Characterization and differential diagnosis of lung pathologies with non-invasive image techniques
External funding

2008-2010 Characterization and differential diagnosis of animal models of emphysema, inflammation and lung cancer using non invasive imaging
PI: Dr. Luis Montuenga
Spanish Ministry of Health (FIS)

2008-2010 Imaging techniques for quantification of pulmonary emphysema and pulmonary function tests as tools for the identification of high risk subpopulations in the context of a lung cancer screening study
PI: Dr. Javier Zulueta
Spanish Ministry of Health (FIS)

2008-2009 Optimization of atlas-based segmentation of biomedical images
PI: Dr. Arrate Muñoz Barrutia
Regional Government of Navarra
Outline

- Global aim
- Micro-CT
- Functional tests
- Histology
- Conclusions
Biological aim

Study the role of emphysema as an initiator of Lung Cancer using non-invasive imaging in animal models of emphysema, chronic inflammation and lung cancer.
Technological aims

- Detection and differential diagnosis of lung pathologies using micro-CT images
- Establish the viability of follow-up studies in mice models of lung pathologies
- Demonstrate that the analysis of micro-CT images is more sensitive than respiratory functional tests
Acquisition protocol

- 0 min: anesthesia [Ketamina + Xylacina]
- 15 min: intubation
Acquisition protocol
Acquisition protocol

• 17 min: connection to ventilator
Acquisition protocol

- 18 min: stabilization + Functional test
Acquisition protocol

• 20 min: scan starts
Acquisition protocol

- 50 min: scan completed
Acquisition protocol
Scale-sensitive filtering
Airway tree segmentation

Helpful for:
- Lung and lobe segmentation
- Disease quantification
- Intra-subject registration
Airway tree segmentation
Airway tree segmentation

Algorithmic framework:
- Wave front propagation
- Propagation evaluation
- Segment evaluation
Lung segmentation

- Lung segmentation necessary for disease quantification
- When the disease is very severe, an atlas based segmentation is a suitable option
Atlas-based segmentation

This method is based on registering pairs of images.

Registration:
- Calculation of a transformation: $F(A,B) \to T$
Atlas-based segmentation
Disease quantification

Emphysema
Disease quantification

Inflammation
Disease quantification

Cancer
Functional test

Single compartment model
Two parameters:
- R: Airway resistance
- C: Airway compliance
Histology

Control

Emphysema

x10
Manual Emphysema Quantification

Mean Linear Intercept Destructive Index
Automatic Emphysema
Quantification
Conclusion

- Computer Aided Detection and characterization of pathologies in micro-CT images
- Ongoing work, characterization of emphysema model progression at short times
- Ongoing work, characterization of the nodule load of combined models
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Publications


