Lung lobes partitioning via identification of pulmonary fissures in multi-slice CT imaging

Pulmonary lobes detection in multi-slice computed tomography (MSCT) is essential for modelling the functional behavior of the lung in relationship with airway and vascular networks. This study targets the automatic lung fissures detection as landmark definition.
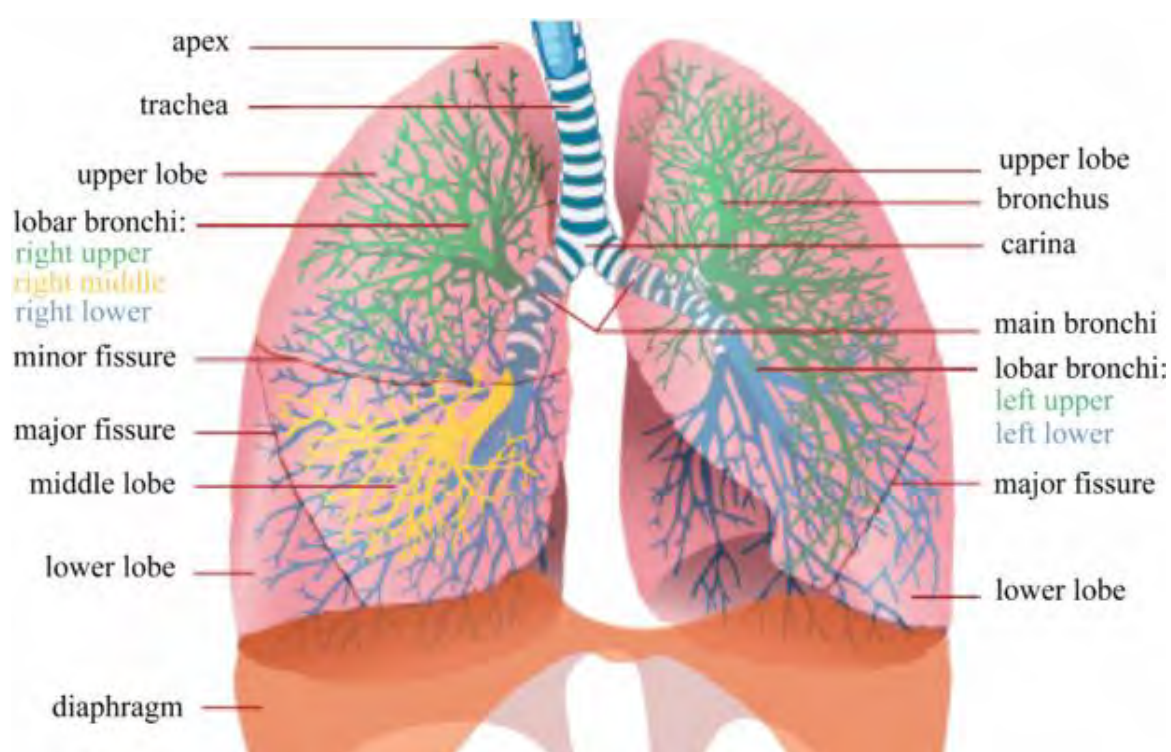
Project team

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Objectives and challenges

■ Detection of lung fissures on MSCT images and visual representation
■ Investigation of different approaches in the literature to discriminate fissures from other dense tissue

Materials

■ High-density structures (>-850 HU) in the lung
■ Segmented 3D airway and vascular trees (yellow)
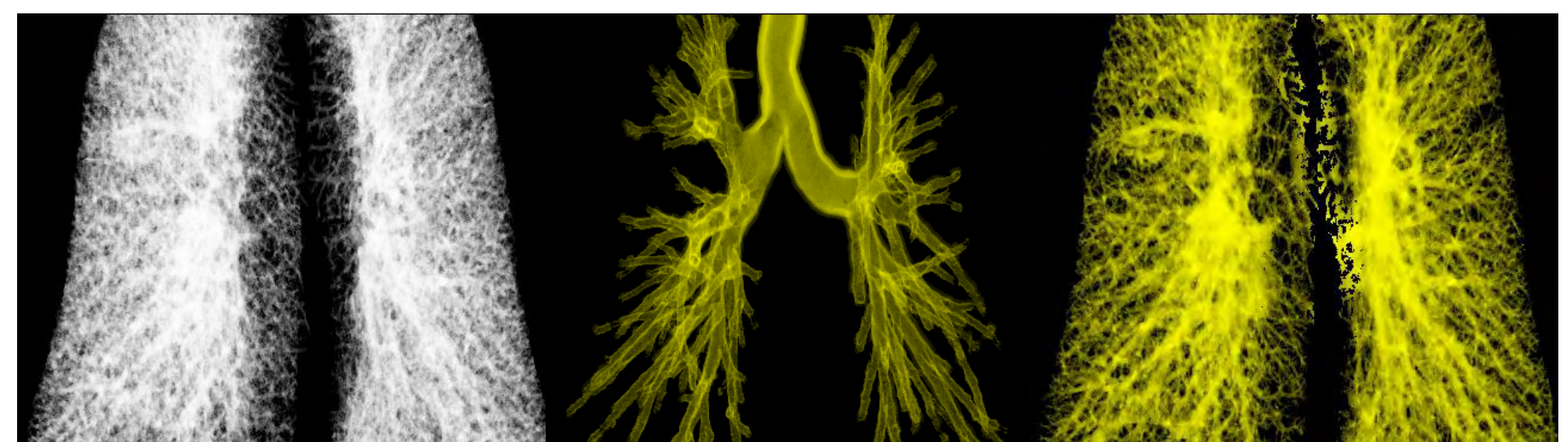
Methods

■ Excluding the (low-order) available segmented airways and vessels (yellow) and discriminating between remaining structures.
■ Exploiting the structure tensor *vs* 4D curvature to detect planar surface features. The norm of the tensor eigenvalues is used as selection criterion, in combination with directional filtering.
■ Connected component analysis defines the fissure candidates (red).
■ Surface orientation used to partition the connected fissures (issues encountered with incomplete fissures).
■ Experimental validation for different implementations and parameters. Future work on complete fissure reconstruction and lung lobe partitioning.
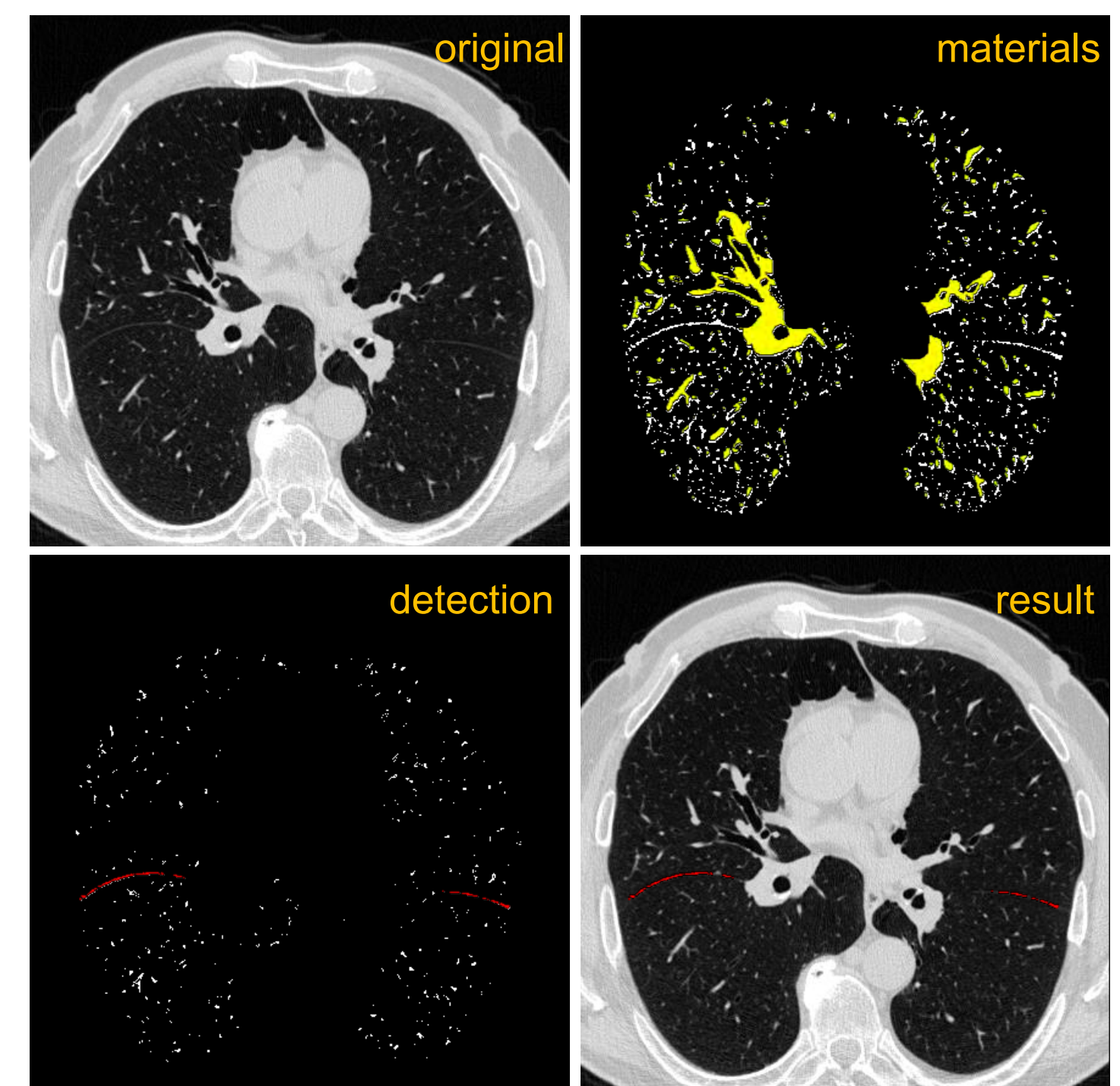
Results

■ Proof of concept illustrated for one patient (below: axial images and 3D rendering) – correct detection
■ Surface orientation analysis (color-coded) to be further exploited for fissure identification and labeling
■ 3D representation in relation with other pulmonary structures (lung volume and airways)