# Artificial Vision and Pattern Recognition
## Lab Assignment 1

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# 1   Introduction

I have collected all the material related to this laboratory, code, paper and report on a Github repo, available at `jeorjebot/automatic_nipple_detection`.

# 2   Implementation of the Algorithm

## 2.1   Algorithm phases

As described in the paper, I divided the entire process in three phases:

1. Human Body Segmentation phase, that take as input the termograms images, locate the body and provide as output the images of human body with a masked black background.

2. Adaptive Threshold phase, that take as input the images of the previous phase, calculate a threshold for each pixel with the adaptive threashold algorithm and provide as output the thresholded image.

3. Nipple Selection phase, that analyze the output of the previous phase, locate the nipples candidates and detected the nipples according to a list of features.
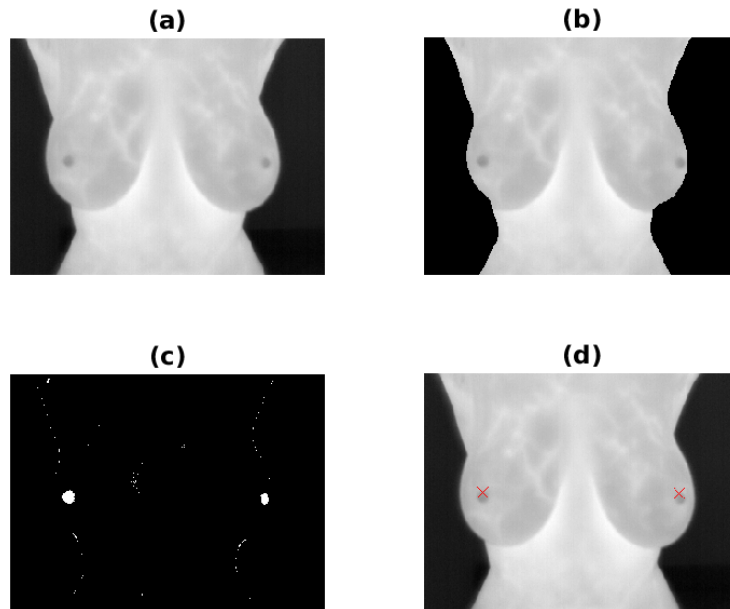


Figure 1: **(a)** the input image, **(b)** the segmented image, **(c)** the threasholded image, **(d)** the detected nipples
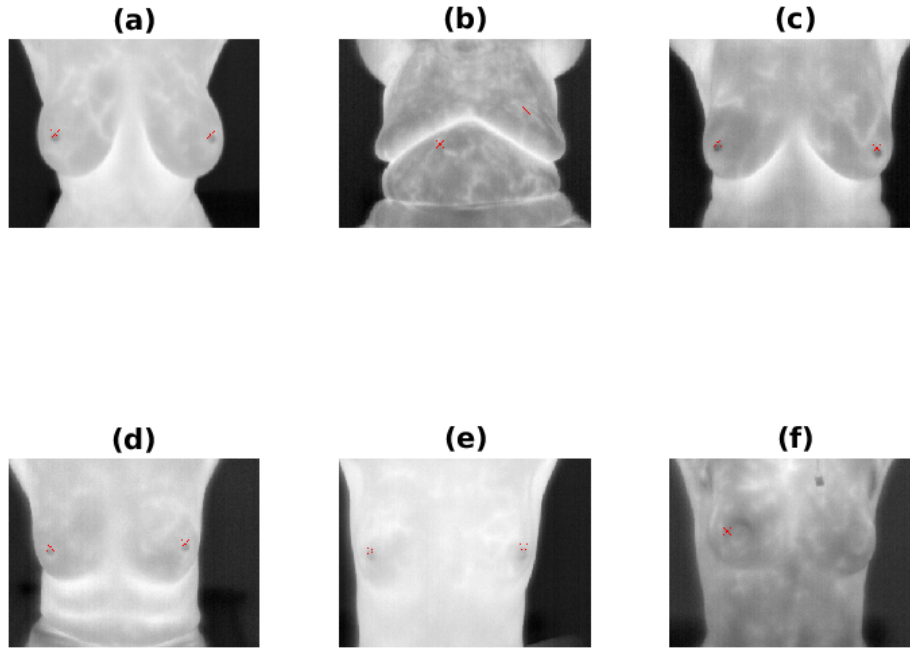
Figure 2: Nipple Selection phase output

## 2.2    Results

The algorithm correctly detect nipples: as shown in Figure 2 in **(a)**, **(c)**, **(d)** and **(e)** images, the algorithm has identified a pair of round nipple, one in the left side and the other on the right side.

In the **(b)** image, the detection was incorrect, due to the fact that nipples are not clear or present in the images.
The **(f)** image was a particular case: here, where it is more difficult to locate a round nipple, the algorithm identify only a point on the nipple border.
I tried to change hyperparameters (in particular adaptive threshold hyperparameters such as neighborhood and C constant) but the result has not improved.

The execution time of the algorithm is limited by the performance of Matlab Online, which is a cloud provided service, but the execution time on my laptop is similar to the result achieved in the paper.

## 2.3    Tools

To implement the algporithm proposed in the paper, I choose to use Matlab Online and Live Script, a sort of Python Notebook provided by Matlab, where you can mix code, formatted text and images, and visualize better the output.