



TOWARDS A TOOL FOR AN AUTOMATIC EVALUATION OF MAMMOGRAPHIC IMAGE QUALITY

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1. INTRODUCTION

In order to identify small structures with low density differences, a high image quality is required with the use of low doses of radiation. The analysis of the quality of the obtained image from a mammogram is performed from an image of a simulated breast and this is a fundamental key point for a program of quality control of mammography equipments.

2. OBJECTIVES

Development of a protocol for automatic evaluation of mammographic image quality, specifically aiming the image resolution and the detection of microcalcifications.

3. MATERIALS AND METHODS

The strategy to achieve this goal is multi-level:

- Fourier transform is the technique used to determine the limits of the spatial resolution. The existence of very specific frequencies in the image is shown by the luminous points visualized in the transformed images, and the location of the highest frequency level, the mean, and variance of the distance of the others frequencies to this highest one may show, computationally, the difference between the resolutions. An scheme of this technique for the assessment of resolution can be seen in Figure 1.

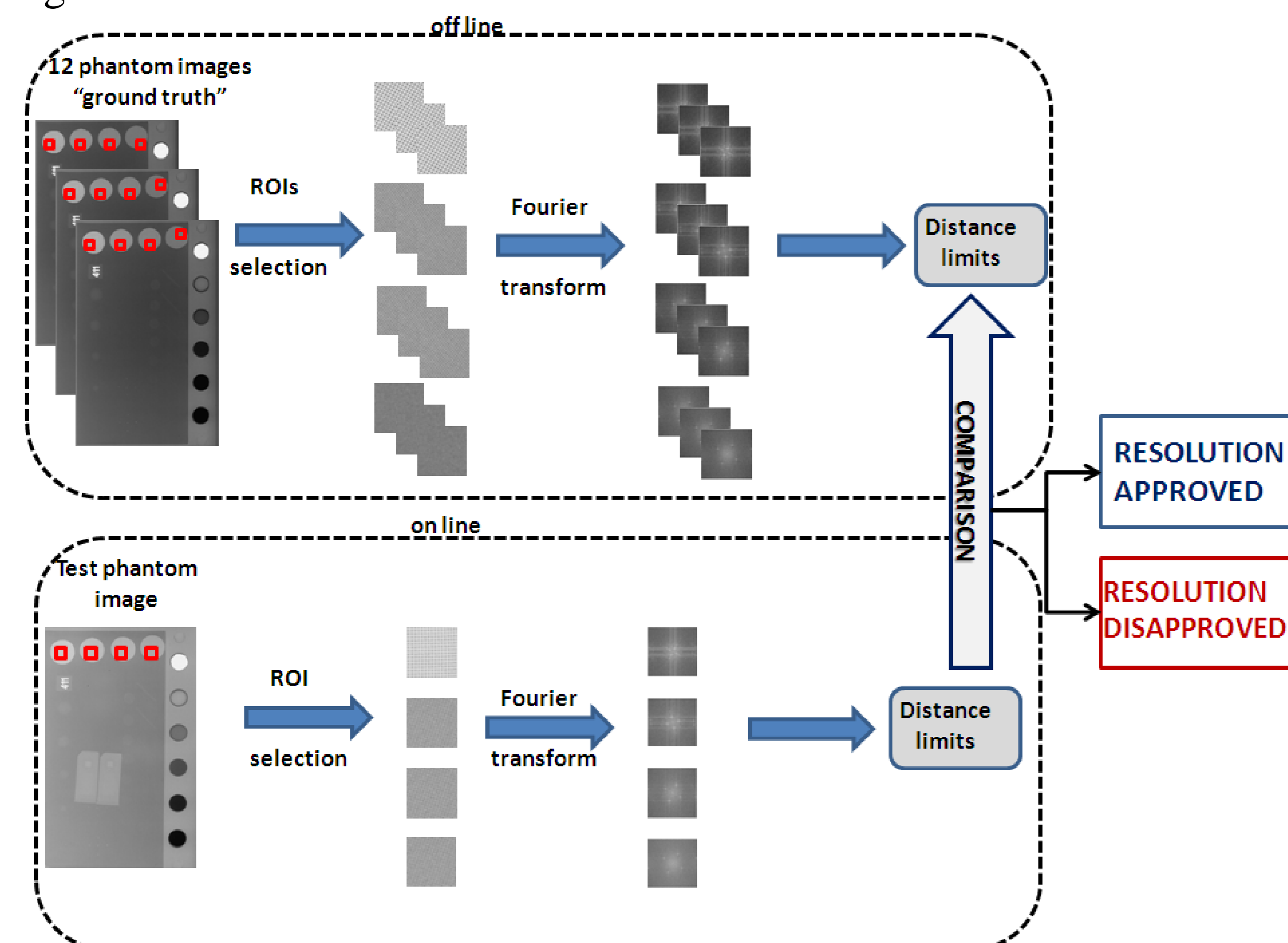


Figure 1. Scheme for the assessment of the resolution of mammographic phantom images .

- For the detection of microcalcifications, it is selected a region of interest (ROI) performing a subtraction of the background, and then a thresholding technique together with morphological operations is applied in order to determine the structures.

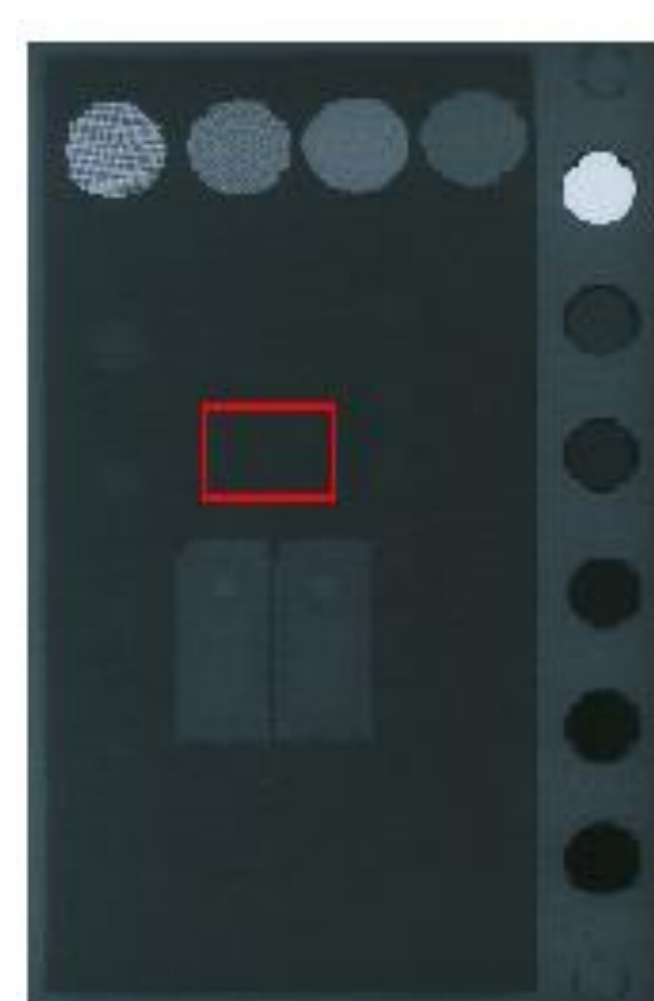


Figure 2 presents the selected ROI (4th group of microcalcifications), and application of the following steps:

- Conversion of RGB to grayscale.
- Implementation of the image filter: Filter Wiener
- Application of thresholding.
- Morphological Operators: Dilated, Eroded.
- Morphological Operators: Open, Close.
- Determination of the centroids of microcalcifications and counting of these.

Figure 2. Selection of ROI, fourth group of microcalcifications

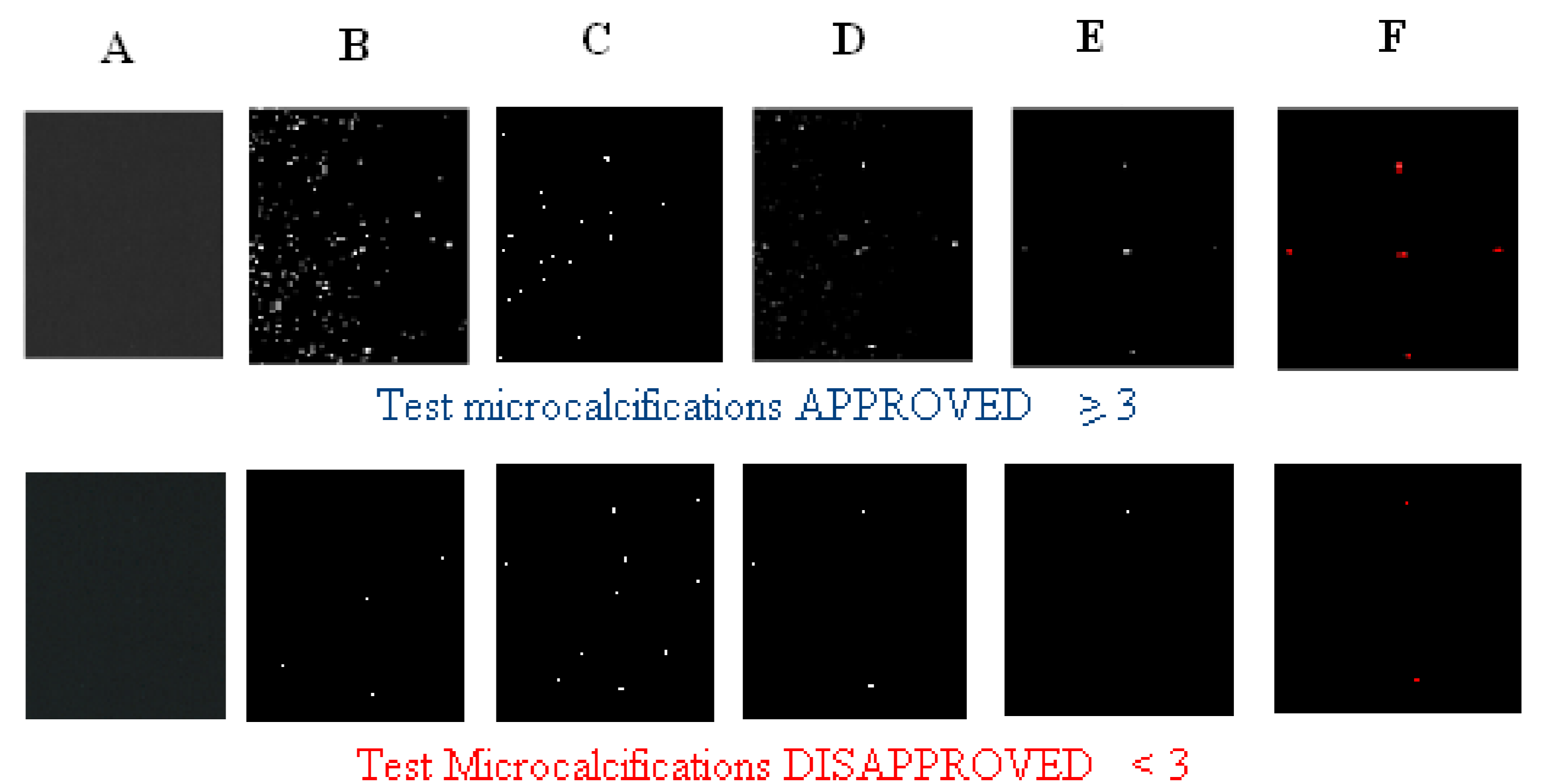


Figure 3. Scheme for the assessment of the microcalcifications of mammographic phantom images .

Figure 3 presents the scheme for the assessment of microcalcifications.

These algorithms were developed in the MatLab environment. The phantom images were obtained of the phantom Brazilian College of Radiology (CBR) and evaluations of test objects were made following the parameters of the Ministry of Health of Brazil.

28 phantom images with the ground truth settled were used in the experiments.

4. RESULTS AND DISCUSSIONS

Table 1 presents, for the four image resolutions, the mean and standard deviation of the distance limits obtained from the 12 phantom images which are the ground truth, and also the evaluation of two test images.

Table 1. Ground truth of the distance limits of the resolution and the evaluation of two test images.

	Resolution 1	Resolution 2	Resolution 3	Resolution 4	
Distance limits	12.90 ± 1.4	14.46 ± 1.0	16.80 ± 0.5	18.01 ± .6	
Test Image 1	12.43	14.45	16.30	18.37	APPROVED
Test Image 2	14.73	16.95	18.10	13.60	DISAPPROVED

Regarding the microcalcifications, after the evaluation of images phantoms with the developed program it was found that 76% images were APPROVED, while 40% were approved performing the assessment visual of them.

5. CONCLUSION

The subjectivity inherent in the methods of visual assessment of mammographic images may be eliminated using these techniques with the computer as an aid, and also an efficient tool for image analysis can be provided, so that the improvement of public health is obtained in relation to early detection of breast cancer.

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