Recognition of breast cancer using ultrasonic pictures and improving neural system

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Abstract

Breast cancer recognition using ultrasound pictures processing improving nervous system. In all picture processing method, particularly in medicine, the pictures features finding as well as improving them is a critical subject. The improved features can help their classifying and accelerating the recognition process efficiency. In this thesis, in order to improve and classify the features of ultrasonic picture, a new method has been introduced to let the specialist recognize problems, such as tumors faster and easier. At the first step, using a filter, the initial preprocessing is conducted, and then the obtained picture will be divided into some separate parts, and finally, using some specific features, the pictures will be transformed and classified efficiently using fabricated nervous system. At the end, you can observe enhanced classification of features. Comparing to the common methods, the features will be easier to be identified.

Key words: Processing ultrasonic pictures, breast cancer, improving nervous system, efficient selection of breasts ultrasonic pictures features.

Introduction

Cancer is one of the eight causes of death round the world. The cancer rank among death cause in developing countries is third while in developed ones it is a for runner. 562340 American people died of cancer in 2009, this means more than 1500 a day till 2009, 1479350 types of cancer were listed. In USA cancer is the second cause death all in all and statistic shows it is the cause of a death out of four all through the world.

Breast cancer is very common these days and it’s big threat for American women. The possibility of a cancer attack in a woman life sometimes is about 12%. This growing trend is epidemic round the world about 182000 types of breast cancer. Have been identified up to now and 46000 woman dies of cancer in USA annually in 2009 for 40610 women breast cancer was the death cause.
Solution process:

Filtering the picture through Anisotropy

in picture processing making use of filters to improve the picture is essential. one of the common filters is Anisotropy filter. This filter can make the texture look more integrated and cause an increase the sharpness of the focus. Using the filter on a supersonic picture of breast can make the following result.

Using this filter the picture will be effaced to give a more vivid picture. in this research I'm to make use of Prona-Malik filter.

Dividing the picture using active contour Model

In order to dividing the picture I use Chan’s algorithm. One energy function will be defined in order to minimize the energy function and minimizing all layers of $\phi$ will do the division.

Energy function in general will be as follows:

$$F(\phi) = \mu \left( \int_{\Omega} |\nabla H(\phi)| dx \right)^{p} + \nu \int_{\Omega} H(\phi) |dx|$$

$$+ \lambda_1 \int_{\Omega} |I - c_1|^2 H(\phi) dx + \lambda_2 \int_{\Omega} |I - c_2|^2 (1 - H(\phi)) dx.$$  

Parameters will be determined by the user, this function is a general function of Mumford King Parameters will be adjusted as follows:

$$p = 1, \nu = 0, \lambda_1 = \lambda_2 = 1$$

$H$ and $I$ have been defined similar to last stage $C_1$ and $C_2$ consequently in time $\phi$ is bigger and smaller than zero has been defined as follows:

$$c_1 = \frac{\int_{\Omega} I H(\phi) dx dy}{\int_{\Omega} H(\phi) dx dy}, c_2 = \frac{\int_{\Omega} I (1 - H(\phi)) dx dy}{\int_{\Omega} (1 - H(\phi)) dx dy}$$

Making use of oiler-logo lounge and Descending Gradian for all layers function and for division the energy function will be functioned.

$$\phi_\varepsilon = \delta(\phi) \left[ \mu p \left( \int_{\Omega} \delta(\phi) |\nabla \phi| \right)^{p-1} dV \left( \frac{\nabla \phi}{|\nabla \phi|} \right) - \nu - \lambda_1 (I - c_1)^2 + \lambda_2 (I - c_2)^2 \right]$$

After line up and disconnect of the above differential equation we will try to minimize the energy function.
δ is a soften form of Delta function:

\[ \delta_h(x) = \frac{1}{\pi h^2 + x^2} \]

L stands for the long of perimeter

\[ L(\phi^n) = \int_{\Omega} \delta_h(\phi^n)|\nabla \phi^n| \, dx \, dy \]

The following constants will be considered for algorithm

\[ C_1 = \frac{1}{\sqrt{(\phi_{i+1,j}^n - \phi_{i,j}^n)^2 + (\phi_{i,j+1}^n - \phi_{i,j}^n)^2 / 4}} \]

\[ C_2 = \frac{1}{\sqrt{(\phi_{i-1,j}^n - \phi_{i,j}^n)^2 + (\phi_{i,j+1}^n - \phi_{i-1,j}^n)^2 / 4}} \]

\[ C_3 = \frac{1}{\sqrt{(\phi_{i+1,j}^n - \phi_{i-1,j}^n)^2 / 4 + (\phi_{i,j+1}^n - \phi_{i,j}^n)^2}} \]

\[ C_4 = \frac{1}{\sqrt{(\phi_{i+1,j-1}^n - \phi_{i-1,j-1}^n)^2 / 4 + (\phi_{i,j}^n - \phi_{i,j-1}^n)^2}} \]

Using the above definitions the final formula will be.

\[ \phi_{i,j}^{n+1} \left[ 1 + \frac{\Delta t}{h} \delta_h(\phi_{i,j}^n) \mu (p \cdot L(\phi^n))^{p-1} (c_1 + c_2 + c_3 + c_4) \right] \]

\[ = \phi_{i,j}^n + \frac{\Delta t}{h} \delta_h(\phi_{i,j}^n) \mu (p \cdot L(\phi^n))^{p-1} \left[ c_1 \phi_{i+1,j}^{n+1} + c_2 \phi_{i,j+1}^{n+1} + c_3 \phi_{i,j-1}^{n+1} + c_4 \phi_{i-1,j}^{n+1} \right] \]

\[ - \Delta t \delta_h(\phi_{i,j}^n) \left[ \nu + \lambda_1 (l_{i,j} - c_1 (\phi^n))^2 - \lambda_2 (l_{i,j} - c_2 (\phi^n))^2 \right] \]
Extraction of morphological features

Binary divided binary pictures will be analyzed and morphological feature are extracted out of all its parts. The features are as follows area.

Area: Extracted area of the piece

Perimeter: Extracted perimeter of the piece

Thickness: Perimeter thickness

Area of the piece: This parameter is obtained through the rate of perimeter of the low brightness to the perimeter of high brightness. It determines the text density pieces.

This parameter is the rate of the obtained pieces and its surrounding rectangular

The differences between \( \pi^4 \) and the rate of perimeter to the power of two to the area

All these figures can be computed for all tissues in a picture. (maybe there is more than one).

This is formation will be labeled and the picture that show the tumor will be saved for improving the quality and classifying.

The improvement of the neural network:

Finally the obtained features will be registered in neural network in order to go through segmentation and improvement process. Doing so we have utilized a neural network with two layers, in first layer there is 10 neurons and in second there is 5 for activating parameter neural network toolbox. Descending Gradient Algorithm also was applied.

Implementation and Result

in this section the offered methods will be implemented and the obtained results will be compared in the Re reference essay, other morphological features has been used for classification in this thesis the applied data set of Re reference essay has been useful comparing the obtained results.

then the obtained results of different staged and final matrix classified neural network and ROC curve that show obtained results out of 20 abnormal pictures (benign cancer and malignant ones) and 19 normal pictures have been used.
a sample of abnormal picture:

![Abnormal Picture](image)

a sample of normal pictures:

![Normal Pictures](image)

In the following, the results of the filters application and segmentation of normal and abnormal pictures have been offered and then the results of training and improving of neural network have been offered.

The obtained results of abnormal pictures have been filtered and segmented from the left side as the main picture, filtered picture and segmented picture.

The results of one of normal pictures:

![Normal Picture](image)

**The result of abnormal picture**

Finally, the abovementioned features have been extracted and used for improving and segmentation of neural network.

The obtained result of neural network mistakes matrix and ROC curves have been displayed in the following Chart.

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the above matrix accuracy is 96.3% for all data and shows one percent more accuracy comparing to original essay.

in the mean time Roc curve which shows the data resolution based on the selected feature have been show in the following section.

in the best situation the curve must be inclined to left and above to display the acceptable resolution of the data.

**The conclusion:**

In this essay using pre-analysis filter and segmentation and then extraction of Feature out of Two-layer segmented picture adequate information has been collected this segmentation out of supersonic pictures we can recognize the cancer Texture information.
Finally these inputs will be used in neural network and the output accuracy rate will be shown in training and improving neural network we utilized descending Gardian and displayed that with segmentation of information will improve the quality of neural network.

In future it would be possible to make use of other pre analytic filters to improve the quality.

Also using of the morphological features of the Texture like the brightness intensity or variance average rate can be of use in segmentation.

Reference


http://www.csie.ntu.edu.tw/~cjlin/libsvm/.
