calculated orientation path. Compared with gradient calculation and pixels differentiation, the dominant direction rotated local binary patterns can give better results. With this the computation of similarity is easy and time saving.

In this method statistical and textural feature extractions have been evaluated for the taken medical images. These features are generally like mean, standard deviation, skew ness, variance, entropy, energy, correlation, root mean square value, contrast, kurtosis, etc. Difference movements have been calculated. Geometrical features like area, perimeter, circularity, centroid and Centroid mid-point have been evaluated. Rotated local binary patterns and dominant rotated local binary patterns have been measured for comparing the query image with data base features. Histogram of some gradient of images is considered along with histogram of curvature of images. Tamura features are also considered for internal features. All the features are fused into set and reduced with reduction algorithm for speed up the process. An evolutionary algorithm based extreme learning machine is used for comparing the feature set of testing and training. Extreme

learning machine consist of two classification methods. Neural network architecture and discriminant analysis are combined in this process to get better results. All the images are given ranking based on similarity between the test and training images. The best suited values image can be taken as retrieved image from the given data base. The image types like X-ray image, magnetic resonance image, computed tomography scan image, ultrasound image, mammograms, etc. can be displayed and features or parameters of the taken or retrieved image along with details of the retrieved image, if any saved can be displayed.

3. Results and Discussion

A suitable and noisy medical query has been considered for retrieving process. The image has been enhanced with pre-processing techniques. As discussed above, the statistical, texture and area features have been evaluated. Dominant direction has been evaluated by rotating with different suitable angles. The table1 shows the statistical values of different features that were calculated for query image in dominant rotated local binary

patterns. Figure 1 is showing query, speckle noisy, denoised with denoising algorithm and post processed image. The post processed image is taken as query image. As discussed earlier, the feature set of query and database images are compared. Based on the similarity the ranking is given. Based on the required number of retrieval images the output is shown and parameters are calculated. Table 2 is calculated for a given query as discussed and database of 300 images. Based the rankings of the images of three categories of the images the confusion matrix is formed. The producer, user and overall accuracy are calculated and given in table 3. Other quality parameters like precision, F1 measure, sensitivity or recall and specificity for the proposed are calculated and formulated in table 4. These values are compared with different existing models to get better analysis and given table 5. The error rate of 0 and normalised average rank of retrieval of 0.04 are obtaining for the given method. These values are depending on the number of required retrieved images. Table 6 to table 8 shows the confusion matrix for second query image, different accuracies with the query image and different quality parameters with that query image are given respectively.

Table 1: Different features of the input medical query image

S.NO	Parameter	Value
1	Contrast	0.3230
2	Correlation	0.9687
3	Energy	0.1806
4	Homogeneity	0.8741
5	Mean	81.9966
6	Standard Deviation	77.7027
7	Entropy	6.1363
8	Root Mean Square	12.3067
9	Variance	4.1596 e+03
10	Smoothness	1.0000
11	Kurtosis	1.9333
12	Skew ness =	0.4502
13	IDM	255
14	Area	79665
15	Perimeter	3.1770e+03
16	Circularity	4.9354
17	Centroid Mid Point (X)	118.1801
18	Centroid Mid Point (Y)	241.1049

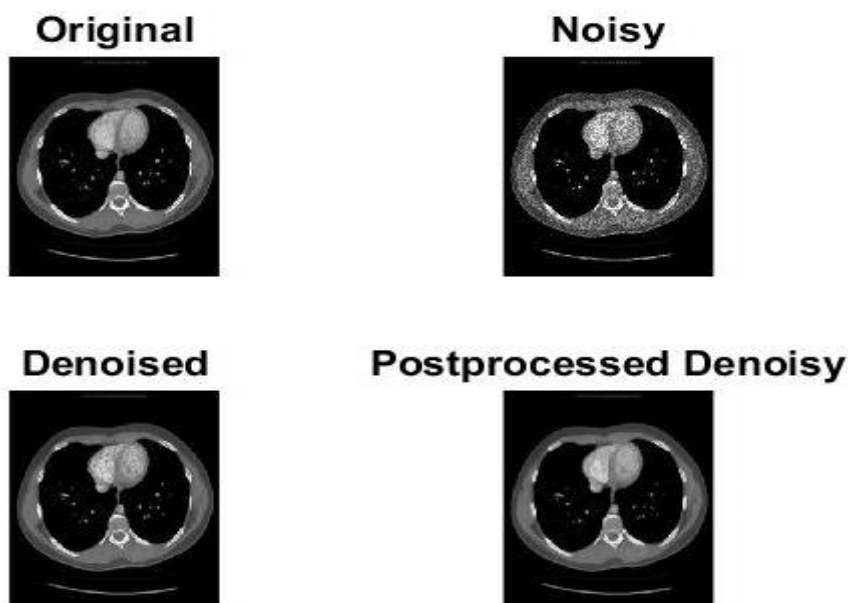


Figure 1: Input, speckle noisy image, denoised image and post processed image of query Image

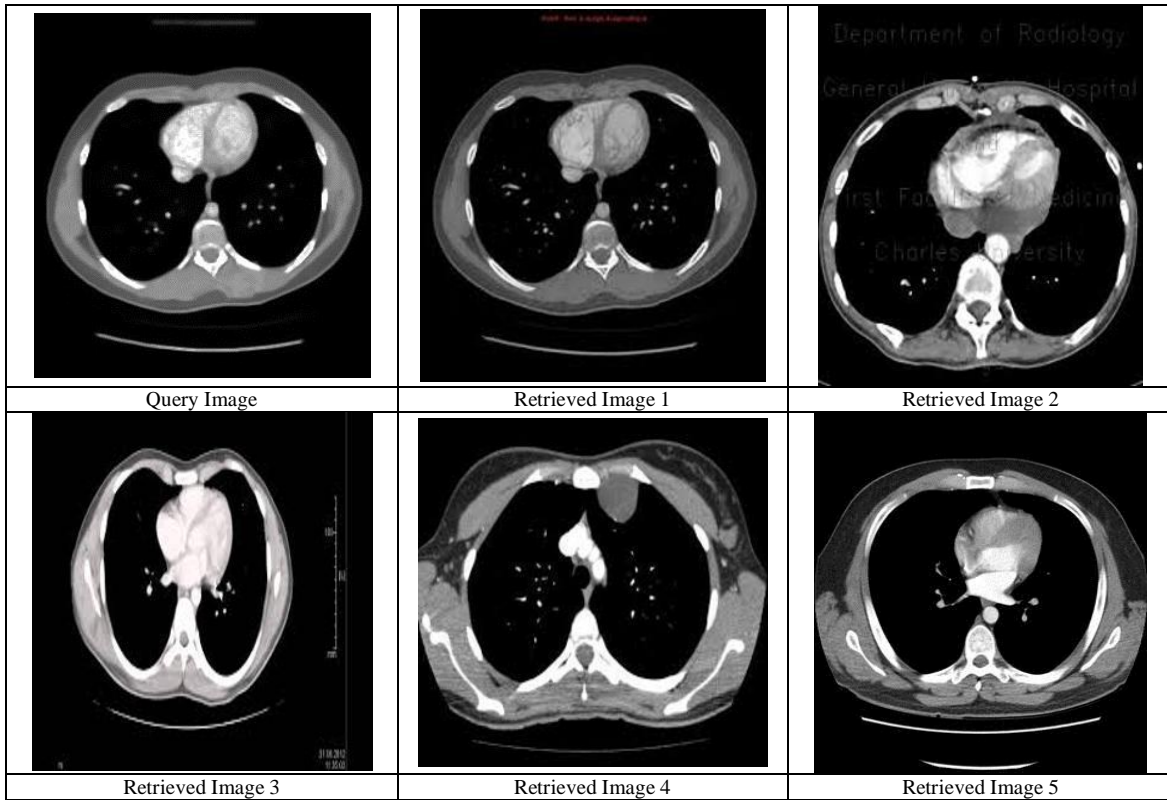


Figure 2: Query and its five retrieved images

Table 2: Confusion matrix for query image with extreme learning machine

		PREDICTED			
		CLASS	A	B	C
ACTUAL	A	97	0	3	100
	B	2	98	0	100
	C	0	3	97	100
	Total	99	101	100	300

Table 3: Accuracy measurements for query image with extreme learning machine

Class	Reference Pixels	Classified Pixels	Matching	Accuracy type	
				Producer	User
A	99	100	97	97.98%	97.00%
B	101	100	98	97.03%	98.00%
C	100	100	97	97.00%	97.00%
Total	300	300	292		
Overall Classification Accuracy				97.33%	

Table 4: Different parameters calculated for query image with extreme learning machine

	Accuracy	Precision	Recall	Specificity	F1 score
A	0.9733	0.9798	0.9700	0.9900	0.9749
B		0.9703	0.9800	0.9850	0.9751
C		0.9700	0.9700	0.9850	0.9700
Over all		0.973365	0.9733	0.9867	0.9733

Table 5: Different parameters calculated for query image with different methods

	Accuracy	Precision	Recall	Specificity	F1-score	Error Rate	NARR
LDEP	95.3333	95.3333	95.3333	97.6667	95.3333	0.1	0.2611
SR-EMD	90	90.3677	90	95	90.0821	0.1667	0.1167
GS	95.3333	95.3297	95.3297	97.6675	95.3297	0.1	0.2611
CNN	95.6667	95.6667	95.6667	97.8333	95.6667	0.1	0.05
Proposed	97.3333	97.3365	97.3333	98.6667	97.3333	0	0.04

Table 6: Confusion matrix for query image with extreme learning machine

		PREDICTED			
		CLASS	A	B	C
ACTUAL	A	99	0	1	100
	B	3	97	0	100
	C	1	2	97	100
	Total	103	99	98	300

Table 7: Accuracy measurements for query image with extreme learning machine

Class	Reference Pixels	Classified Pixels	Matching	Accuracy type	
				Producer	User
A	103	100	99	96.12%	99.00%
B	99	100	97	97.98%	97.00%
C	98	100	97	98.98%	97.00%
Total	300	300	293		
Overall Classification Accuracy				97.67%	

Table 8: Different parameters calculated for query image with extreme learning machine

	Accuracy	Precision	Recall	Specificity	F1 score
A	0.9767	0.9612	0.9900	0.9800	0.9754
B		0.9798	0.9700	0.9900	0.9749
C		0.9898	0.9700	0.9950	0.9798
Over all		0.9769	0.9767	0.9883	0.9767

4. Conclusion

This method is an adaptive method to retrieve the image from given database. It has been verified for different varieties of medical images like X-ray image, magnetic resonance image, etc. It has given the best matching images which are very much nearer to the original image. It is very much useful to a doctor to take decision based all the histories of the best suited images to query image. The explained method has given appreciable quality parameters like overall accuracy including producer and user accuracies, specificity, recall, kappa, etc. to say that it is one of the very good methods in this area.

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