International Journal of Combined Research & Development (IJCRD)
eISSN:2321-225X;pISSN:2321-2241 Volume: 3; Issue: 5; November -2014

CDS: A Novel Approach System for the Detection of Calcification in the Breast Cancer Images.

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Abstract: **The most deadly disease which causes more death worldwide is cancer. Among women, the major death cause is due to breast cancer and cervical cancer. If the cancer tissues detected earlier then it will be easy to get rid off by medical application. The major concern is to identify the existence of the cancer tissue. Even though many computer aided applications have been developed for the detection still improvements can be done for efficient results. This paper presents a novel system "Calcification Detection System", which identifies even the very smallest cancer tissue in the images of mammography and others. The architecture makes use of clustering algorithms like K-Means and K-Medoid improved versions and implemented using MATLAB.**

Keywords: Cancer, Calcification, Mammography, K-Means, K-Medoid.

I.INTRODUCTION

The leading diagnosed cancer among women is breast cancer and is causing more deaths in women. Generally there are many situations where the person suffering from cancer comes to know at the final stages due to lack of knowledge or unable for the detection with the screening techniques. So early detection [1] has to be done so that easily it can be prevented. The main problem is in detection of calcifications of very small size which can be termed as micro-calcification. If neglected which may lead to the growth of large tissues and can spread over the body area, and may lead to death. Especially for breast cancer the mammography is the most commonly used screening tool. There are many issues also in mammography [2] as it will be suggested for age of women over 40years which fails in the early detection. Due to the high risk and mutation of BRCA1 and BRCA2 gene there may be increase in risk of development of cancer more than five times of development. And only single screening technique will not give sufficient details for the existence.

There are mainly two different types of breast cancer invasive and non invasive breast cancer. For invasive breast cancer it spreads outside the membrane invading the surrounding tissues. For non invasive the cancer cells remains in the same place not spreading around the surroundings.

The major symptoms will be lumpiness around the arm pit which may look like uneven edges and hard to feel, shape changes of breast, fluid like blood coming from breast nipple. For men also there may be possibility of developing breast cancer and the symptoms for men are breast lump, pain and tenderness, paining of bones, loss of weight.

Considering all these things, this paper presents a novel approach which detects the micro calcified tissue.

II.RELATED WORK

Alaa A. Hefnary[4], proposed an approach for the detection of breast cancer using watershed algorithm which makes use of watershed transform and level set method.

Aioub Zeinvand Lorestani et. al[5], in his work , makes use of fuzzy logic combined with the neural networks for detection in early stages.

R. Ramani et.al[6], mentioned in her survey paper about the various clustering techniques based on K-Means related algorithms.

Many approaches are there for the detection of the micro calcification but then also there are many issues related to it. Patient undergoing radiation may have their DNA affected which changes in the mutation and may lead to the development. If undergone for breast biopsy then also in future there may be risk of getting breast cancer.

But we require a methodology to identify the micro calcified tissue in the noisy images and providing high performance of detection. Many clustering algorithms can be made use of in the proposed system for identification[7].

III.PROPOSED SYSTEM

The structure of the CDS system is shown in the below figure 1.

A.Preprocessing: in this stage we convert the given image based on the grayscale enhancement and remove the labels[12-13].

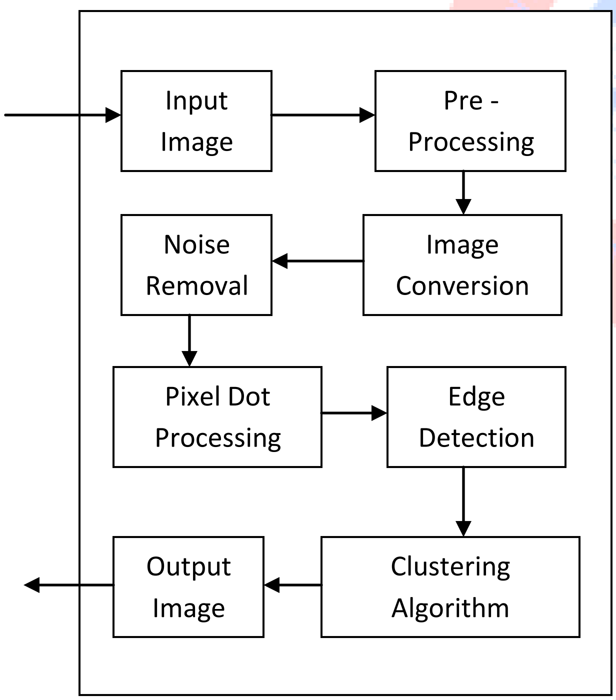

Figure 1: Architecture of CDS system

B.Image conversion: the given image is converted to negative images, which helps in future for the detection and elimination of noise and identification of edges.

The negative images formation is given by s=1.0-r, where s=T(r), in which s indicates the processed image pixel value and r indicating the original image pixel value.

C.Pixel dot processing: each and every pixel of the given image is converted to matrix and processed completely, the intensities of each pixel is calculated and stored in the database. So that the high contrast pixel can be usage in the clustering techniques implementation.

D.Edge detection: various algorithms have been in usage like Gradient edge detection, canny edge detection, Prewitt's algorithm etc. But we make use of fuzzy logic detection system for the edge detection which gives better result[15-16].

IV.CLUSTERING TECHNOLOGIES

In this paper, two clustering algorithms are proposed, Modified K-Means[8-10] and Modified K-Medoid [11] which is described below.

A.Modified K-Means:

Initially "k" centroids are defined, one for each group such that the position of centroid is important to the result based on intensity. After which based on the similarities the groups will be enhanced. At each object adding to the group, the centroid of that group is recalculated and updated. During this process the distance is assigned as weight to the objects by connecting the object to the cluster head or centriod. In the sense each object in that group will be connected with edge being represented with the weight which will be distance.

Then we identify the minimum spanning tree for each group and delete weight in descending order. The average value will be the initial cluster.

Calculate the distance between each data object and cluster head and update the cluster heads based on the distance and number of objects. If there is no change for updating then the algorithm will be terminated and the resulting clusters can be verified as calcification or not.

B.Modified K-Medoid:

This clustering technique is implemented in two phases. In the first phase, the given image is threshold using Otsu's method. The image components are labeled for all connected areas. Next we need to identify the cluster head or reference area based on the components areas. Then we need to copy all connected regions having area less than cluster head to the output image.

In the second phase at the identified region or cluster head region, each and every pixel intensity along with its neighboring pixels is calculated. If there is any intensity difference greater than the predefined value, put it into the new image of same size as input image. Repeat the calculations of intensity for 3 to 4 times until no updations are possible. Each time we get new image. Combine that new image to form final output image with the calcified tissue.

V.IMPLEMENTATION

MATLAB is made use of for the implementation; here is a sample code bit of implementation of the complete system architecture.

```
clc
close all
clear all
d=10;
order=2;
p=imread('breastcancerimage.jpg');     %Read
an image
r=rgb2gray(p);
im=double(r);
subplot(321)
imshow(im./255);
[r c]=size(im);

n=order;
%%%%%%%%%%% filter technique %%%%%%%%%%%%%%%
A=zeros(r,c);
H=zeros(r,c);
for i=1:r
    for j=1:c
        A(i,j)=(((i-r/2).^2+(j-
c/2).^2)).^(.5);
        H(i,j)=1/(1+((d/A(i,j))^(2*n)));
    end
end
%%%%%%%%%%%%%%Using it for my application as
filtering is
%%%%%%%%%%%%%%application  specific,  taking
the value of alphaL and alphaH
%%%%%%%%%%%%%%values accordingly.
alphaL=.0999;
aplhaH=1.01;
H=((aplhaH-alphaL).*H)+alphaL;
H=1-H;
%%%%%log of image
im_l=log2(1+im);
%%%%%DFT of logged image
im_f=fft2(im_l);
%%%%%Filter Applying DFT image
im_nf=H.*im_f;
%%%%Inverse DFT of filtered image
im_n=abs(ifft2(im_nf));
%%%%%Inverse log
im_e=exp(im_n);
% subplot(1,2,2);
subplot(322)
imshow((im_e),[])
nColors = 3;
% repeat the clustering 3 times to avoid
local minima
[ab,noise] = wiener2(im_e);
[p1 q1]=size(ab);
b = reshape(ab,[p1*q1 1]);
[cluster_idx,       cluster_center]        =
kmeans(b,nColors);
%display kmeans clustered image
pixel_labels = reshape(cluster_idx,p1,q1);

subplot(3,2,3),     imshow(pixel_labels,[]),
title('image labeled by cluster index');
segmented_images = cell(1,3);
rgb_label = repmat(pixel_labels,[1 1 3]);

for k = 1:nColors
    color = p;
    color(rgb_label ~= k) = 0;
    segmented_images{k} = color;
end
% display cluster images
subplot(3,2,4),
imshow(segmented_images{1}), title('objects
in cluster 1');
subplot(3,2,5),
imshow(segmented_images{2}), title('objects
in cluster 2');
subplot(3,2,6),
imshow(segmented_images{3}), title('objects
in cluster 3');
```

Modified K-Means implementation code

```
clc;
close all;
clear all;
he = imread('breastcancer2.jpg');
subplot(3,2,1:2), imshow(he),
title('breastcancer image');
```

```
cform = makecform('srgb2lab');
lab_he = applycform(he,cform);

ab = double(lab_he(:,:,2:3));
nrows = size(ab,1);
ncols = size(ab,2);
b = reshape(ab,nrows*ncols,2);

nColors = 3;
% repeat the clustering 3 times to avoid
local minima
[ab,noise] = wiener2(b);
[cluster_idx, cluster_center] =
kmeans(ab,nColors);
%display kmeans clustered image
pixel_labels =
reshape(cluster_idx,nrows,ncols);
subplot(3,2,3), imshow(pixel_labels,[]),
title('image labeled by cluster index');

segmented_images = cell(1,3);
rgb_label = repmat(pixel_labels,[1 1 3]);

for k = 1:nColors
    color = he;
    color(rgb_label ~= k) = 0;
    segmented_images{k} = color;
end
% display cluster images
subplot(3,2,4),
imshow(segmented_images{1}), title('objects
in cluster 1');
subplot(3,2,5),
imshow(segmented_images{2}), title('objects
in cluster 2');
subplot(3,2,6), imshow(segmented_images{3}),
title('objects in cluster 3');
```

VI.CONCLUSION

Currently there are more deaths due to the rapid growth of cancer in women. Only Mammography doesn't give enough details and issues related to it cannot be overcome. So the proposed approach deals with all types of screening images and provides better performance of detection of micro calcification. Due to which the early detection through other screening techniques can be done and after which can avoid the risk of development of cancer mass.

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