

Early Experiences with Crowdsourcing Airway Annotations in Chest CT

Veronika Cheplygina,^{*†} Adria Perez-Rovira,^{*§} Wieying Kuo,^{§¶} Harm A. W. M. Tiddens,^{§¶}
Marleen de Bruijne^{*‡}

^{*}Biomedical Imaging Group Rotterdam, Erasmus Medical Center, Rotterdam, The Netherlands,

[†]Pattern Recognition Laboratory, Delft University of Technology, Delft, The Netherlands,

[‡]The Image Group, Department of Computer Science, University of Copenhagen, Copenhagen, Denmark,

[§]Dept of Pediatric Pulmonology and Allergology, Erasmus Medical Center - Sophia Children's Hospital, Rotterdam, The Netherlands,

[¶]Dept of Radiology, Erasmus Medical Center, Rotterdam, The Netherlands

Introduction

- Measuring airways important for e.g. cystic fibrosis
- Measurement is very time-consuming
- **Can airway measurements be crowdsourced?**

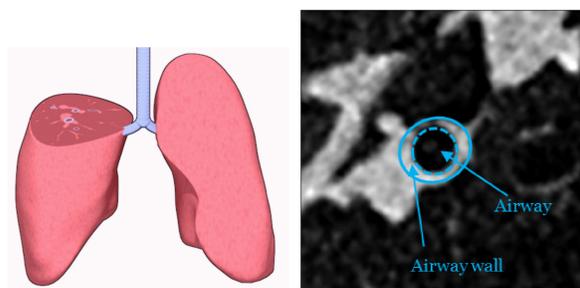


Figure 1: Annotation of an airway in a 2D slice of a CT scan

Crowdsourcing Experiment

- 1 inspiratory CT scan with 76 expert-annotated airways
- Generate images at expert locations+orientations
- Amazon MTurk with freehand, later ellipse drawing tool
- **Task: annotate airway with 2 ellipses**

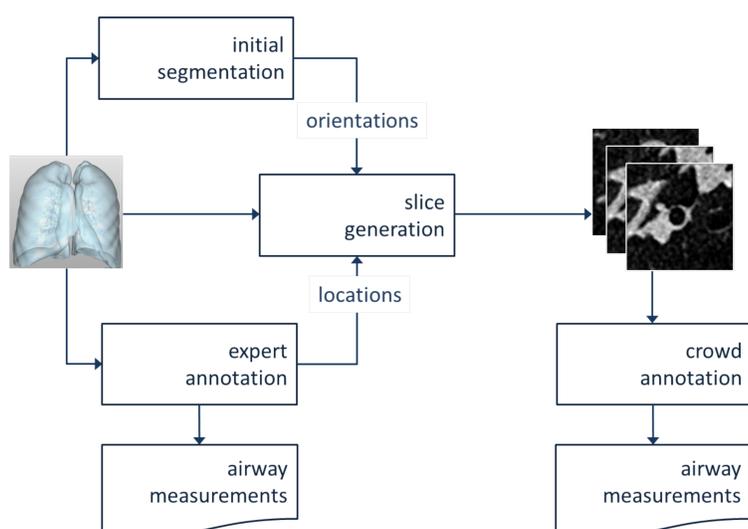


Figure 2: A 3D image is annotated by experts. Locations and orientations of the annotations are used to generate 2D slices, which are then annotated by workers (KWs).

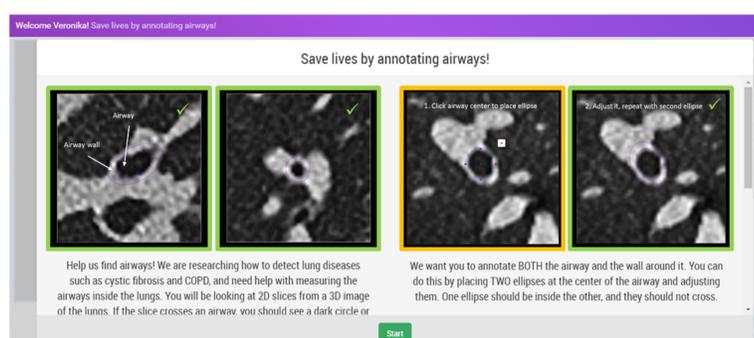


Figure 3: Instructions to the annotators (notice the scrollbar)

Results

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

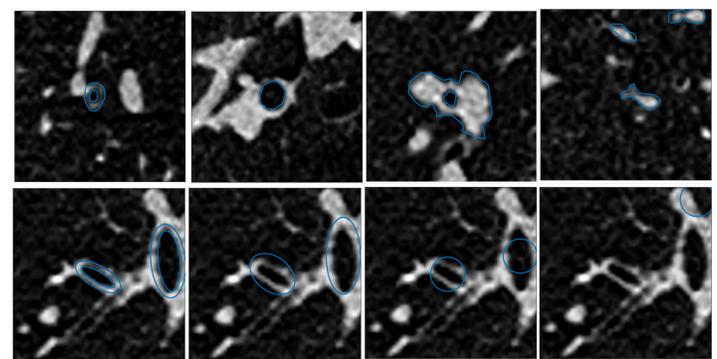


Figure 4: Examples of annotations collected with freehand and ellipse tools. Freehand was used initially but was soon by ellipse, which was used for all annotations.

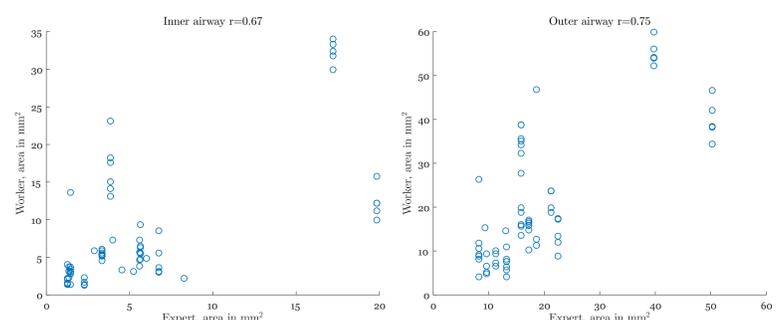


Figure 5: Expert vs KW measurements of airway lumen (left) and wall (right)

Discussion

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

Contact

- v.cheplygina@erasmusmc.nl / <http://www.veronikach.com>

