A Pilot Study Evaluating the Robustness of Density Mask Scoring (RA-950), a Quantitative Measure of Chronic Obstructive Pulmonary Disease, to CT Parameter Selection Using a High-Throughput, Automated, Computational Research Pipeline

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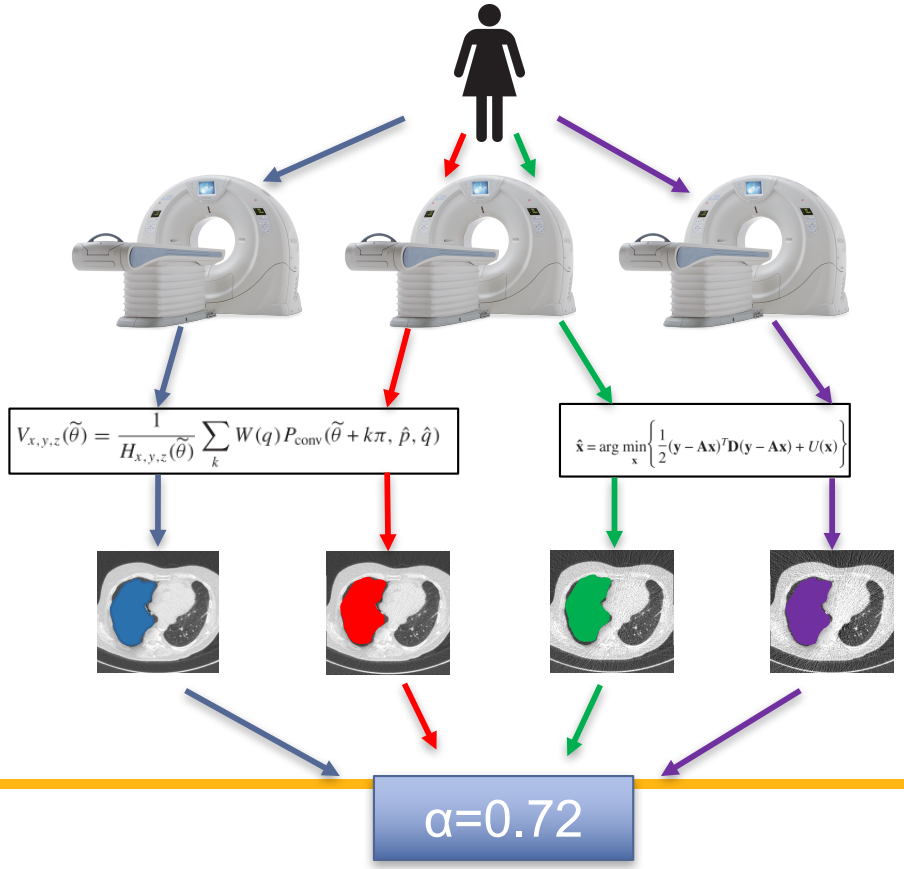
July 30, 2017
AAPM Annual Meeting 2017

UCLA Health

Background

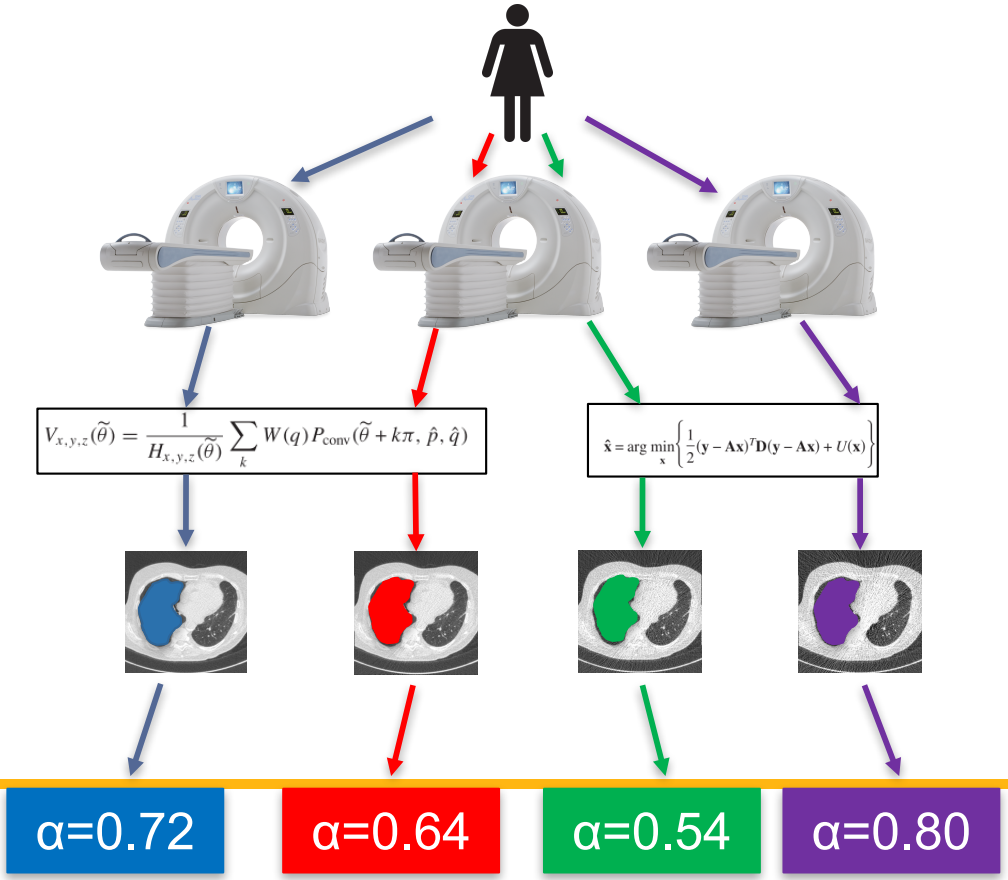
- Ideal QI test result would only be impacted by underlying disease



Background

- CT acquisition and reconstruction parameters impact QI imaging measures and tests

- "**How** we scan can be as important as **what** we scan"



Goal

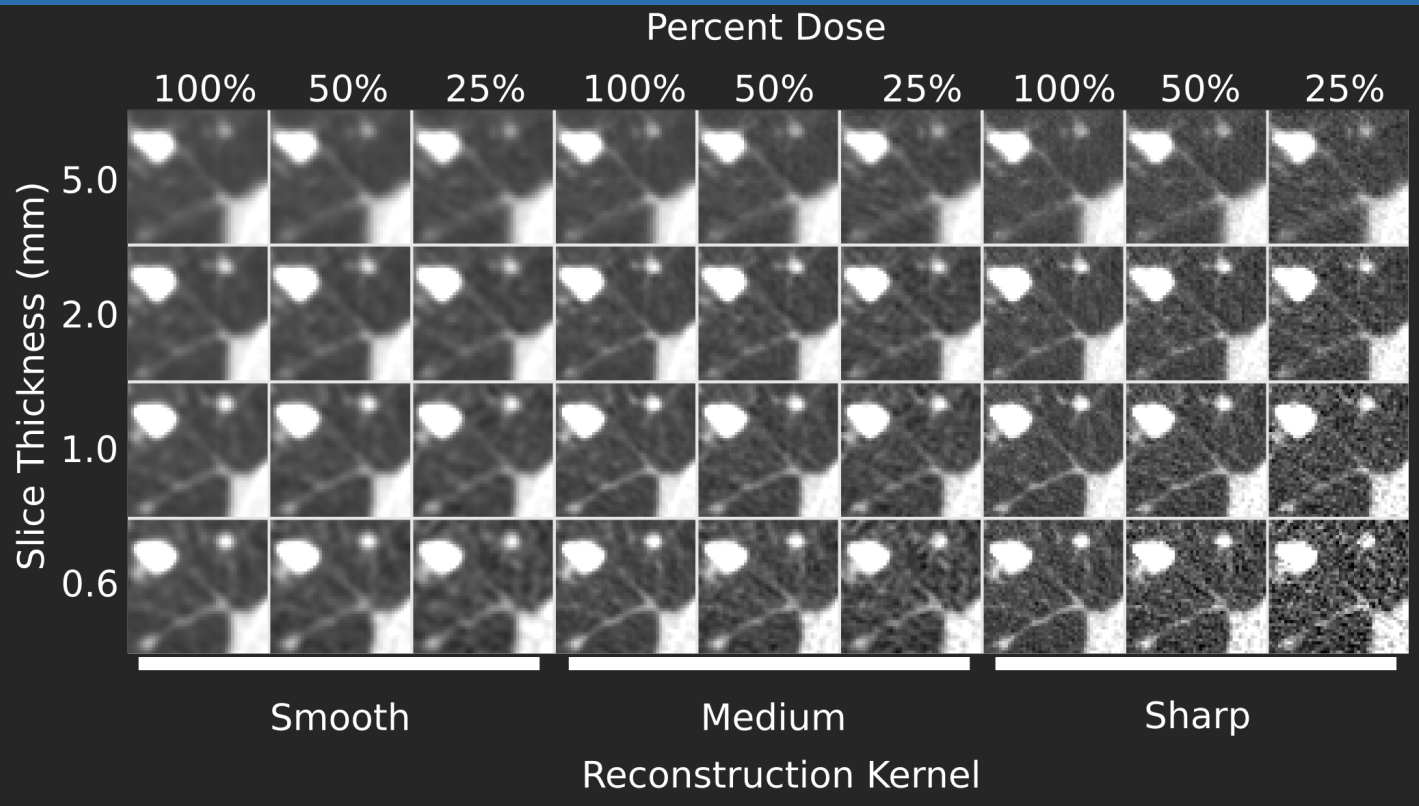
1. Investigate the impacts of reconstruction and acquisition parameters on RA-950 scoring
2. Interaction of different parameters
3. Demonstrate utility of our high-throughput pipeline

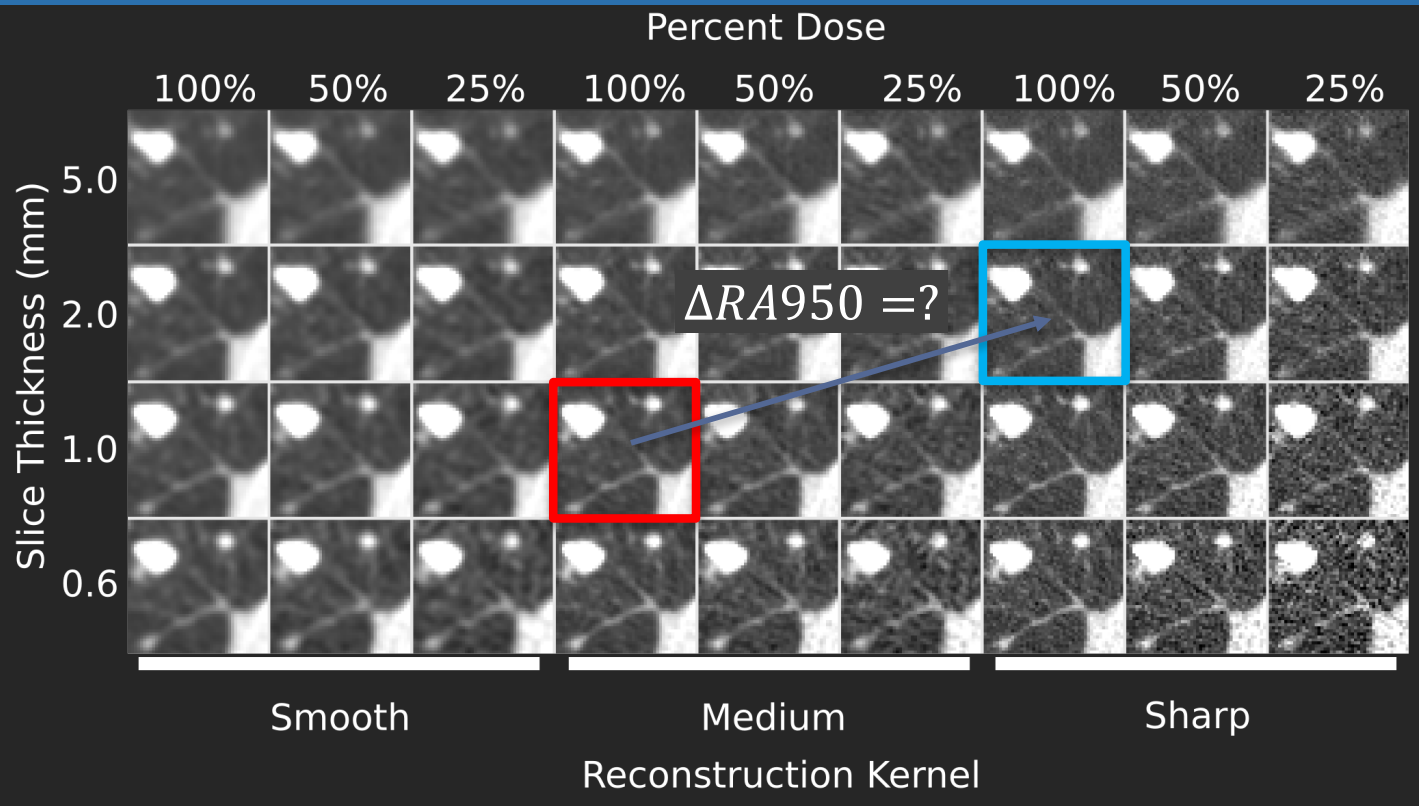
Methods

- The Pipeline:
  - Covered in detail in TU-C2-GePD-IT-2
  - High-throughput reconstruction and QI analysis pipeline
  - Allows large-scale, automated investigation of QI

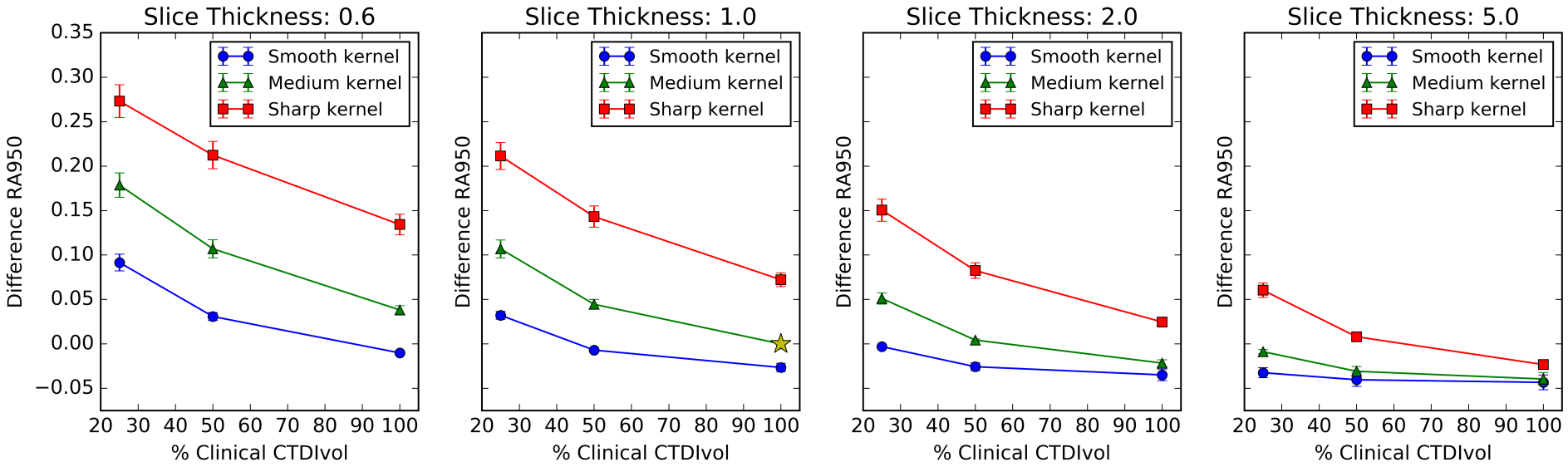
Methods

- Cohort (pilot):
  - 10 UCLA lung screening patients
  - 2 with substantial emphysema
- Reconstructions
  - 36 reconstructions per patient
    - Dose: 100%, 50%, 25%
    - Kernels: Smooth, Medium, Sharp
    - Slice thickness: 0.6, 1.0, 2.0, 5.0

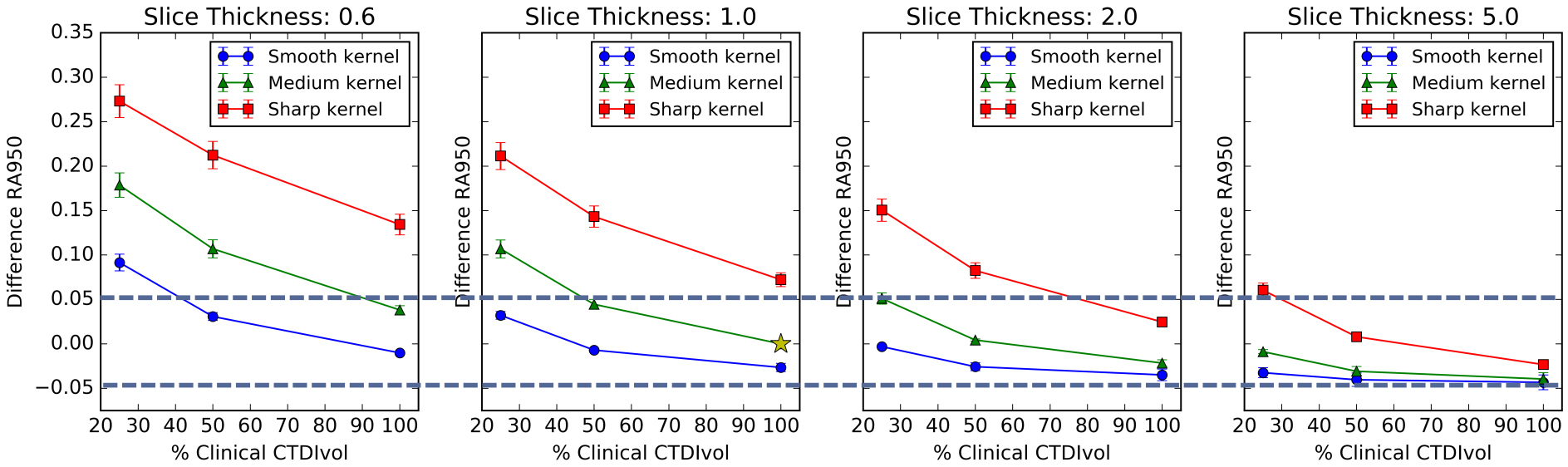

Percent Dose
100%
50%
25%
100%
50%
25%
100%
50%
25%
Slice Thickness (mm)
5.0
2.0
1.0
0.6
Smooth
Medium
Sharp
Reconstruction Kernel


Percent Dose
100%
50%
25%
100%
50%
25%
100%
50%
25%
Slice Thickness (mm)
5.0
2.0
1.0
0.6
$\Delta RA950 =?$
Smooth
Medium
Sharp
Reconstruction Kernel

Results


Slice Thickness: 0.6
Slice Thickness: 1.0
Slice Thickness: 2.0
Slice Thickness: 5.0
Smooth kernel
Medium kernel
Sharp kernel
Difference RA950
% Clinical CTDIvol
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
−0.05
20 30 40 50 60 70 80 90 100

Results


Slice Thickness: 0.6
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Smooth kernel
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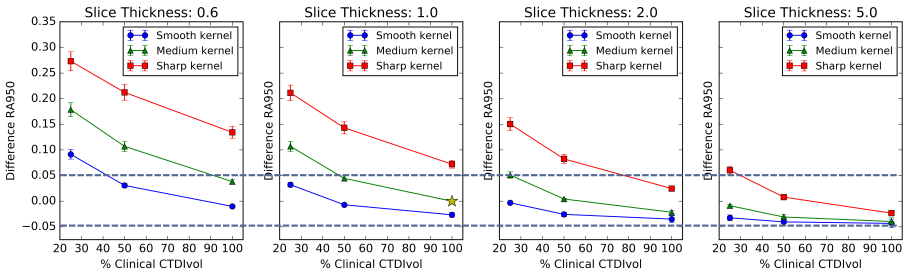
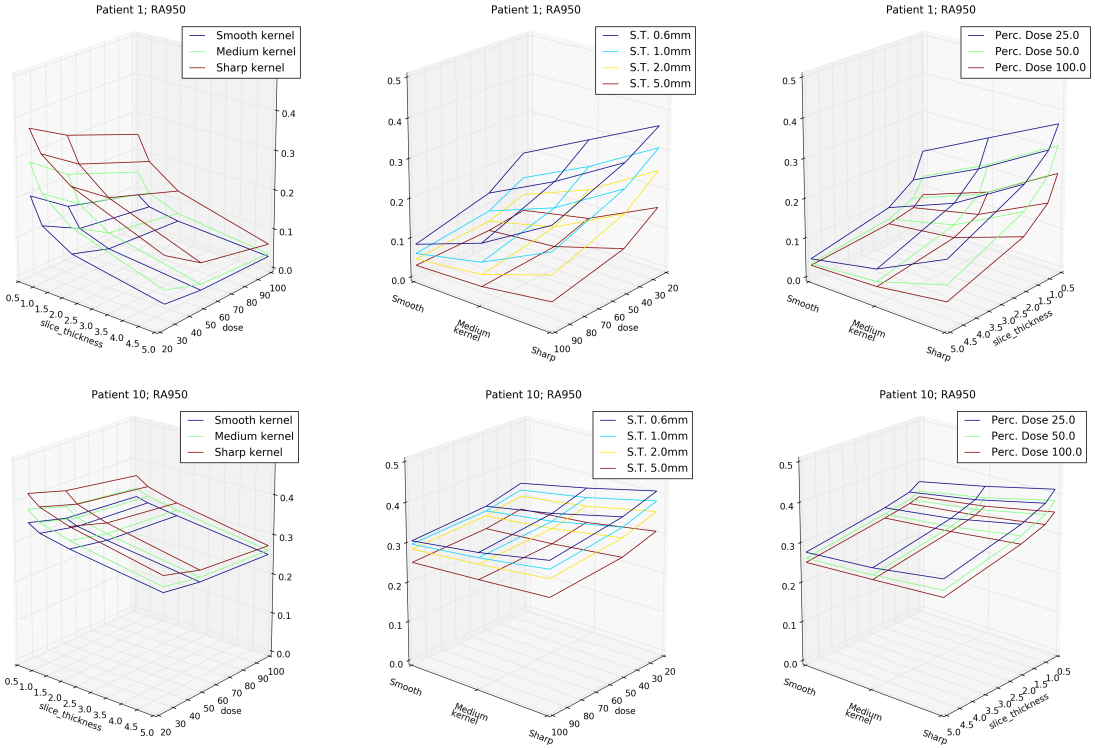
20 30 40 50 60 70 80 90 100

Results



- Smooth and medium kernels are “safe” at most doses and slice thicknesses
- Sharp kernel should not be used in almost all cases

Results



- Patient specific surface plots
  - Amount of emphysema affects robustness

Conclusions

- Pipeline accelerated QI study
  - Already have scaled to 142 subject cohort (5,112 reconstructions)
  - Powerful technique for dataset building
- Emphysema scoring
  - Fairly robust to protocol selections tested
  - Sharp kernels should not be utilized
  - Patient specific factors interact with scan specific factors

Thank you! Questions?

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