Lung-airway Data Interrogation via Cluster Analysis

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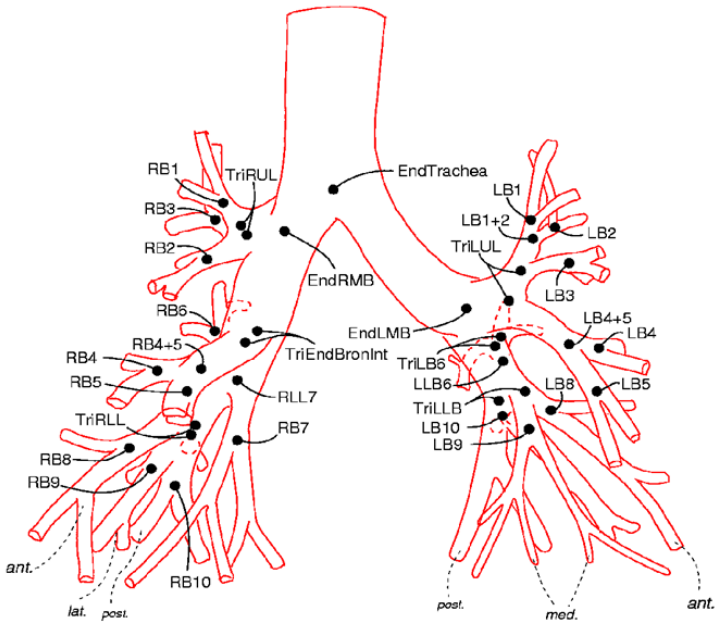
Introduction

- Multi detector-row CT (MDCT)-based imaging and automated image analysis yield rather detailed *in vivo* measurements of individual human lung airways.



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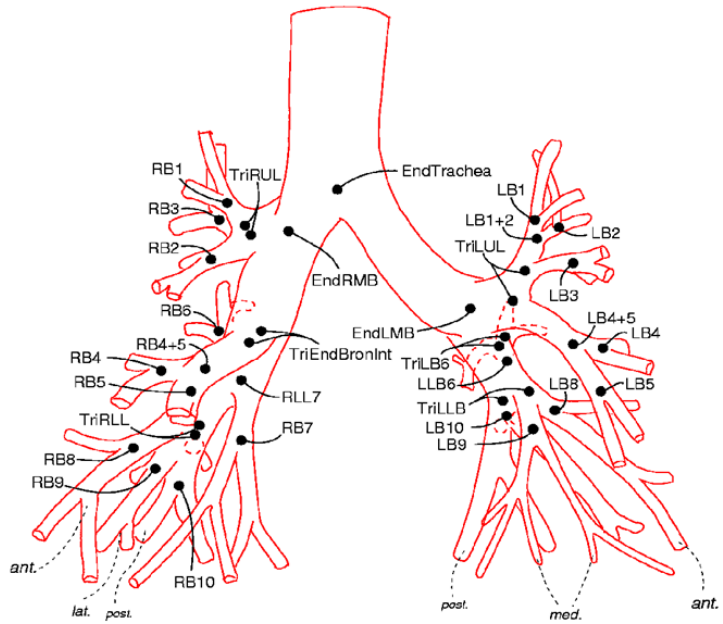
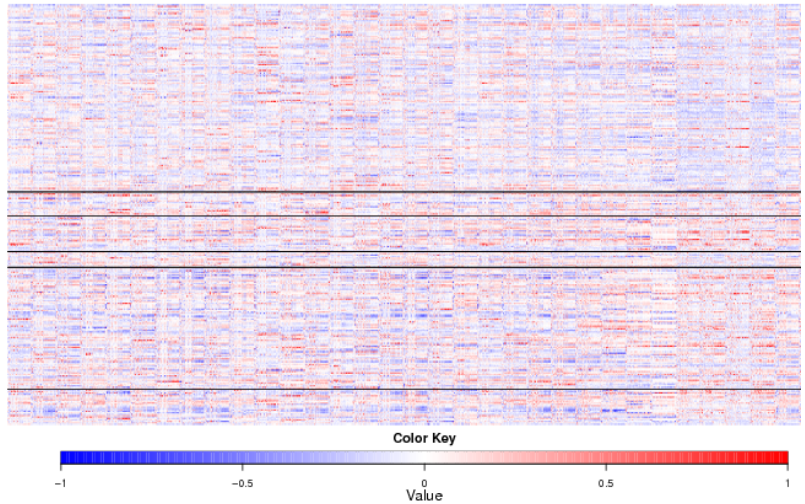
- Lung airway data comprise high-dimensional image variables, e.g. segment-by-segment average wall thickness, average inner area, branch angles, etc.





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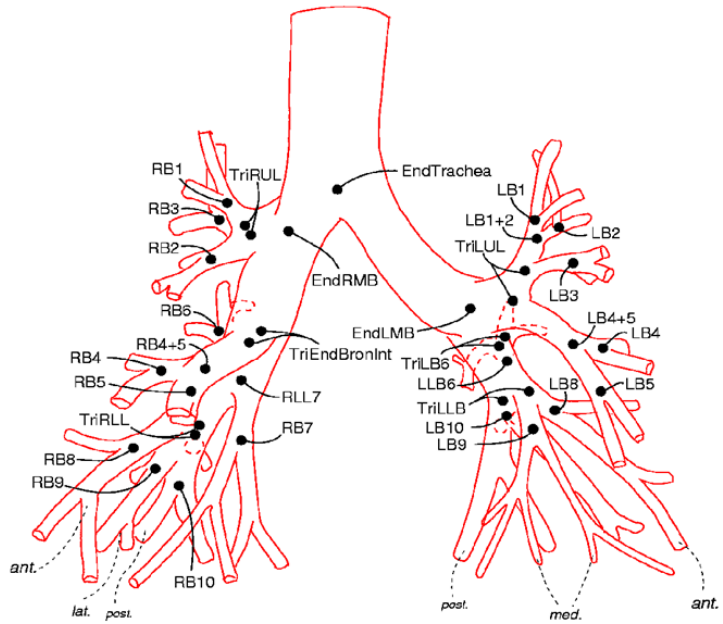
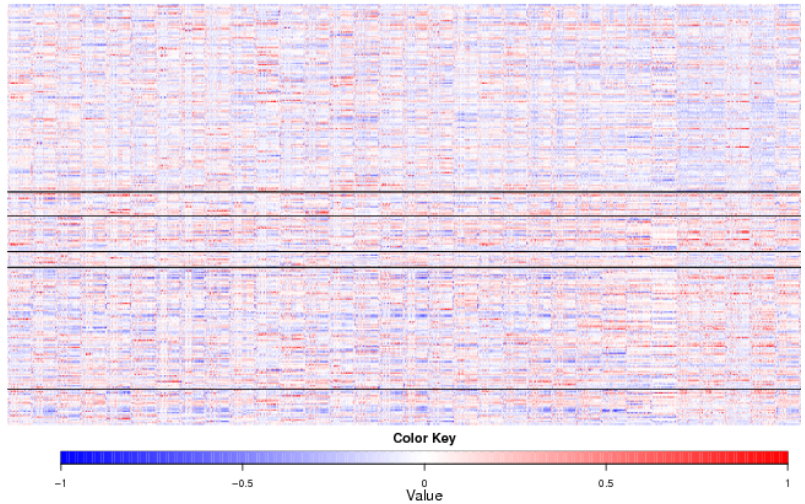
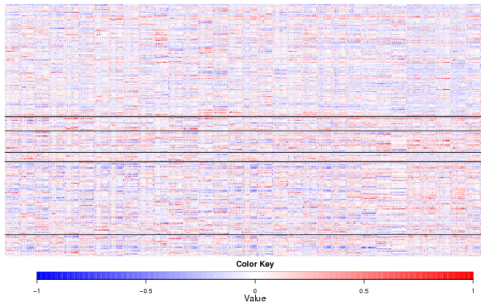
- Lung airway data comprise high-dimensional image variables, e.g. segment-by-segment average wall thickness, average inner area, branch angles, etc.
- Issue: explore the presence of systematic variations in the lung airway structure between normal non-smokers (n=132) and asthmatics from SARP (n=164). 1567 (derived) airway measurements per subject.





Method

$$\begin{pmatrix} Y_{1,1} & Y_{1,2} & \cdots & Y_{1,1567} \\ \vdots & \vdots & \ddots & \vdots \\ Y_{132,1} & Y_{132,2} & \cdots & Y_{132,1567} \\ Y_{133,1} & Y_{133,2} & \cdots & Y_{133,1567} \\ \vdots & \vdots & \ddots & \vdots \\ Y_{296,1} & Y_{296,2} & \cdots & Y_{296,1567} \end{pmatrix} = \begin{pmatrix} \sqrt{\frac{164}{132 \times 296}} \\ \vdots \\ \sqrt{\frac{164}{132 \times 296}} \\ -\sqrt{\frac{132}{164 \times 296}} \\ \vdots \\ -\sqrt{\frac{132}{164 \times 296}} \end{pmatrix} \begin{pmatrix} v_1 & v_2 & \cdots & v_{1567} \end{pmatrix} + E$$



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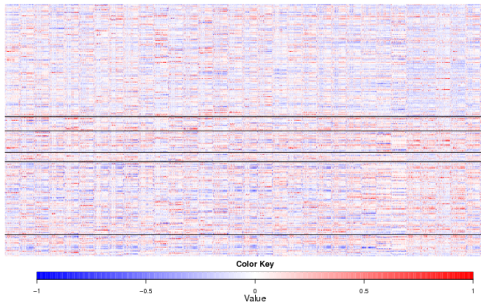

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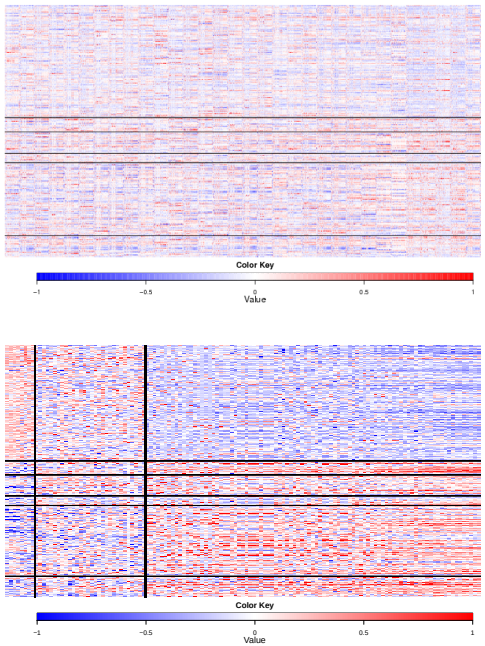

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- Employ a new statistical method (RRR-SVD) that provides good fit with a sparse estimator of the v's.

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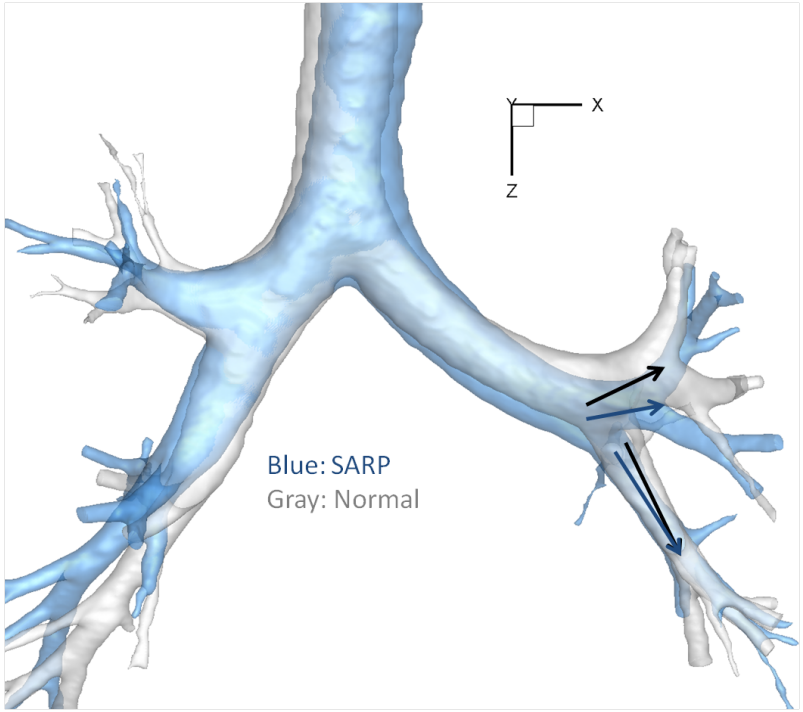

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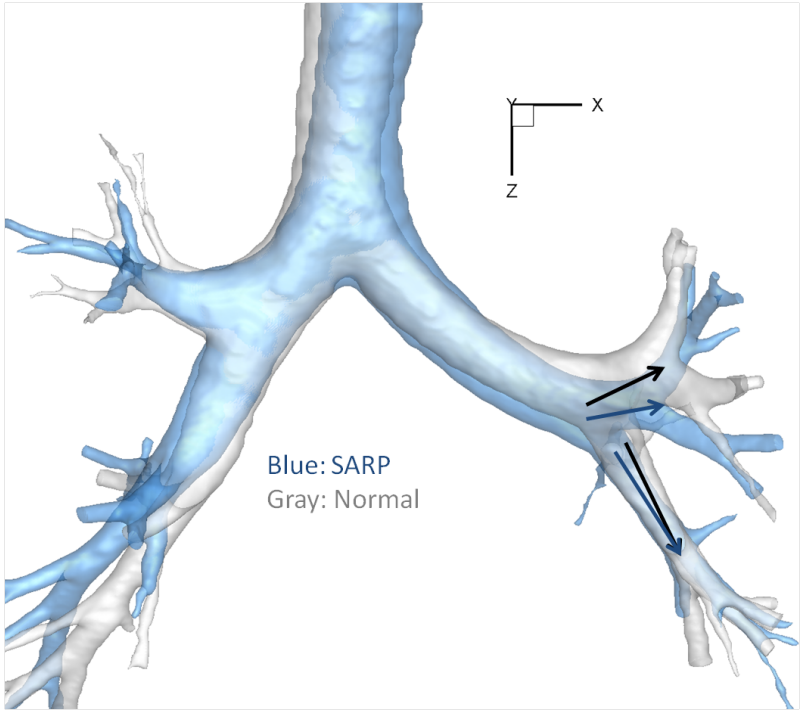

	Out-of-sample		
	MCR	FPR	FNR
With all variables	12.2%	10.6%	13.4%
Without "angle" variables	15.5%	17.4%	14.0%
"Angle" variables only	16.2%	18.2%	14.6%

MCR: misclassification rate
FPR: rate of misclassifying normal subjects as asthmatics
FNR: rate of misclassifying asthmatics as normal
These rates are based on twenty-fold cross validation

Thank You!

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