Automated Lung Histology Analysis

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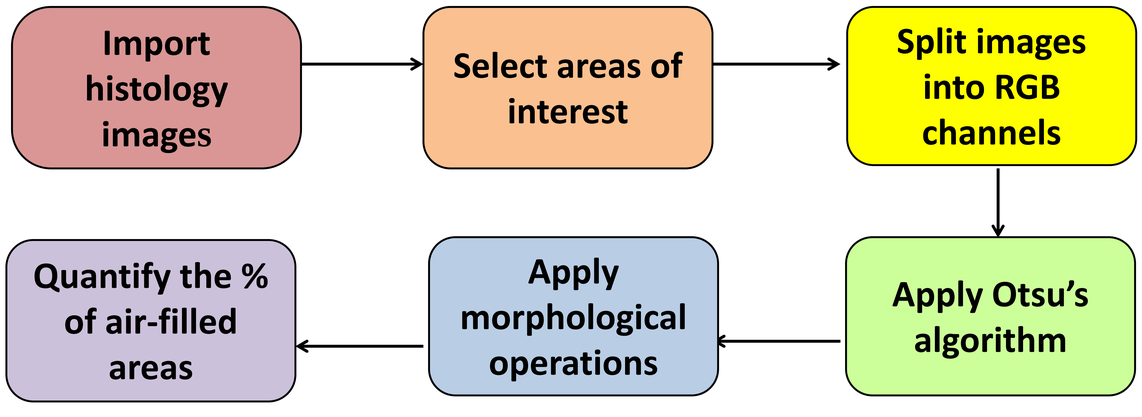
Introduction

- Current pandemic sets unmet needs in research into pulmonary diseases.
- Pathological analysis heavily relies upon pathologist's manual workload.
- We hypothesize that an automated analysis tool could quantify the percentage of air-filled areas. We test this hypothesis by developing this tool and comparing structural features of alveoli from diseased lungs.

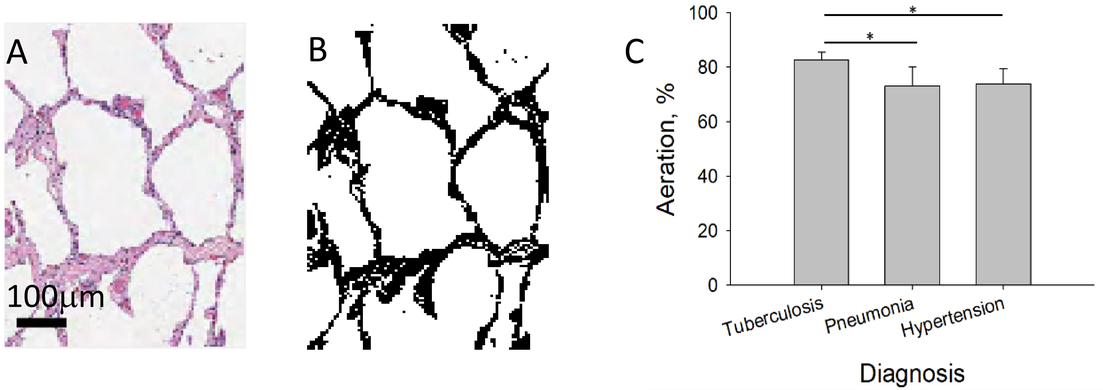
Materials

- Images are from publicly available dataset [1].
- Essentially air-filled areas excluding large airways and vessels are focused.
- All images are pre-processed in Aperio ImageScope.
- Computational environment is within Matlab.
- Morphological operations including dilation and erosion were applied for noise reduction and image enhancement [2].
- We quantify % of air-filled areas. We run statistical analysis and accept difference at *P<0.05 by ANOVA.



Results and Discussion

- The total alveolar areas analyzed are tuberculosis (n = 9), pneumonia (n = 15), and hypertension (n = 9).



- We collect three observations.
  - Processed images preserve alveolar morphology present in the original images (Fig 1A and 1B).
  - There are statistical differences in the % of air-filled areas in the three disease conditions (Fig. 1C). The tuberculosis patients present the highest aeration.

Conclusion

- It is technically feasible to automatically quantify air-filled areas in lung histology.
- Future work will be towards development of computational methods to distinguish other areas including edematous, large airways, and vessels.

References

1. https://www.pathology.med.umich.edu/slides/
2. Xu, X. Acta Microscopica 29.6 (2020)