TELECOM SudParis

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Physiopathology of respiratory airway tree: morphological *vs* functional parameters in MSCT

Multi-slice computed tomography (MSCT) is the reference imaging modality in human airway tree investigation and the diagnosis tool for the related pathologies. This study assesses the relationship between morphological and functional parameters of the airway tree

Project team

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Supervision

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Coordination

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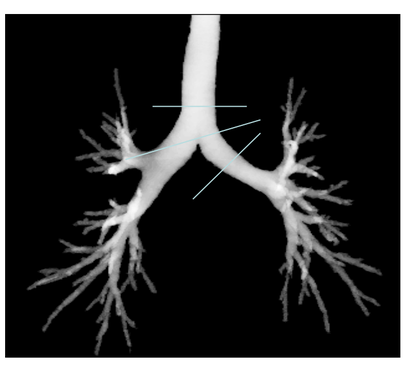
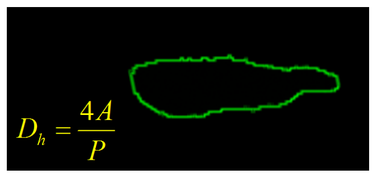
Materials

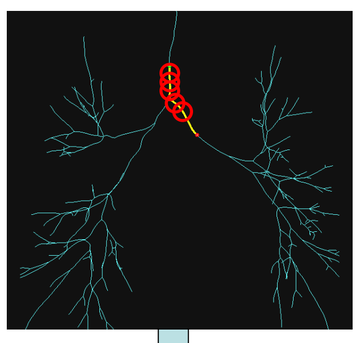
- Segmented 3D airway tree from MSCT
- Central axis and selected paths

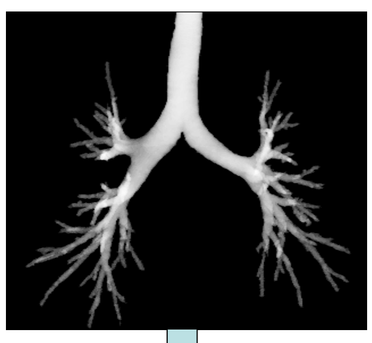
Methods

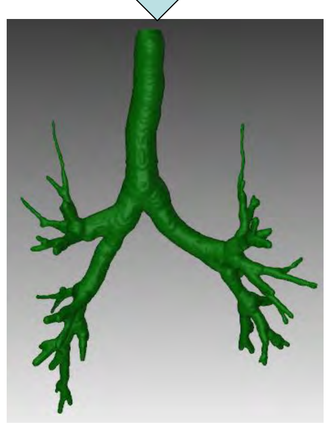


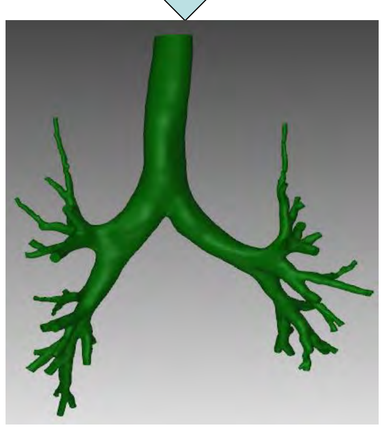


- Generate a cylindrical mesh model of the airway based on D_h and comparison with real patient geometry.







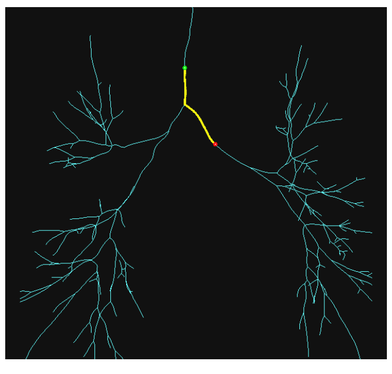


Partners

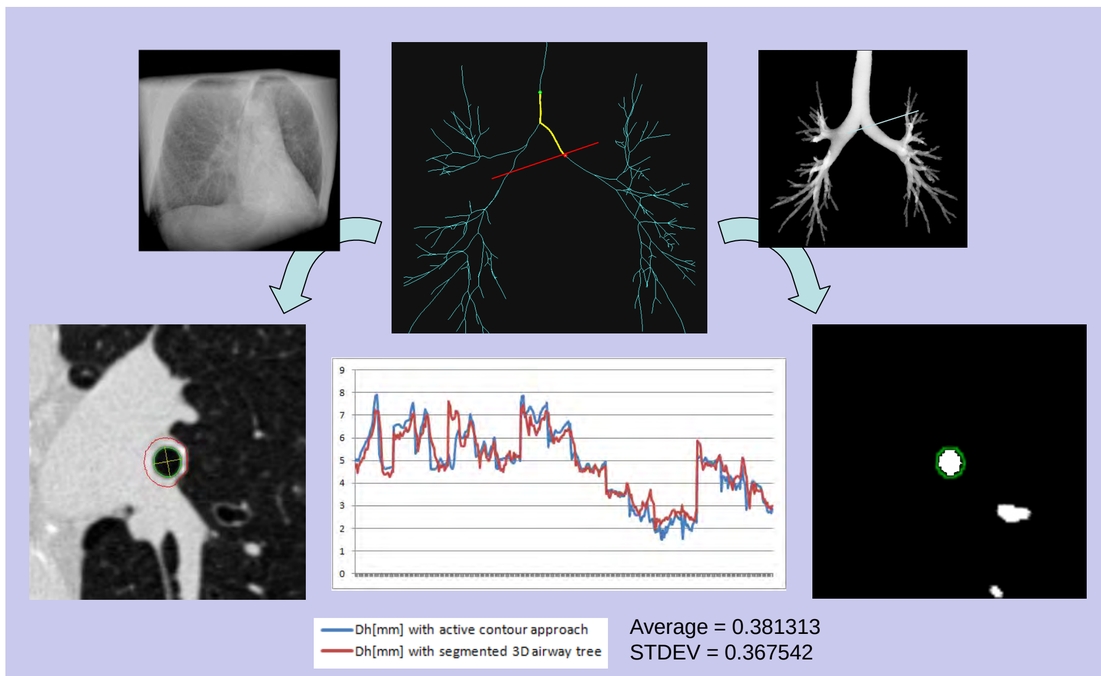
Groupe Hospitalier Pitié - Salpêtrière

Objectives and challenges

- Study the relationship between the local hydraulic (D_h) and minimal (D_m) diameters of the airway tree for pathology detection (stenosis and bronchiectasis).
- Build a cylindrical airway geometry based on D_h information and the corresponding 3D airway axis model, to be used in computational simulations of the airflow.



- Compute cross-section images at dense sampling points on the path.
- Select the airway component on the path using the grass-fire algorithm.
- Define the contour of the object using the Marching Squares.
- Compute the hydraulic diameter (D_h) based on area and perimeter measurements.
- Validation w.r. to a state-of-the-art method performing the same measurements on original grayscale cross-section images.



Achievements

- Functional airflow information based on hydraulic diameter
- Alternative airway geometries for computed fluid dynamics simulations

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