AbstractID: 3708 Title: Evaluation of Computer Aided Diagnosis on Thin-slice Pulmonary CT Images

Purpose: Pulmonary stereotactic radiation therapy achieves a >90% local control rate for small tumors (<30mm); motivating early detection of small lung nodules. With the increasing image resolution afforded by multi-slice CT scanners, radiologists can discern more easily these very small lung nodules. However, to overcome the challenge of image overload, assistance from lung CAD systems becomes a necessity. The purpose of this work is to evaluate the performance of our lung CAD algorithm on low-dose, thin-slice CT images from the Early Lung Cancer Action Program (ELCAP) database.
Method and Materials: Our CAD algorithm models lung nodules as spheres (a modification of the 3D template-matching method presented in AAPM’03) and searched for structures similar to the templates throughout the whole lung volume. This approach eliminates the need for segmentation of blood vessel-nodule complex and is insensitive to noise and low-contrast of some nodules. In the extraction of lung volume, a watershed transform was applied to separate left and right lungs when necessary. A 3D spherical structure element was used to smooth out the surface of both lungs in order to incorporate pleural nodules. An improved padding scheme was adapted on the templates to make the detection capacity of templates more isotropic. A test dataset was used, consisting of 55 central contiguous slices (voxel size: $0.57\times0.57\times1.25mm^3$) from a particularly challenging subject in the ELCAP database. 41 nodules were identified by an experienced radiologist from our institution.
Results: 37 out of 41 nodules were detected by our CAD algorithm, a sensitivity of 90.2%. Among them, 28 out of 32 nodules with diameter <3mm were detected. The smallest detected nodule had a diameter of only ~3 pixels (1.7mm) and a volume of ~17 voxels.
Conclusion: Our CAD method is capable of detecting with high sensitivity very small lung nodules in low-dose thin-slice chest CT.