Characterization of Lung Nodules On Bone Subtracted X-Ray Images Using Region Wise Image Enhancement and an Active Contour Model

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Accurate detection and characterization of lung nodules is an unresolved issue. Although chest CT has been demonstrated to increase diagnostic accuracy, it suffers from several disadvantages such as higher costs, increased radiation exposure and a large number of false positives which may result in longer reading periods and unnecessary invasive interventions. Improving CAD techniques on chest radiography has been proposed as a potential method for improving lung nodule detection and characterization.Once a lung nodule is detected, then the next step is to assess the nature of the lesion.

The purpose of this work was to develop a lung nodule characterization scheme on bone subtracted images and evaluate its performance on a public database.

The nodules detected by the reader were first cropped as small regions approximately twice the size of the nodule. Then standard image enhancement methods were interactively used on the cropped regions. An active contour segmentation algorithm was used to delineate the lung nodules. Fourteen features were extracted from the segmented nodule shape. These features were fed to an artificial neural network with ten hidden layers. Data were randomly partitioned as 70% for training, 15% for validation and 15% for testing. The original standard digital image database with and without chest lung nodules (JSRT database) was used for the study. The database contains 154 nodule and 93 non-nodule images. These images have high resolution (2048 x 2048 matrix size, 0.175 mm pixel size) and a wide density range 12 bit, 4096 gray scale. We have used the bone subtracted version of the images [7].

Our initial results indicate an accuracy of 86.7%.

The results show a high rate of accurate characterization on bone subtracted chest radiographs. The number of invasive biopsies may be potentially reduced with accurate characterization.

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