

Automatic segmentation of microcalcifications based on the fusion of different algorithms over CC and MLO views

Martí J, Freixenet J, Peracaula M, Oliver A, Raba D, Espunya J, Pont J, Martí R {joanm, jordif, martapb, aoliver, draba, jespunya, marly} @eia.udg.es / University of Girona rd.jpont@htrueta.scs.es / Universitary Hospital of Girona "Dr. Josep Trueta"

9.2 Abstract

The study of mammographic microcalcifications has shown to provide useful information for the early diagnosis of breast cancer. In order to develop a computer-aided diagnosis system named HRIMAC, this work focuses on the automatic and reliable detection of microcalcifications. Our proposal of microcalcification detection is based on the fusion and validation of the results provided by different segmentation algorithms over the CC and MLO X-ray images of the same breast.

1. Gross Segmentation

The method starts with an automatic gross segmentation of both images which results on the detection of regions of interest.



2. Automatic seed detection algorithm

An automatic seed detection algorithm (1 of 3) based on local histogram analysis detects initial pixels belonging to the microcalcification region. The parameters of this algorithm are set up to obtain always an over-segmented result.



3. Segmentation of the abnormalities

Three different specific algorithms begin independently the segmentation of the abnormalities.

- 1) Region growing method (based on the proposal of Shen).
- 2) Method based on mathematical morphology operations (inspired on the Mossi and Albiol proposal).
- 3) Method based on gradient information (following the work of Bankman et al).

Region Growing method

a) The initial seeds grow to larger regions following a region grey level homogeneity function fitted by τ .

 $(1+\tau)(F_{\max}+F_{\min})/2 \ge p(i,j) \ge (1-\tau)(F_{\max}+F_{\min})/2$



Mathematical Morphology

a) Top-Hat operator that performs opening operations using specific structural elements in order to enhance possible microcalcifications.

b) Substraction of the enhanced image and the original one, and binarization of this result image.



Gradient Information

a) Validation of each initial seed as a possible microcalcification finding the gradient along the Mlenght radius for discrete angles. $s(x, y) = \frac{f(x_0, y_0) - f(x, y)}{x_0 - x_0}$



4. Merging the results

The results obtained by the algorithms are merged and refined by eliminating the false positive finding the correspondences between the CC and MLO views.





CC with

elled Lesion

62 5. Results and Conclusions

The method is tested over a set of 40 cases from different image sets specially developed for this research. That cases are being integrated to HRIMAC, a Content Based Image Retrieval System, to perform a final evaluation with radiologists.

