Comparison of Two-Dimensional and Three-Dimensional Features for Lung Nodule Detection in CT

Helical computed tomography (CT) is the most sensitive imaging modality for the diagnosis of lung nodules. Complex normal anatomy, however, makes nodule identification cumbersome for radiologists. Therefore, we have developed a computerized scheme to automatically analyze three-dimensional structures within the volumetric image data acquired during CT examinations to identify lung nodules.

Gray-level thresholding and a rolling ball algorithm produce segmented lung regions within each CT section. The resulting segmented lung volume is iteratively thresholded to eliminate pixels with gray levels less than the particular threshold; remaining pixels at each iteration are grouped into contiguous three-dimensional structures. A volume criterion is imposed to determine a set of nodule candidates, which is then subjected to two- and three-dimensional feature analysis. To distinguish between candidates representing nodule and non-nodule structures, these features are merged through automated classifiers.

In a preliminary database, linear discriminant analysis yielded an area under the receiver operating characteristic curve of 0.93 in the task of distinguishing between nodule and non-nodule structures within the set of nodule candidates. We are investigating the robustness of this method using an enlarged database of 40 CT cases (1:1 pitch with 10-mm collimation and reconstruction interval) in conjunction with an artificial neural network. The overall performance of the method and the performance of an enhanced set of two-dimensional features relative to an enhanced set of three-dimensional features will be discussed.

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