ISSN : 2347 - 8446 (Online)
ISSN : 2347 - 9817 (Print)
Vol. 2, Issue 3 (July - Sept. 2014)
International Journal of Advanced Research in Computer Science & Technology (IJARCST 2014)

Evaluation of Breast Percent Density in Digital Mammography Images Using Fuzzy C-Means Clustering and Support Vector Machine

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Abstract
Breast cancer is detectable and can be prevented through technical solutions. The human health care processes are advanced with the modern technology and computation. Estimation of breast percent density and stages of cancer predicated based on the level of affected density using mammography. The density of the breast tissue predicated based on the fuzzy c means clustering and Support vector machine.

Keywords
Digital mammography, Density determination, clustering.

I. Introduction

Mammogram is the special type of x-ray. It is effective, low cost and efficient method to detect breast cancer early. Digital image consists of discrete picture elements called pixels which can be associated with digital number represented as DM that depicts the average radiance of relatively small area within a scene. The quantity of fibro glandular tissue content in the breast as estimated mammographically is commonly referred as breast percent density (PD %)which is one of the most significant risk factor for developing breast cancer.[1]. Furthermore, most studies Published today investigating computer-aided assessment of breast PD% have been Performed using digitized screen-film mammograms, while digital mammography is increasingly replacing screen film mammography in breast cancer screening protocols. Digital mammography imaging generates two types of images for analysis, raw (i.e., "FOR PROCESSING") and vendor post processed (i.e., "FOR PRESENTATION"), of which post processed images are commonly used in clinical practice.[2].Fig 1 is Development of an methodology which effectively estimates breast PD% in mammography images.

II. Methodology

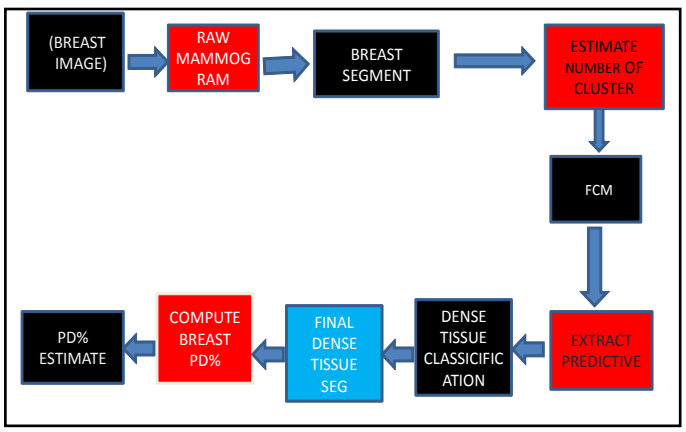

Fig. 1: Methodology

III. Data Set

The data for estimating the breast percent density is arrived at digital mammogram images. The mammogram images should be 12-to- 14 gray levels depth.

IV. Image Reprocessing

Image is collected from on line and then preprocessing to be done. Pre processing is always a necessity whenever the data to be mind in noisyand incomplete, preprocessing improves the effectiveness of the data mining techniques. The applied the techniques to the images, which is called by the name cropping.
The cropping operation removes the unwanted parts of the digital image (i.e) this proposed method is used at initial level of digital mammogram (mammogram with cancer tissues).

V. Fuzzy Clustering

Clustering of numerical data forms the basis of many classification and system modeling algorithms. The purpose of clustering is to identify natural groupings of data from a large data set to produce a concise representation of a system's behavior. The Fuzzy Logic is equipped with some tools that allow you to find clusters in input-output training data.Fig1.2 is the cluster information to generate a Sugeno-type fuzzy inference system that best models the data behavior using a minimum number of rules. The rules partition themselves according to the fuzzy qualities associated with each of the data clusters. This type of FIS generation can be accomplished automatically using the command line function, fcm.

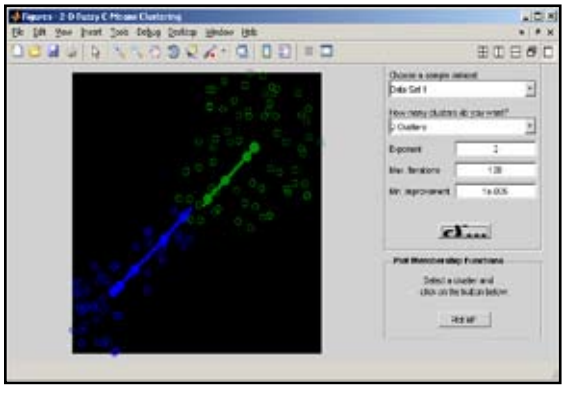

Fig. 1.2: Fuzzy clustering

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VI. SVM CLASSIFIERS

The SVM is predictor variable is called an attribute, and a transformed attribute that is used to define the hyper plane is called a feature. The task of choosing the most suitable representation is known as feature selection.

A set of features that describes one case(i.e., a row Of predictor values) is called a vector so the Goal of SVM modeling is to separate cluster of vector in such a way that into two category as affected and Unaffected groups in two planes. Fig 1.3 is vector near the hyper plane which is called support vector.

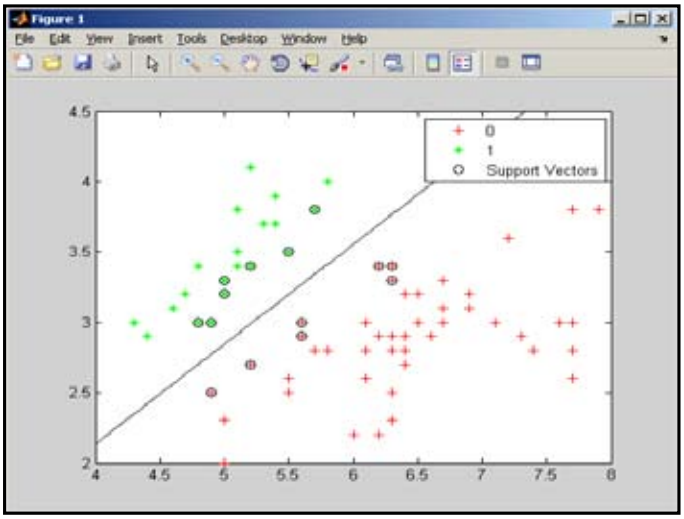

Fig. 1.3: Support vector machine

VII. Standard Dataset:

The standard dataset which is used for evaluating the breast percent density is shown below:

a) Calculate the total no of pixels in each image.
b) Selection of affected image from the segmented image which is high density pixels and then identify the non-zero element combination of set value to determine the percentile of affected particles in particular image.
C) Calculate the sum in corresponding to non-zero elements which is occurred in the segments sub image for each and every high resolution images.

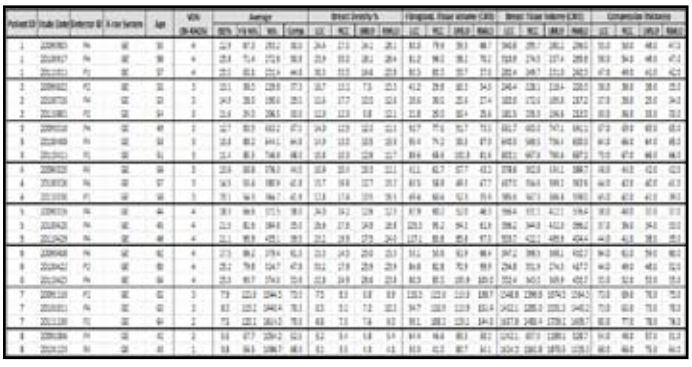

Fig . 1.4: standard data set .

Calculation process

The formula for calculating the breast percent density is

a) For each image which is having high density for each image property.
b) Find how many times the same clustered images occurs (i.e) frequency.
c) Calculate total density and average density for each clustered image.
d) Calculate level of affected using the following formula: PD%= MD/MB*100% Where , MD=Dense Tissue, MB=Breast Tissue

VIII. Stages Of Breast Cancer

After calculating the common index value can find the stages of the cancer. There are 5 stages, which from 0-4.

a)If the pd=0-20 then stage=0.
b)If the pd=21-40 then stage=1.
c)If the pd=41-60 then stage=2.
d)if the pd=61-100 then stage=3.

The stage 0 is the type of vasive breast cancer. The remaining stages such as stage 1,stage2,stage3 and stage 4 are invasive breast cancer.

Parameter Declaration

The parameter also called as attributes which involves for calculating the breast percent density method is:

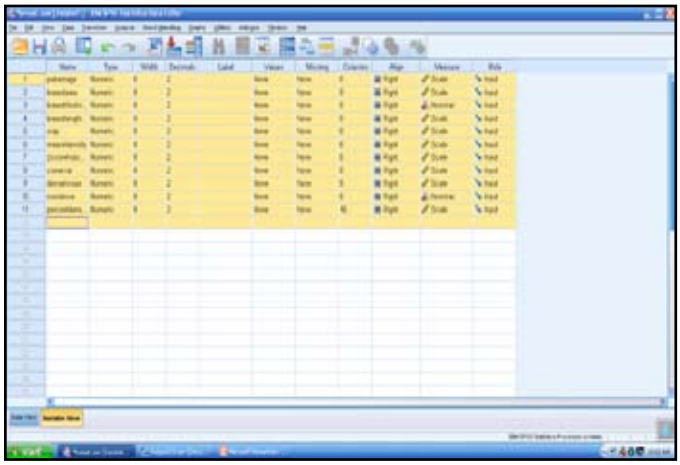

Fig. 1.5: Parameter decleration.

Result

The process of estimating breast Percent density is shown below: The rotated image can be adopted by the property rotate-90, rotate+90 and so on. The average values can be calculated for each clustered image. The following table shows for each image property, average values affected density pixels. The following table shows for each image property, which clustered image is having high density pixels. The Fig1.6 shows the property.

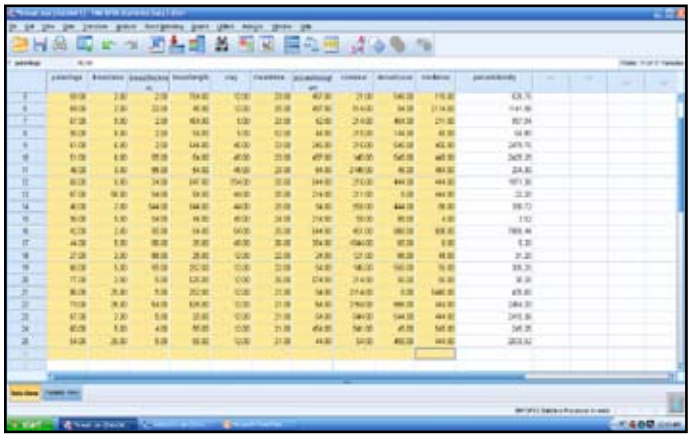

Fig. 1.6 : Result.

IX. Conclusion

In this paper, fuzzy c is used for pre processing, cropping operation to remove unwanted parts and make all images in equal size. The c-means clustering algorithm is used to cluster the images. The SVM approach is used to find the percentage of affected area in digital mammogram. This method can predict breast percent density based on patient age and breast tissue thickness.

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