LUNA16 Competition. (Nodule detection track)

"Multi Opening and Threshold" CAD (MOT_M5L).

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Description

The Multi Opening and Threshold CAD is a fully automatic CAD developed to be included/combined into the M5L system [1]. No paper description has been published yet, as its development is very recent.

The parenchymal volume is obtained by 3D region growing, with a trachea exclusion and lung separation procedures.

The segmentation of nodule candidates is based on ideas by T. Messay [2], with several modifications to the sequence of threshold and opening radius, as well as to the merging procedure. The method described in [3] for nodule separation from vascular structures is applied during the segmentation step.

For each nodule candidate, the following 15 features are extracted:

Geometrical features

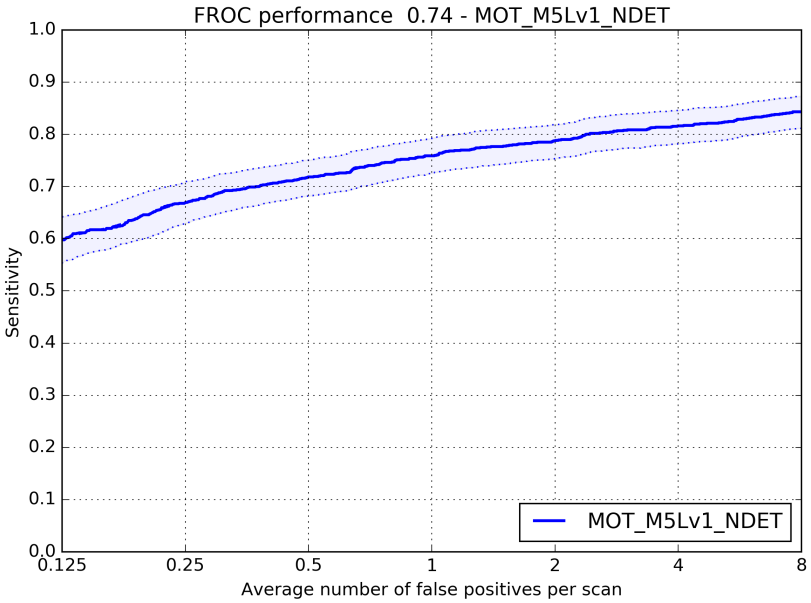
- Radius (mm)
- Sphericity
- Skewness of distance from center
- Kurtosis of distance from center
- Fraction of voxel connected to lung cage
- Distance from lung top
- Distance from Hilux
- Distance from parenchymal

Intensity-related features

- Average
- Average outside mask
- Standard deviation
- Standard deviation outside mask
- Maximum
- Entropy
- Entropy outside mask

In order to reduce the number of FP from about 1000 to 100 per CT, a filter is applied before the classification step to the correlation Sphericity-Radius.

Classification results were obtained in 10-fold cross-validation procedure using a Feed-Forward Neural Network with 15 input neurons, 1 hidden layer with 31 neurons and 1 neuron in the output layer.



References

1. E. Lopez Torres, E. Fiorina, F. Pennazio, C. Peroni, M. Saletta, N. Camarlinghi, M. E. Fantacci and P. Cerello. Large scale validation of the M5L lung CAD on heterogeneous CT datasets. Med. Phys. 42, 1477 (2015)
2. T. Messay, R. C. Hardie, and S. K. Rogers, “A new computationally efficient CAD system for pulmonary nodule detection in CT imagery,” Med. Image Anal. 14, 390–406 (2010)
3. "Morphological Segmentation and Partial Volume Analysis for Volumetry of Solid Pulmonary Lesions in Thoracic CT Scans". IEEE TRANSACTIONS ON MEDICAL IMAGING, VOL. 25, NO. 4, APRIL 2006 417.