

# Using a new method in thermal images to diagnose early breast diseases

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## Abstract

This paper presents a study for diagnosis of breast diseases in early stages (tumors, fibroadenomas, cyst) using thermal images. Initially the thermal image is segmented in two new images. These images will be used at the new method proposed. The original contributions of this work are the use of thermal image on diagnosis of breast disease and an approach that classifies images.

**Keywords:** Processing of medical images, Thermography

## 1. Introduction

It is very important the early detection of breast cancer. Some studies have shown that, if detected early, the patient with cancer has 85% chance of cure, whereas if detected late, only 10% [1]. Currently, it has been used mammography and ultrasound to diagnose early breast cancer. The most used method is mammography. The disadvantage of the mammography is that it is invasive and experts believe that electromagnetic radiation can also be a triggering factor for cancerous growth. In contrast, the diagnosis of breast diseases through the use of thermal imaging is a noninvasive method that makes use of infrared radiation from the body. The use of thermal image in medical and biological applications is very important due to the fact of not using ionizing radiation, intravenous contrast injection or breast compression as the other types of exams. Thus represents a physiological test, while other forms of diagnosis such as mammography and ultrasound, are anatomical tests [2]. In the cancerous cells, due to angiogenesis and high metabolic rates, are at a higher temperature than the normal cells around it. Malignant tumors always cause a change in the temperature of the breast [3]. In addition, thermal image is early detection of any problem in the breast [4]. The results of thermography can be correct 8-10 years before mammography can detect a mass in the patient's body [5].

## 2. Thermal Images

Each pixel of a thermal image represents a temperature at the acquired scene (figure 1). The simplest way to represent thermal imaging is through of shades of gray. So, a change in temperature is related to the variation in gray tone of the image. In this paper, we use nine thermal images (five images of patients with breast disease and four images of healthy patients). Such

images were acquired as part of a project of a thermal image data base.

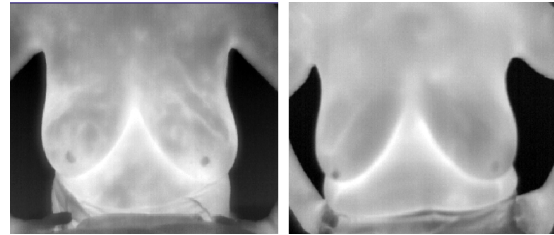


Figure 1: The left image corresponds to the thermal image of a patient with malignant tumor and the right image corresponds to the thermal image of a patient with normal breast.

## 3. Pre-processing

The preprocessing stage, intends to separate the left and the right breast image using five steps. The first step aims to identify the upper limit of the region of interest (ROI). The second step's goal is to find the ROI's bottom limit. The objective of the third step is to discover and erase disconnected pixels from the ROI. In the fourth step, the lateral limits are detected and after that, the ROI is separated in two (left and right breast).

The Figure 2 is going to be used to exemplify each of these steps.

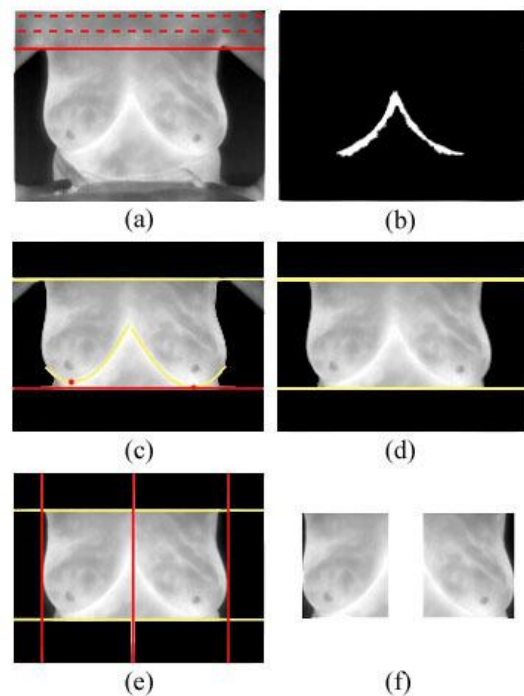


Figure 2: Preprocessing steps.

In order to detect the ROI's upper limit that corresponds to the first step, a top-bottom scan is utilized to find the vertical coordinate of the first pixel that belongs to the background. The Figure 2a shows that this pixel is easily identified, because smaller tones represent lower temperatures. After that, to find the breast's lower's curve (second step), a threshold based on the higher temperatures is done as can be notice in Figure 2b. The bottom limit is set as the lower pixel of this curve, completing the second step (Figure 2c). In the third step the goal is to eliminate pixels that do not belong to the ROI's area. Using neighborhood four, pixels are grouped and the area of each group is calculated. Then, only the group with the biggest area remains (Figure 2d). Taking the image obtained at the third step, it is easy to determine the lateral limits utilizing a left-right scan and where columns are searched until the first pixel from the ROI's boundary is found. The horizontal coordinate of this pixel is set as the left limit. The same process is repeated from the right to the left, obtaining the right limit, completing the fourth step. The last step is accomplish taking the mean distance of the lateral limits and set it as a central coordinate in order to divide the image in two equal parts as showing at the Figure 2e. Finally, one of these parts is taking as the left breast and the other is taking as the right breast (Figure 2f).

In the next stage, the extraction of characteristics of these segmented thermal images is done, using the method proposed in this paper.

#### 4. Diseases Identification

The diagram in figure 3 summarizes the steps of proposed method.

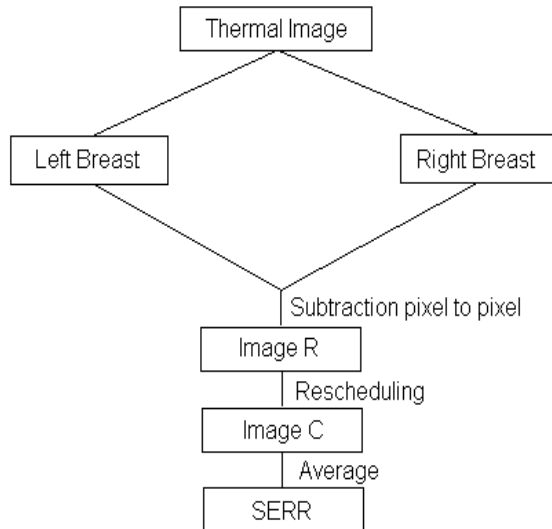


Figure 3: The steps of proposed method.

Initially, a pixel to pixel subtraction on a vertical axis of symmetry with the two images generated by the segmentation is done. So, as a result of the subtraction pixel to pixel will have a "Image R". Then, it made a rescheduling of the tones of the pixels in "Image R",

generating an "Image C" with tones of the pixels between 0 and 1. We calculate the average of the tones of the pixels of the image C, generating the result SERR.

#### 5. Results

TABLE 1 - Results found for SERR

Image	SERR	Diagnosis
2889	0.1386	Abnormal
3416	0.1394	Abnormal
3434	0.1603	Abnormal
3740	0.1791	Abnormal
3924	0.1532	Abnormal
5077	0.1106	Normal
5462	0.1247	Normal
5528	0.1049	Normal
5855	0.1032	Normal

#### 6. Conclusion

The proposed method showed good results. In future work aims to use a larger amount of thermal images and using fractal geometry and new techniques.

#### References

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