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Crowdsourcing Airway Annotations in Chest CT Images

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Introduction

- Measuring airways important for e.g. cystic fibrosis
- Measurement is very time-consuming
- Machine learning methods need annotated data
- **Can airway annotations be crowdsourced?**

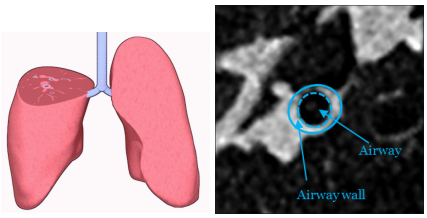

Figure 1: Annotation of an airway in a 2D slice of a CT scan

Crowdsourcing Experiment

- 1 CT scan with 76 expert-annotated airways
- Generate images at expert locations+orientations
- Amazon MTurk
- **Task: annotate airway with 2 ellipses**

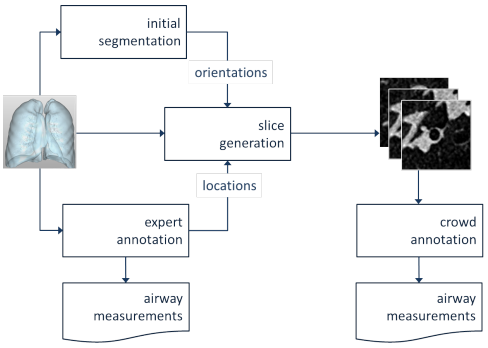

Figure 2: Overview of the process

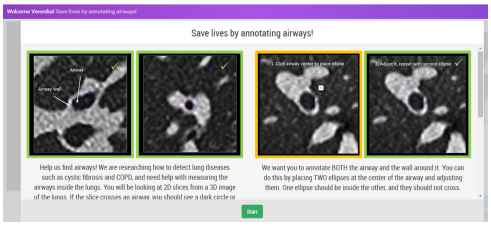

Figure 3: Instructions to the annotators (notice the scrollbar)

Results

- 90 images annotated by 10 workers each
- Many annotations unusable: 0 or 1 ellipses
- Usable annotations often good: medium/high correlations with expert

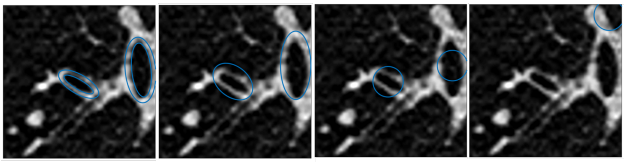

Figure 4: Examples of collected annotations

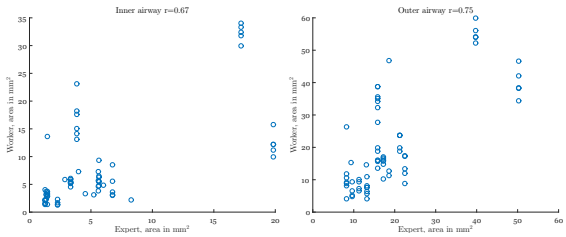

Figure 5: Expert vs worker measurements of airway lumen (left) and wall (right)

Discussion

- Overall good first experience with crowdsourcing
- Instructions need to be shorter, simpler
- Validation on 24 subjects with 20 annotations/image planned
- Decide locations and orientations without expert?
- Get more out of unusable annotations?
- Use annotations to improve machine learning algorithms for airway extraction

Cheplygina, V., Perez-Rovira, A., Kuo, W., Tiddens, H. A., & de Bruijne, M. (2016). Early Experiences with Crowdsourcing Airway Annotations in Chest CT. Large-Scale Annotation of Biomedical Data and Expert Label Synthesis (MICCAI LABELS) (pp. 209-218).