Development of Medical Image Retrieval Model based on Minimum Cross Entropy Thresholding

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Abstract— **In this paper one of modern methods of edges detection was used for medical images retrieval. The edge detection gives the useful image information and neglects the other data of the image. This method is based on Minimum Cross Entropy Thresholding in the medical image edge detection, because it has a higher edge detection capability than other conventional methods, it also in the noise images the results were accurate and fast. X-ray images were used as the main input for the proposed study. These images were collected from the Radiology Department at Misurata Central Hospital. Since sample images came with some noise and low resolution, the accuracy of the system outputs will be challenge. These images were divided into five groups (chest, knee, pelvis, hand, foot), and each group of not less than six images. As a total, the used database accommodated seventy medical images. Some similarity measurements were used for the retrieval process. The efficiency and accuracy of the algorithm was measured in the process of retrieval medical images using precision and recall rates, as well as the time measurement function. The results obtained from the development system shown good results interms of accuracy and retrieving speed compared to canny edge detection method in the retrieval process.**

Keywords- Image retrieval; Minimum Cross Entropy Threshold; Edge Detection; Content-Based Image Retrieval (CBIR); Medical Images.

I. INTRODUCTION

The volume of information and medical images for individuals are growing very rapidly in recent years. These images are subject to heavy analysis in order to extract available information from them. As a result, the need to creative methods to archive and access these images motivates many researches to tackle this issue.

As that search in conventional databases only allow for textual search on metadata . Often, the database only includes references to the image data, which are stored on the file system as individual files[1]. Since the images are stored according to patient names, it makes searching on a special organ or ailing is very difficult task. To overcome this issue, the mining and retrieving the information based on the images content has become an urgent necessity.

However, interpreting of a medical image goes through three steps: the first step is identifying contents of the image. The second step is the interpretation of these contents and in third step adducing recommendation to medical administration is provided [2]. Moreover, for doctors to do these steps, they need to look in images similar to the case of their patient's injury from the database of medical images for comparison and conclusion. In case the database was very huge, as is the case today, the need for an approach to help in retrieving images from the database similar to a specific picture (the query image) is raised. This process should be done timely and systematically to help in images interpretation. To accomplish this task, a massive database management for medical images processing is needed [2].

However, image mining is defined as searching and finding valuable information and knowledge in huge files of data [3]. In addition, the main goals of data mining are fast data/information retrieving and discovering knowledge from the databases [4]. Clearly, the image mining requires that images are retrieved based on several requirement specifications such as visual image features[5]. The study in [5] focuses on query image contents which considered a very important factor in retrieving the desired images.

The CBIR system is based on the quality of the extracted features. Images edges are regions with strong intensity than other regions. Edges are a jump in intensity from one pixel to the next. In addition, using the edge detecting of an image can reduce the amount of data and filters out un useful information. As a result, it preserves the important structural properties in an image [6]. However, entropy is used to distinguish the texture of the input image, its value and does not affected by rotation nor scaling [7].

II. RELATED WORKS

Many studies have been done during last few years regarding to image retrieval. However the most relevant studies for our approach are discussed in the reminder of this chapter.

The authors in [8] presented an effective approach for content based image retrieval (CBIR). It presented four methods for calculating the feature vector of image. Retrieving the images from the database using the entropy of sub blocks of one, three, four and twelve bit plane as a feature vector. Using threshold bit plane one for inter band average image and three for color image on other side using bit plane slicing upper four bit plane for gray scale image and twelve bit plane (upper four for each color plane) for color image entropy feature vector is calculated and compared with each other. To improve the precision and recall performance of each method entropy sub block of each type of bit plane calculate which performance is better than full bit plane. Using a similarity measurement for computing the distance between each database image and query image on feature vector to find set of images falling in the class of query image. In this approach performance of twelve bit plane entropy feature vector of color image shown good results.

In [9], the researchers proposed a model for the Content Based Medical Image Retrieval System by using texture feature in calculating the GLCM. It used a various statistical measures in sake of increasing similarities between query image and database images for improving the retrieval performance. This model was developed successfully in an effective manner by achieving the targeted output. This image retrieval model is capable of retrieving images based on the texture feature of the image. It takes into account the preprocessing as a traditional segmentation process, feature extraction, classification and retrieval steps in order to construct an efficient retrieval tool. The model was designed with a flexible and consistent flow for easy understanding. By achieved the targeted output, the results shown that the system has been developed successfully and in effective manner.

The researchers in [7] suggested a method for automatic image retrieval using moment invariants and image entropy. This method consists of two parts, which are region selection and shape matching. In the first part, the image is partitioned into a set of sub images by using a local diffusive segmentation method. In the second part, the image entropy is computed and used to narrow-down the search space. The later, the moment invariants of the image are matched, which are independent to translation, scale, rotation and contrast, to every sub image and to the given template. To this effect, this method uses image moments and entropy experimental results demonstrate that the purposed technique is efficient.

In [10] the Content based image retrieval was done by using the edge detection algorithm called canny edge detection algorithm. It used the color and texture for retrieving the image. Because color is the important cue in extracting the information from images, color histograms are commonly used in content based retrieval systems and they are very useful. Also texture plays an important role, because all the region is spatially distributed on the image. That regions are taken into consideration for the gradients calculation in the canny edge detection algorithm. That regions were smoothed and further steps done for selected regions. This make the work easy, thus the texture played an important role in the image retrieval. So that the image retrieval was accurate and the correct image was retrieved, all the steps are played a major role in the implementation to give good result.

The study in [6] introduced a shape representation and retrieval method using the canny edge detection operator to shape features of medical images. At first, the color image is read from a database that contains a collection of medical images. These images are converted to grayscale images. Then global thresholding value was applied in order to obtain binary images. After that, a median filter was used to remove noise. Finally, canny edge detection algorithm was applied to produce the final images. This algorithm is considered to be a very good candidate for image retrieval. This is due to high generalization performance of canny edge detection. The experimental results revealed that the method gained good results.

III. Minimum Cross Entropy Thresholding & Edge Detection Algorithm

The image edges provides important information about the image contents since they constitute boundaries between objects in the image. However, the images are prone to artifacts and noise . To obtain valuable information from edge detection technique an accurate method for edge detection is needed [11]. The reminder of this chapter introduces entropy and minimum cross entropy thresholding.

A. Cross Entropy Thresholding

It measures distance between two distributions. This distance is a theoretic information. Cross entropy is used as a constraint for imposition the total intensity in the thresholded image. It is intended to be identical to the original image. This achieved by minimization of cross entropy between input image and output binary image. Since image thresholding is considered one of the methods used for separating objects from the background, the most widely used thresholding technique is depended on the grey level histogram[12]. Thresholding of an image accurately allows examining and analyzing the isolated regions in better details. Moreover, the thresholding is lesser rigorous computation than most of the current available methods, and it easier for implementation successfully. It has various applications including target detection in medical images and document analysis [13]. To clarify this aspect, let $F = \{ f_1 ,f_2, \dots , f_N \}$ and $G = \{ g_1 ,g_2 ,\dots, g_N \}$ are two probability distributions on the same set [11]. As reported in[11], the cross entropy between F and G is defined by:

$$D\,(F,G) = \sum_{i=1}^{N} f_i \, log \frac{f_i}{g_i}$$

B. Minimum Cross Entropy Thresholding

The minimum cross entropy thresholding algorithm selects several thresholds by minimizing the cross entropy between the original image and the resulting image [11]. To explain this aspect, let I be the original image and the corresponding histogram is $h(i), i=1,2,\dots,L$ when L is being the number of gray levels. Then the resulting image, denoted by I_t using t as the threshold value is constructed as informed in[11]:

$$I_t\,(x,y) = \begin{cases} \mu\,(1,t) & I(x,y) < t \\ \mu\,(t,L+1) & I(x,y) \geq t \end{cases}$$

where:

$$\mu\ (a,b) = \frac{\sum_{i=a}^{b-1} i\, h(i)}{\sum_{i=a}^{b-1} h(i)}$$

the cross entropy is then calculated by:

$$D\ (t) = \sum_{i=1}^{L} i\, h(i)\log(i) - \sum_{i=1}^{t-1} i\, h(i) loge(\mu(1,t))$$
$$- \sum_{i=1}^{L} i\, h(i)\log(\mu(t,L+1))$$

As reported in[11] the Minimum Cross Entropy thresholding algorithm determines the optimal threshold by minimizing the cross entropy is formulated based on equation:

$$t^* = argmin\,\{D(t)\}$$

C. Edge Detection using Minimum Cross Entropy Thresholding

May be defined a spatial filter mask as a matrix *w* of size $m\times n$. The spatial filtering process is consisting simply by moving a filter mask *w* of order $m\times n$ from point to point in an image. At each point *(x,y)*, the response of the filter at that point is calculated a predefined relationship. Assume that $m=2a+1$ and $m = 2b+1$, where *a*, *b* are nonnegative integers[11]. For this, smallest meaningful size of the mask is 3×3, as shown in Fig (1).

W(-1,-1)	*W(-1,0)*	*W(-1, 1)*
W(-0,-1)	*W(0,0)*	*W(0, 1)*
W(1,-1)	*W(1,0)*	*W(1, 1)*

Figure (1) Mask coefficients showing coordinate arrangement

f(x-1,y-1)	*f(x-1,y)*	*f(x-1, y+1)*
f(x,y-1)	*f(x,y)*	*f(x, y+1)*
f(x+1,y-1)	*f(x+1,y)*	*f(x+1, y+1)*

Figure (2) Image region under the mask

Image region under the above mask is shown in Fig. (2). In order to detect an edge, mostly classified of all a pixels that satisfy the criterion of homogeneousness. After that, all the pixels on the borders between different homogeneous areas are detected. This scheme is preformed through creating a binary image by choosing a suitable threshold value using minimum cross entropy. Window is applied on the binary image, to find the edge pixels[11]. Set all window coefficients equal to 1 except center, center equal to x as shown in Fig (3).

1	1	1
1	X	1
1	1	1

Figure (3) Window coefficients

After that move the window on the whole binary image and find the probability of each central pixel of image under the window. Then, the entropy of each central pixel of image under the window is calculated as:

$$H\ (CP) = -\,p_c\ \ ln\ (p_c)$$

where, p_c is the probability of central pixel, and *CP* of binary image under the window. When the probability of central pixel $pc = 1$ then the entropy of this pixel is zero. Thus, if the gray level of all pixels under the window homogeneous, then $p_c = 1$ and $H = 0$. In this case, the central pixel is not an edge pixel.

The Algorithm that shown Figure (4) summarize this technique for calculating the optimal threshold values and the edge detector[11].

Algorithm: Edge Detection

1. **Input:** Image I of size $M \times N$ and t^{opt}, that has been calculated by Minimum Cross Entropy.
2. Create a binary image: For all x, y,
   if $I(x,y) \le t^{opt}$ ***then*** $f(x,y) = 0$ ***else*** $f(x,y) = 1$.
3. Create a mask w of order $m \times n$, in our case ($m = 3, n = 3$)
4. Create an $M \times N$ output image g: For all x and y, Set $g(x,y) = f(x,y)$.
5. Checking for edge pixels:
   Calculate: $a = (m-1)/2$ and $b = (n-1)/2$.
   For all $y \in \{b+1, \ldots, N-b\}$, and $x \in \{a+1, \ldots, M-a\}$,
   $sum = 0$;
   For all $l \in \{-b, \ldots, b\}$, and $j \in \{-a, \ldots, a\}$,
   if ($f(x,y) = f(x+j, y+l)$) ***then*** $sum = sum + 1$.
   if ($sum > 6$) ***then*** $g(x,y) = 0$ ***else*** $g(x,y) = 1$.
6. **Output**: The edge detection image g of I.

Figure (4) Edge Detection using Minimum Cross Entropy Thresholding

The edge detection using minimum cross entropy thresholding algorithm is applied as follows:

Stage 1: Find optimal threshold value (t) using Minimum Cross Entropy.

Stage 2: Applying Edge Detection Procedure with threshold value [11].

In [11] the authors proved that this algorithm is able to detect highest edge pixels in images, and decrease the computation time generating a high quality edge detection. Also it gives smooth and thin edges without distorting the shape of images. Another benefit comes from easy implementation of this algorithm.

IV. Analysis and Classification of Data

A sample of seventy x-ray images were selected to test the proposed approach. Chosen images were divided into five categories (chest, foot, hand, knee, pelvic). Each group contain at least six images. Moreover, for serious testing the selected images came with some noise, and less resolution.

V. The Proposed Model

Once the images are collected and classified, edge detection algorithm was applied in order to extract images features. This process goes through several steps:

The first step, some pre-processes were applied such as convert the images to a fixed size (256x256), and same extension (bmp), which were in gray level type. In second step, the threshold (minimum cross entropy thresholding) was calculated for the x-ray images. In third step, the images were converted to binary by selected threshold. The image pixels less than threshold placed equal zero, whereas the image pixels larger than threshold equal one. In final step, the images edges were detected as shown in Figure(5).

(a) original image (b) binary image (c) image edge

Figure (5) convert an image to binary and detect the edges

After obtaining the features of the sample images by detecting their edges, and selecting the query image to get its features, the similarity was measured between features of database images and query image using several scales, the closest images to the tested image were retrieved.

Some pre-processes were applied on the selected images sample for testing the proposed method. This sample was saved in same path. The retrieval process calls and deals with the images easily via text database, which containing the images name and extension. Then, the images were called for detection their edges, also the query image was called from the same database for detecting its edges. In order to measure the similarity between the query image and the database images features, the retrieval process needs some similarity parameters. The proposed model of the work is illustrated in Figure(6).

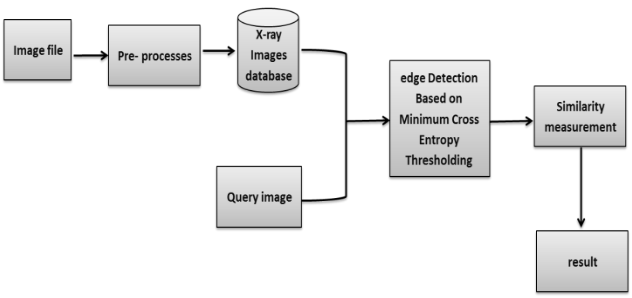

Figure (6) The proposed model of the work

VI. The Prototype System

The prototype system was built using a MATLAB R2013b software application on Intel® Pentium® CPU 2020M @ 2.40GHZ with 4 GB RAM.

To evaluate this model, a graphical user interface is needed. It was built using MATLAB GUIDE, and designed by using the layout tools provided by GUIDE as explained in Figure (7).

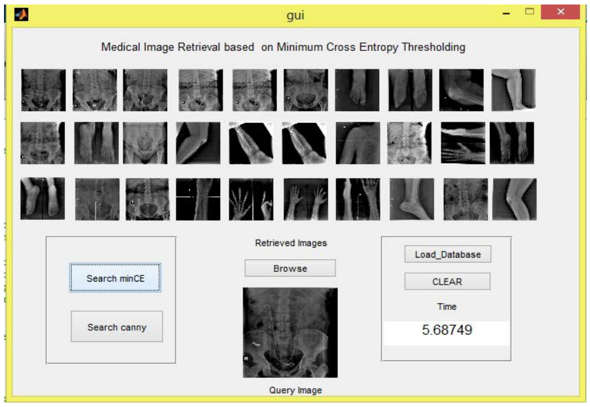

Figure (7) The user interface for medical image retrieval using minimum cross entropy thresholding

The prototype system offers two edge detection methods which are (canny and minCE) for retrieving images purpose. Among seventy medical image that accommodated in the database, the prototype model retrieves thirty images. These images are viewed in GUL axeses. In addition the execution time of each retrieval method is displayed in GUI.

VII. Results and Discussion

The proposed model was evaluated by comparing its results to one of the conventional edge detection model which is (canny) in terms of the retrieval process. Some similarity measures were used to retrieving process. For retrieval efficiency calculation, precision and recall values were calculated for randomly selected query images from seventy medical images database. The following benchmark formulas have been used to calculate the precision values and recall respectively.

$$\text{Precision} = \frac{\text{No.of relevant images retrieved}}{\text{Total No.of images retrieved}}$$

$$\text{Recall} = \frac{\text{No.of relevant images retrieved}}{\text{Total No.of relevant images in the Database}}$$

The efficiency of the proposed algorithm was demonstrated by testing it over different noisy medical images and comparing it with traditional algorithm (canny).

The tables (I) and (II) respectively show, a comparison of the precision and recall values between canny and proposed methods using corr2 similarity measure. It has been found that, the proposed method was better in (Knee, Hand, Foot) image categories, and it was similar in (chest) image category, however it was lower in (pelvic) image category than canny method.

TABLE I. The precision by corr2 similarity measure

corr2					
	Pelvic	***Knee***	***Chest***	***hand***	***Foot***
Canny	0.433333333	0.266666667	0.133333333	0.2	0.333333333
minCE	0.4	0.3	0.133333333	0.233333333	0.4

TABLE II. THE RECALL BY CORR2 SIMILARITY MEASURE

corr2					
	Pelvic	***Knee***	***Chest***	***Hand***	***Foot***
Canny	0.764705882	0.666666667	0.666666667	0.545454545	0.769230769
minCE	0.705882353	0.75	0.666666667	0.636363636	0.923076923

After, the precision and recall were calculated , the linear relationship between recall of canny and proposed methods by corr2 similarity measure for each images category was calculated as shown in Fig(8).

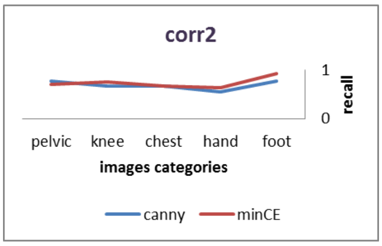

Figure (8) The linear relationship for recall by corr2 similarity measure

As shown in tables (III) and (IV) , a comparison of the precision and recall values between canny and proposed methods by mse similarity measure was conducted. It has been found that, the proposed method was better in (pelvic, Knee, chest) image categories, but it was lower in (hand, foot) image categories than canny method.

TABLE III. THE PRECISION BY MSE SIMILARITY MEASURE

Mse					
	Pelvic	***Knee***	***Chest***	***Hand***	***foot***
Canny	0.033333333	0.3	0.1	0.233333333	0.233333333
minCE	0.266666667	0.4	0.133333333	0.066666667	0.133333333

TABLE IV. THE RECALL BY MSE SIMILARITY MEASURE

mse					
	Pelvic	***Knee***	***Chest***	***Hand***	***Foot***
Canny	0.058823529	0.75	0.5	0.636363636	0.538461538
minCE	0.470588235	1	0.666666667	0.181818182	0.307692308

The linear relationship between recall of canny and proposed methods by mse similarity measure was calculated as shown in Fig(9).

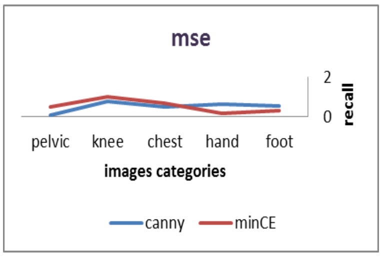

Figure (9) The linear relationship for recall by mse similarity measure

Moving on tables (V) and (VI) , a comparison of the precision and recall values between canny and proposed methods by entropy similarity measure was carried out. It has been found that, the proposed method was better in (pelvic, Knee, chest) image categories. Nevertheless, it was lower in (hand, foot) image categories than canny method.

TABLE V. THE PRECISION BY ENTROPY SIMILARITY MEASURE

Entropy					
	Pelvic	***Knee***	***Chest***	***Hand***	***foot***
Canny	0.033333333	0.333333333	0.1	0.233333333	0.233333333
minCE	0.266666667	0.4	0.133333333	0.066666667	0.133333333

TABLE VI. THE RECALL BY ENTROPY SIMILARITY MEASURE

Entropy					
	Pelvic	***Knee***	***Chest***	***Hand***	***Foot***
Canny	0.058823529	0.83333333	0.5	0.636363636	0.538461538
MinCE	0.470588235	1	0.66666667	0.181818182	0.307692308

The linear relationship between recall of canny and proposed methods by entropy similarity measure was computed as shown in Fig(10).

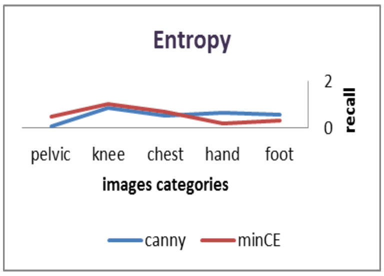

Figure (10) The linear relationship for recall by entropy similarity measure

As explained in tables (VII) and (VIII), a comparison of the precision and recall values between canny and proposed methods by ssim similarity measure was done. It has been found that, the proposed method was better in (pelvic, Knee, chest) image categories. On other hand, it was lower in (hand, foot) image categories than canny method.

TABLE VII. THE PRECISION BY SSIM SIMILARITY MEASURE

	Ssim				
	Pelvic	***Knee***	***Chest***	***Hand***	***foot***
Canny	0.066666667	0.333333333	0.066666667	0.2	0.233333333
MinCE	0.266666667	0.366666667	0.133333333	0.066666667	0.166666667

TABLE VIII. THE RECALL BY SSIM SIMILARITY MEASURE

	Ssim				
	Pelvic	***Knee***	***Chest***	***Hand***	***Foot***
Canny	0.117647059	0.833333333	0.333333333	0.545454545	0.538461538
minCE	0.470588235	0.916666667	0.666666667	0.181818182	0.384615385

The linear relationship between recall of canny and proposed methods by ssim similarity measure was determined as shown in Fig(11).

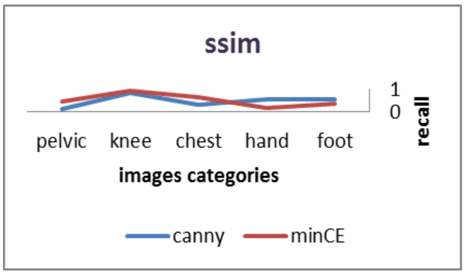

Figure (11) The linear relationship for recall by ssim similarity measure

When it comes to tables (IX) and (X) , a comparison of the precision and recall values between canny and proposed methods by norm similarity measure was performed. It has been found that, the proposed method was better in (Knee, Hand) image categories, it was similar in (Foot) image category, but it was lower in (pelvic, chest) image categories than canny method.

TABLE IX. THE PRECISION BY NORM SIMILARITY MEASURE

	Norm				
	Pelvic	***Knee***	***Chest***	***Hand***	***foot***
Canny	0.533333333	0.266666667	0.2	0.066666667	0.333333333
MinCE	0.466666667	0.333333333	0.166666667	0.1	0.333333333

TABLE X. THE RECALL BY NORM SIMILARITY MEASURE

	Norm				
	Pelvic	***Knee***	***Chest***	***Hand***	***Foot***
Canny	0.941176471	0.666666667	1	0.181818182	0.769230769
minCE	0.823529412	0.833333333	0.833333333	0.272727273	0.769230769

The linear relationship between recall of canny and proposed methods by norm similarity measure was calculated as shown in Fig(12).

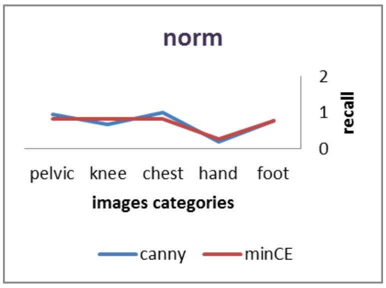

Figure (12) The linear relationship for recall by norm similarity measure

The overall average (precision / recall) of proposed method for image retrieval also computed in order to evaluate the proposed method performance for image retrieval. It has been found that, the proposed method show good results in terms of accuracy as Fig(13) demonstrates.

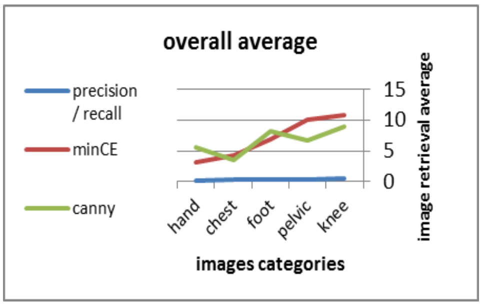

Figure (13) The linear relationship of overall average for image retrieval

There is another interesting finding, when the prototype system execution time in seconds of each method on each similarity measures were calculated. It has been observed that the proposed algorithm works effectively comparing to the run time of other method (canny) with all similarity measures.

Tables (XI), (XII) and (XIII) respectively show, the prototype system execution time in second of canny and proposed methods using corr2, mse and ssim similarity measures. The obtained result has been shown that, the proposed method was speeder in (Knee, chest, Hand, Foot) image categories, but it was slower in (pelvic) image category than canny method.

TABLE XI. THE EXECUTION TIME OF THE PROTOTYPE SYSTEM BY CORR2 SIMILARITY MEASURE.

corr2-time (seconds)

	Pelvic	*Knee*	*Chest*	*hand*	*foot*
Canny	5.65455	5.65388	5.65409	5.65263	5.64723
minCE	5.6469	5.6445	5.6439	5.6437	5.63904

TABLE XII. THE EXECUTION TIME OF THE PROTOTYPE SYSTEM BY MSE SIMILARITY MEASURE.

mse-time (seconds)					
	Pelvic	*Knee*	*Chest*	*hand*	*foot*
Canny	5.4614	5.584	5.463	5.8234	5.943
minCE	5.4947	5.583	5.457	5.68224	5.64554

TABLE XIII. THE EXECUTION TIME OF THE PROTOTYPE SYSTEM BY SSIM SIMILARITY MEASURE.

ssim-time (seconds)					
	Pelvic	*Knee*	*Chest*	*hand*	*foot*
Canny	6.184	6.314	6.087	6.211	6.024
minCE	6.256	6.2127	6.0112	6.126	6.013

Fig(14), (15) and (16) show the linear relationship between proposed algorithm run time and the canny algorithm run time using corr2, mse and ssim similarity measures.

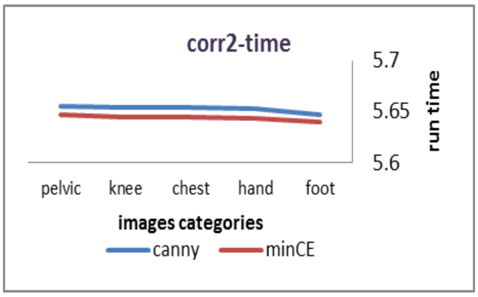

Figure (14) The linear relationship between proposed algorithm run time with the canny algorithm run time using corr2 similarity measure

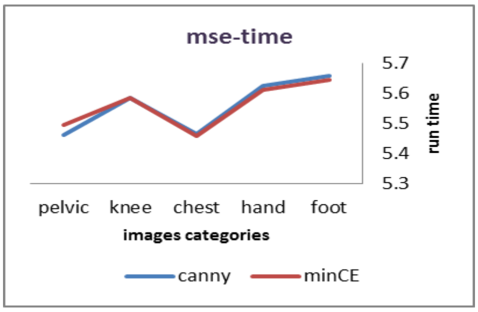

Figure (15) The linear relationship between proposed algorithm run time with the canny algorithm run time using mse similarity measure

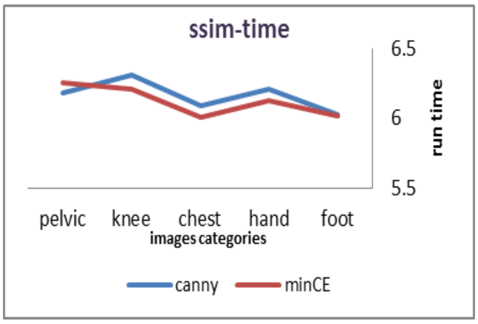

Figure (16) The linear relationship between proposed algorithm run time with the canny algorithm run time using ssim similarity measure

The table (XIV), show the prototype system execution time in second of canny and proposed methods using entropy similarity measure. The obtained result has been shown that, the proposed method was speeder in (Pelvic, Knee, chest, Hand) image categories, but it was slower in (Foot) image category than canny method.

TABLE XIV. THE EXECUTION TIME OF THE PROTOTYPE SYSTEM BY ENTROPY SIMILARITY MEASURE

entropy-time (seconds)					
	Pelvic	*Knee*	*Chest*	*hand*	*foot*
Canny	5.65455	5.65388	5.65409	5.75263	5.63723
minCE	5.6469	5.6445	5.6439	5.7437	5.63904

Fig(17), shows The linear relationship between proposed algorithm run time and the canny algorithm run time using entropy similarity measure.

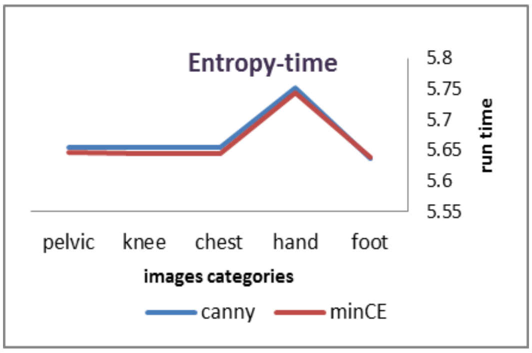

Figure (17) The linear relationship between proposed algorithm run time with the canny algorithm run time using entropy similarity measure

In addition, table (XV), shows the prototype system execution time in second of canny and proposed methods using norm similarity measure. The acquired result has been explained that, the proposed method was speeder in (Pelvic, Knee, chest, Foot) image categories. However, it was slower in (Hand) image category than canny method.

TABLE XV. THE EXECUTION TIME OF THE PROTOTYPE SYSTEM BY NORM SIMILARITY MEASURE.

norm-time (seconds)					
	Pelvic	*Knee*	*Chest*	*hand*	*foot*
Canny	6.532	6.561	6.346	6.326	6.541

minCE	6.476	6.542	6.251	6.342	6.457

Fig(18), shows The linear relationship between proposed algorithm run time and the canny algorithm run time using norm similarity measure.

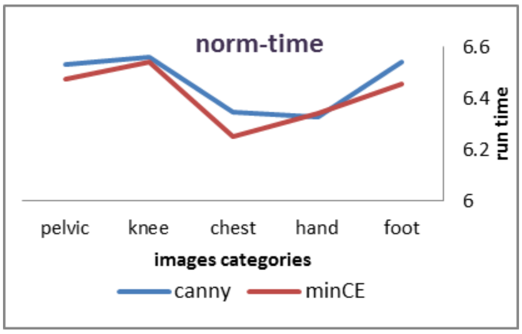

Figure (18) The linear relationship between proposed algorithm run time with the canny algorithm run time using norm similarity measure

VIII. Conclusions

The proposed method concerns with retrieving the medical images from database using the edge detection for extracting the shape features of these images. Edge detection was obtained by using the minimum cross entropy thresholding algorithm. Also some similarity measures were used for the retrieval process. In order to evaluate the proposed method performance, the precision and recall values were computed.

The linear relationship of recall between proposed method and the other method (canny) shows good results for the proposed algorithm.

To find out minimum cross entropy thresholding algorithm performance for image retrieval, the overall average (precision / recall) value was computed . The overall average value demonstrates good results for the proposed algorithm performs.

It has been observed that the proposed algorithm works effectively comparing to the run time of the other method (canny) with most similarity measures.

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