Effect of Segmentation Variation on ECG Imaging

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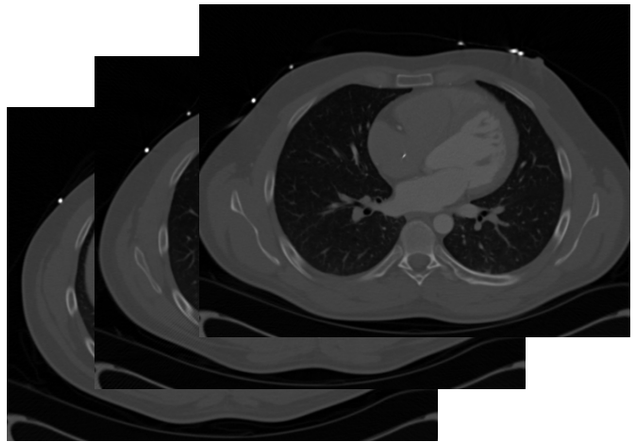
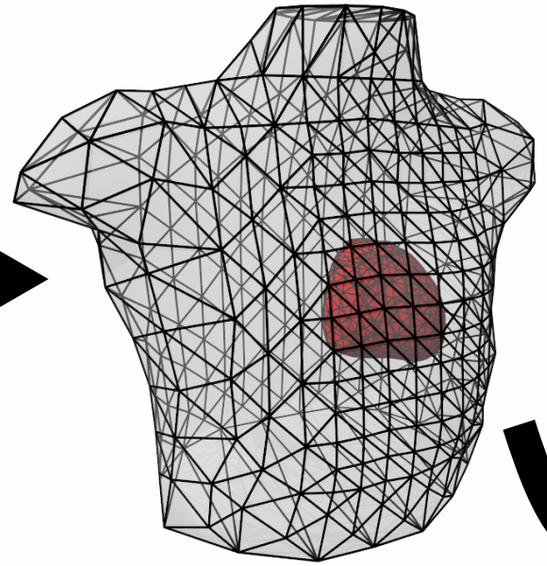
ECG Imaging

Medical Imaging



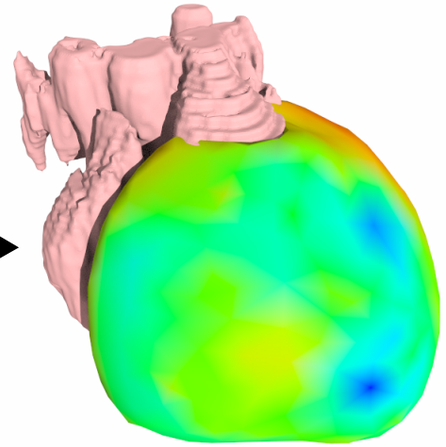
Geometric Model



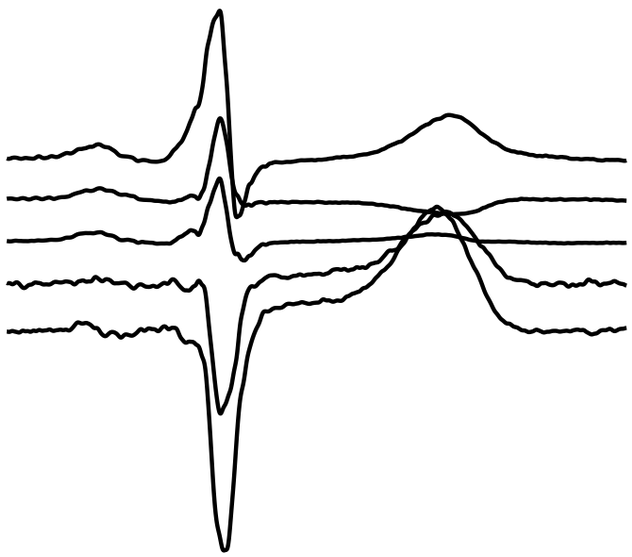
Forward Model

Solve Inverse

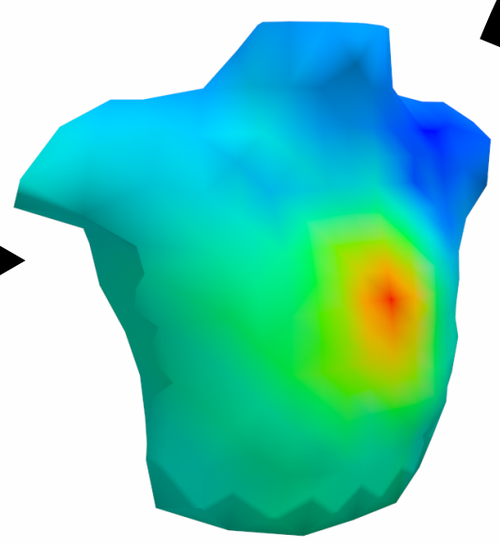
Cardiac Activity



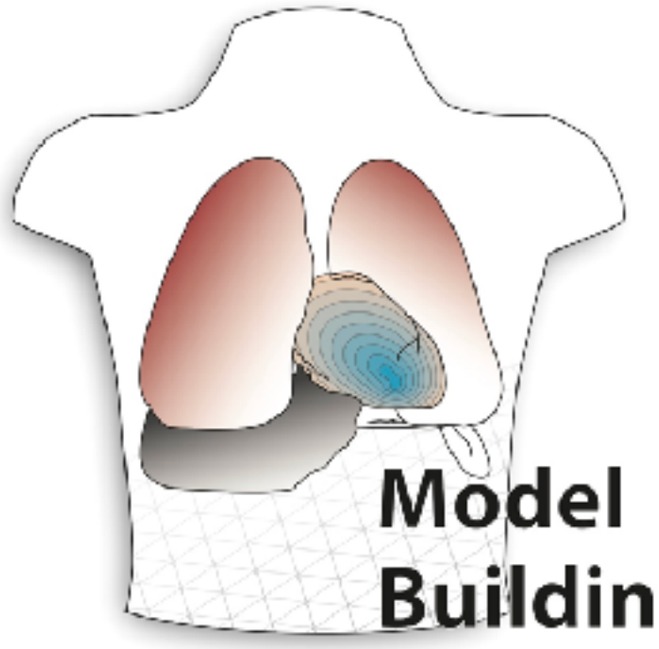
ECG Recordings



Potential Maps



CEI: Modeling Error Workgroup
(Consortium for ECG Imaging)



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CEI: Modeling Error Workgroup
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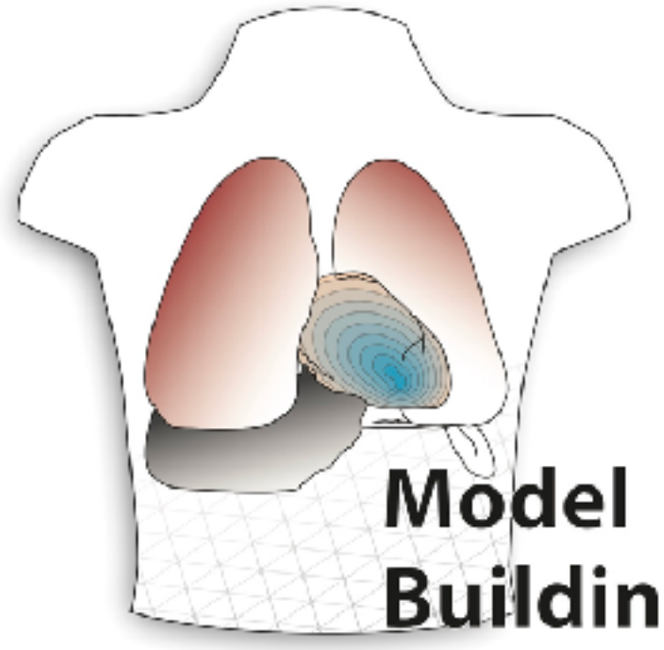

Quantify the effects of error

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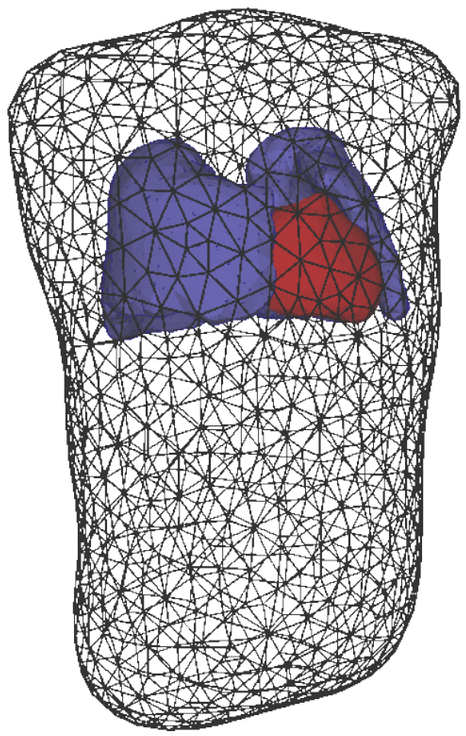
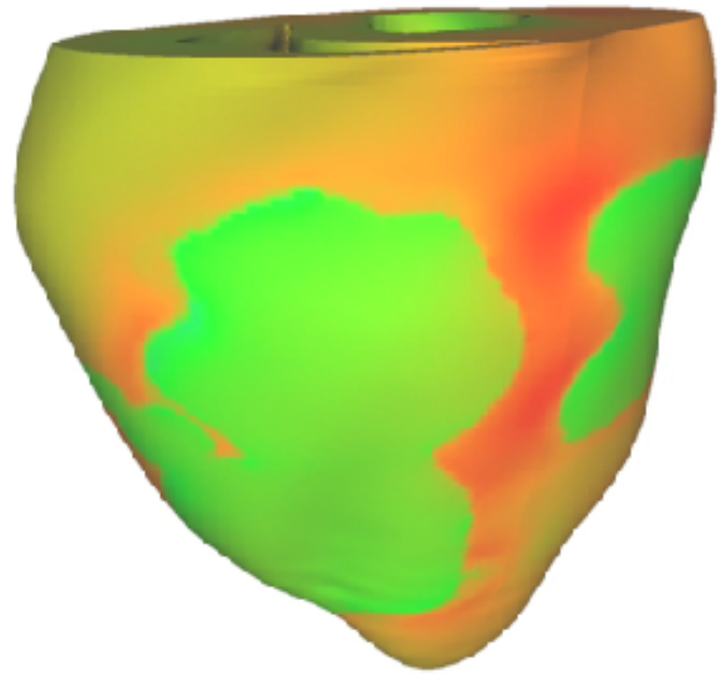
Origins of Error

Geometry

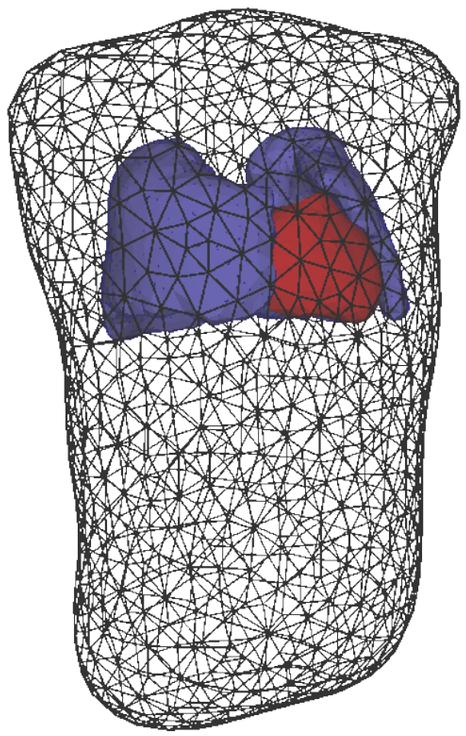


Sources



Origins of Error

Geometry



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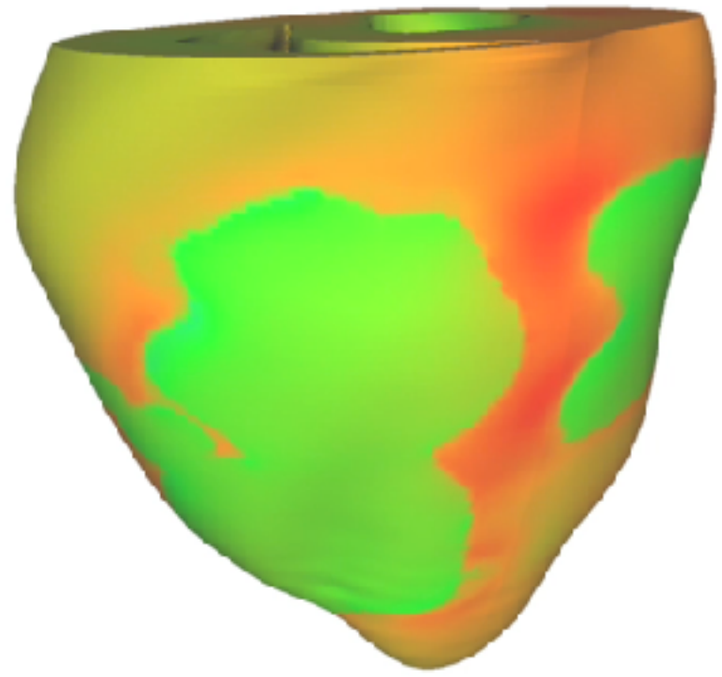
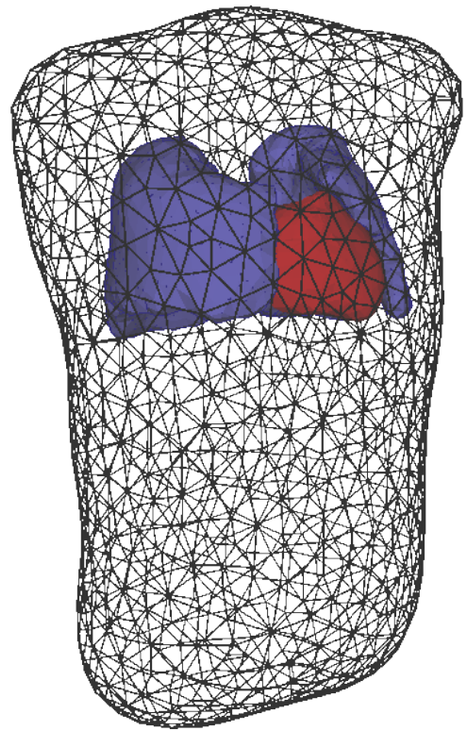


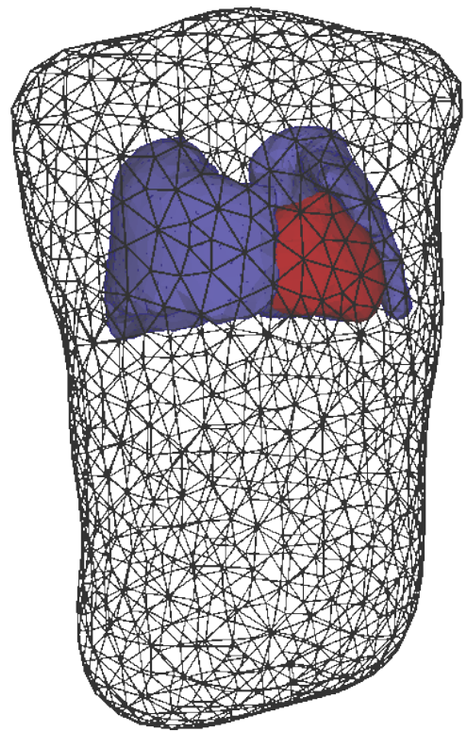
Origins of Error

Geometry



Origins of Error

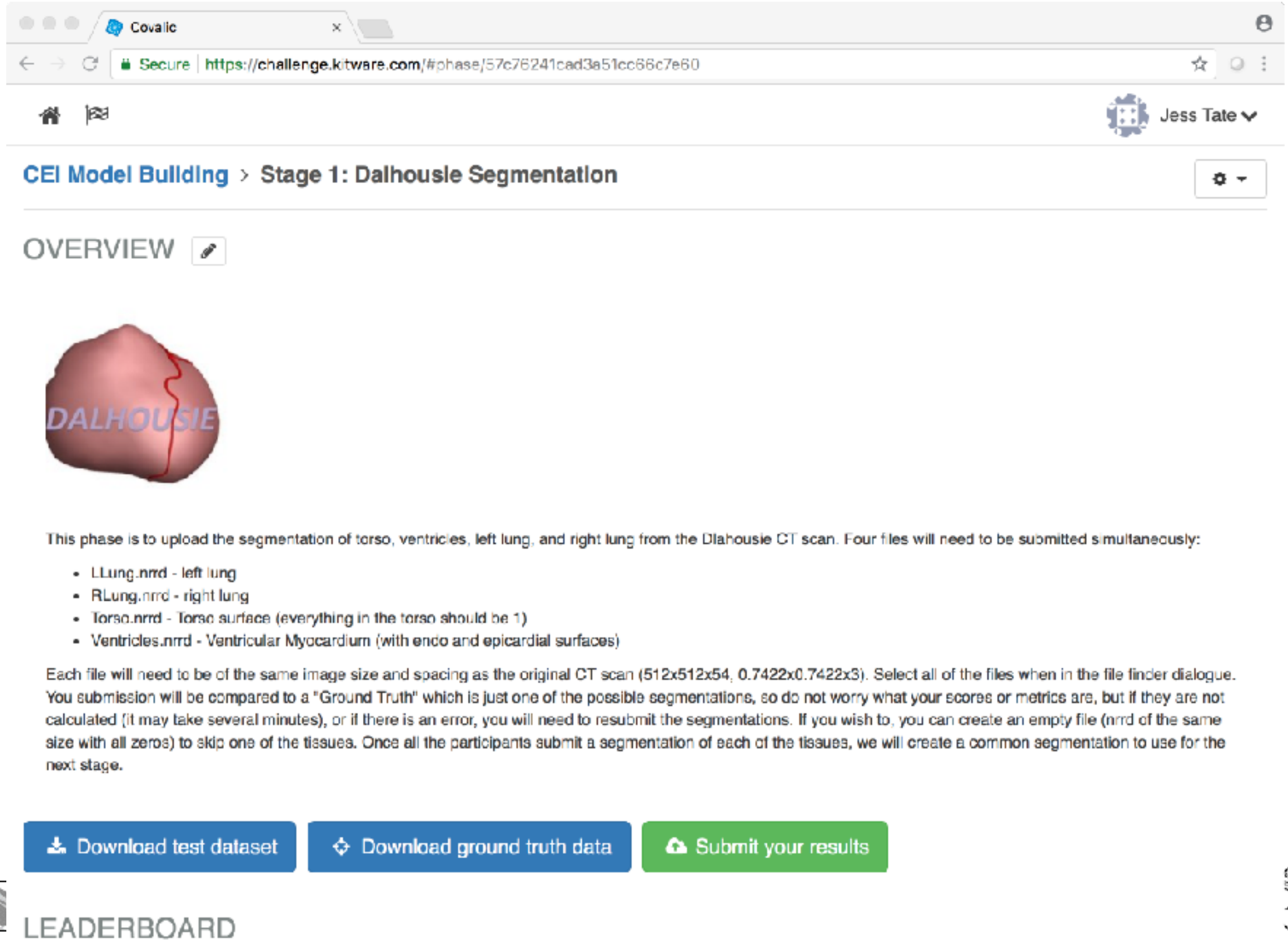
Geometry



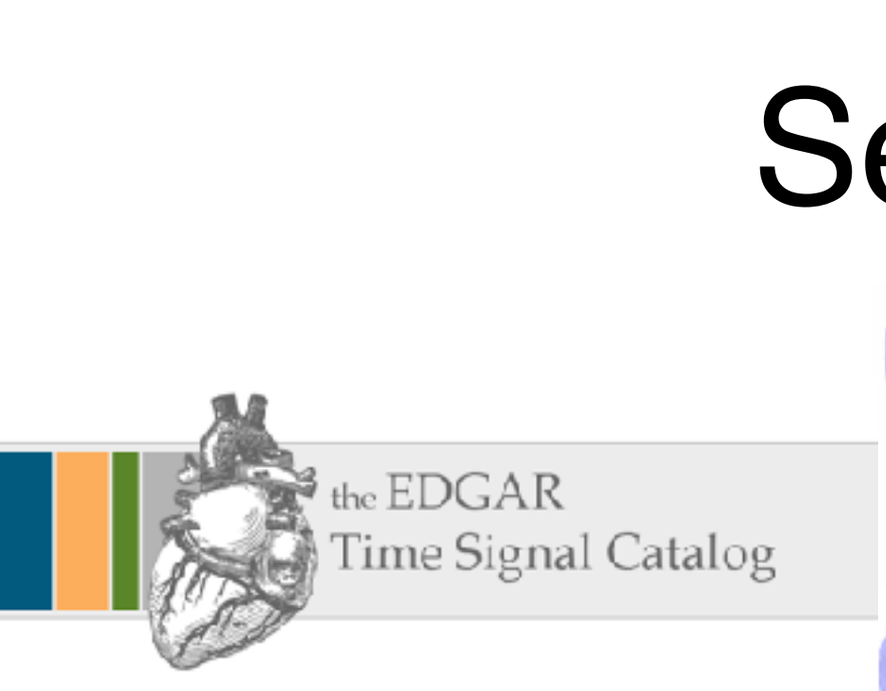
Segmentation

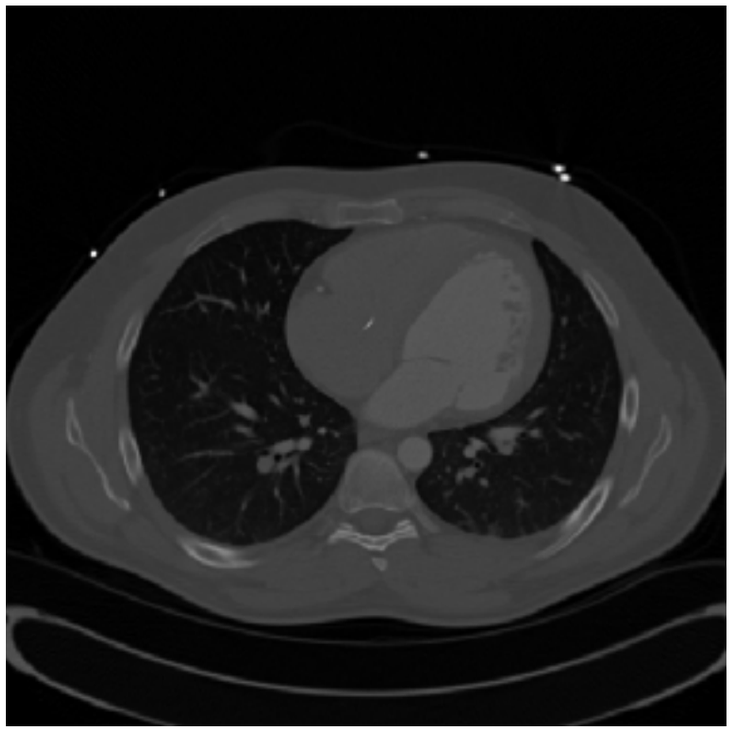
Segmentation Error

Data Collection

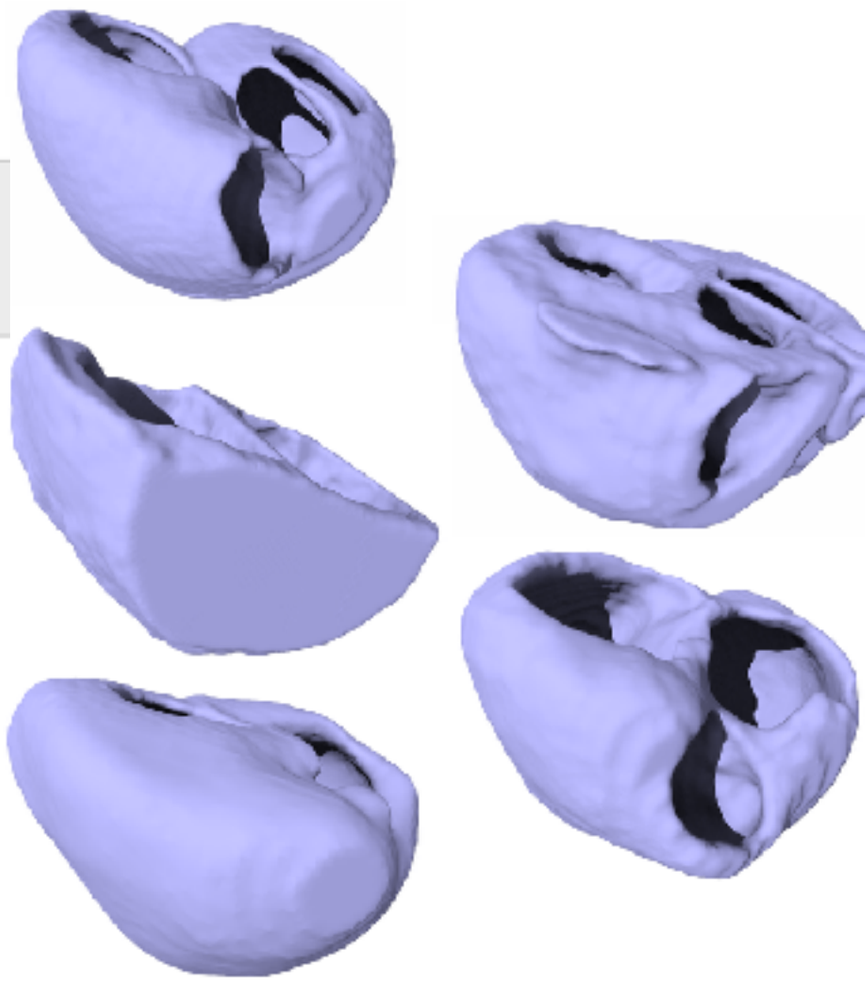


Segmentations

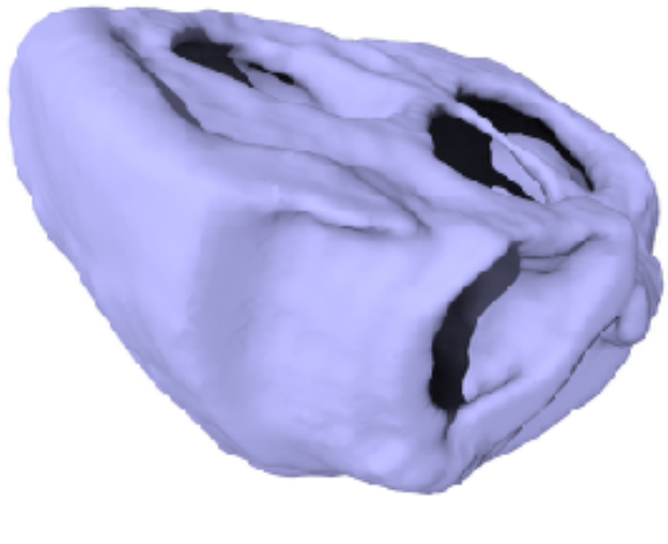




CT scan

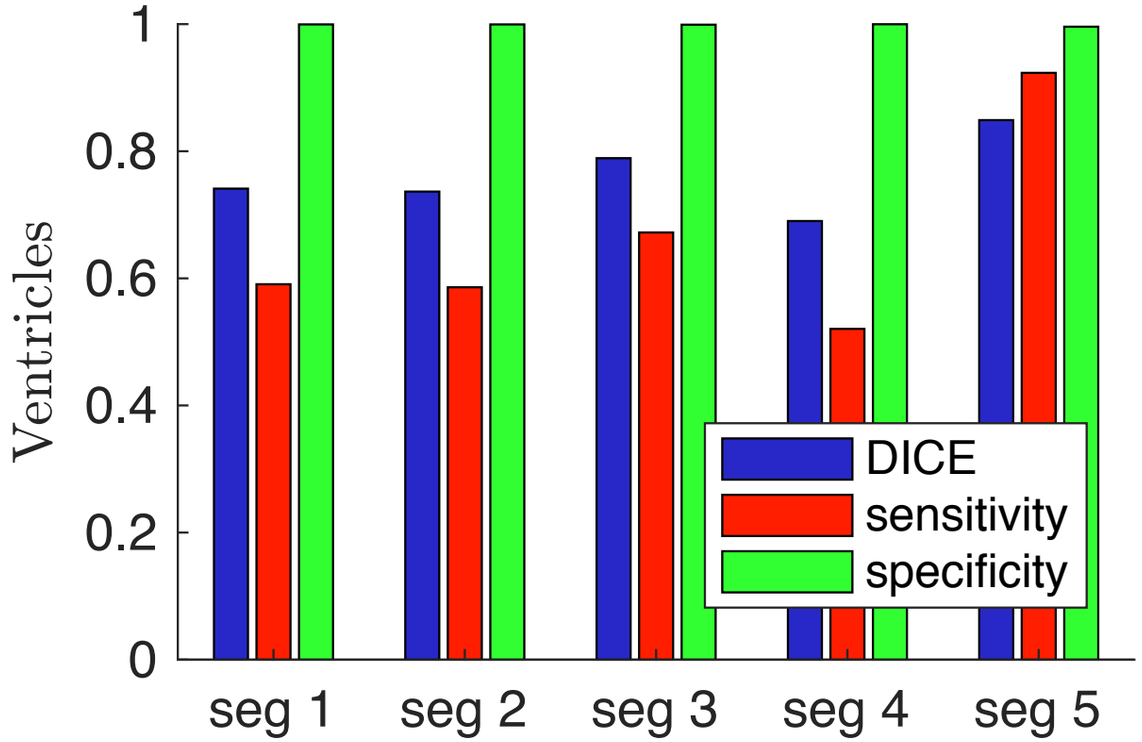


Covalic



STAPLE

Segmentation Variation



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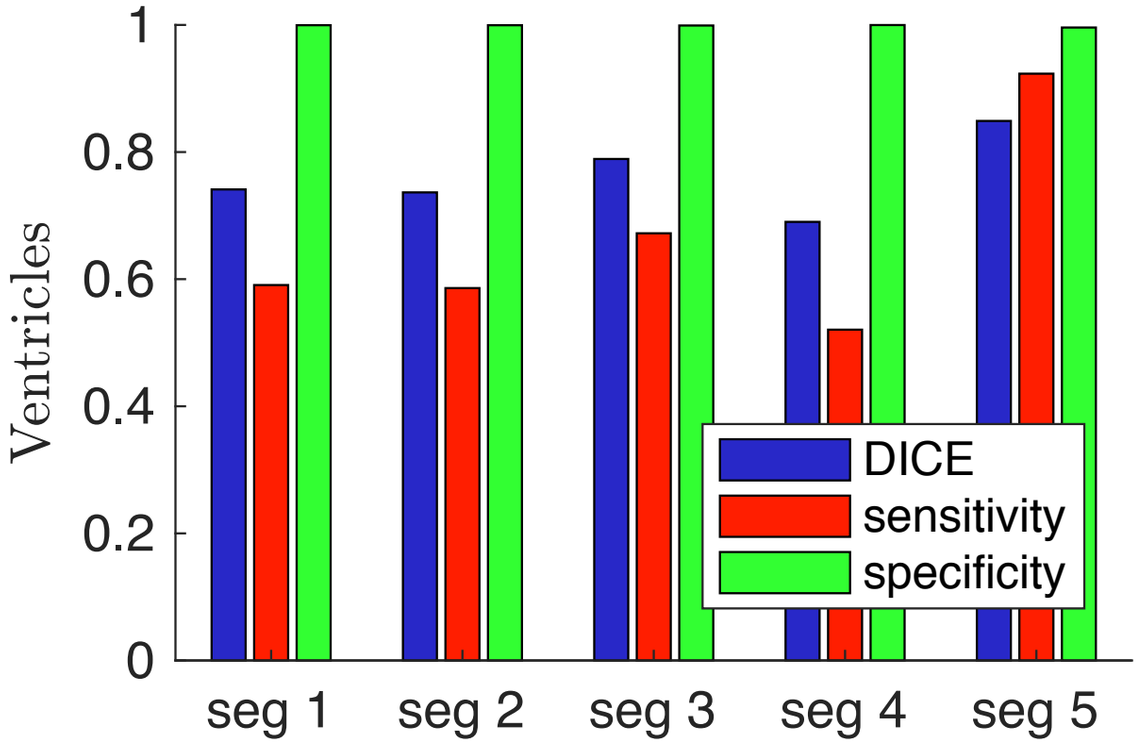
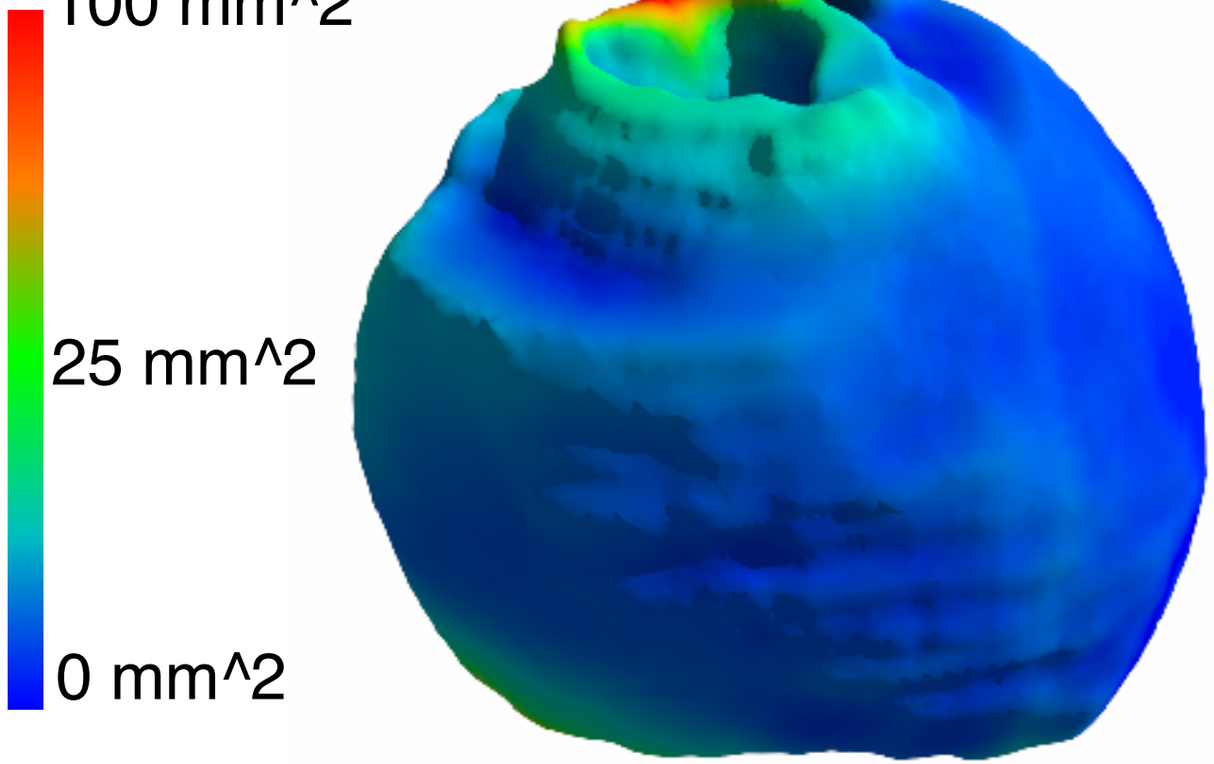
Segmentation Variation



Variance of min distance



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Quantify the effect of segmentation variation on ECGI solutions

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ECGI pipeline

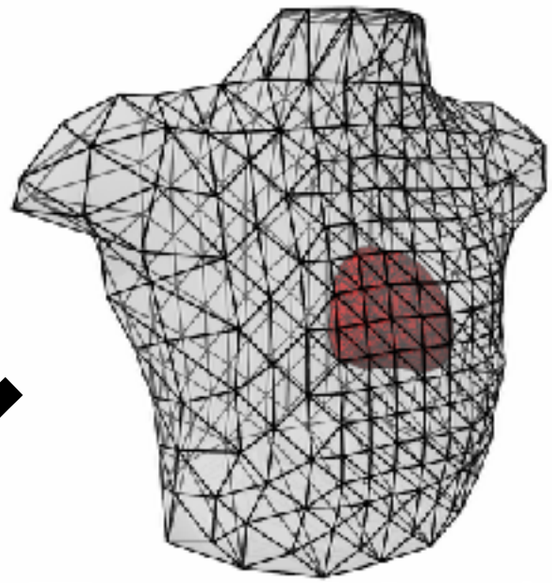
Covalic

Segmentation

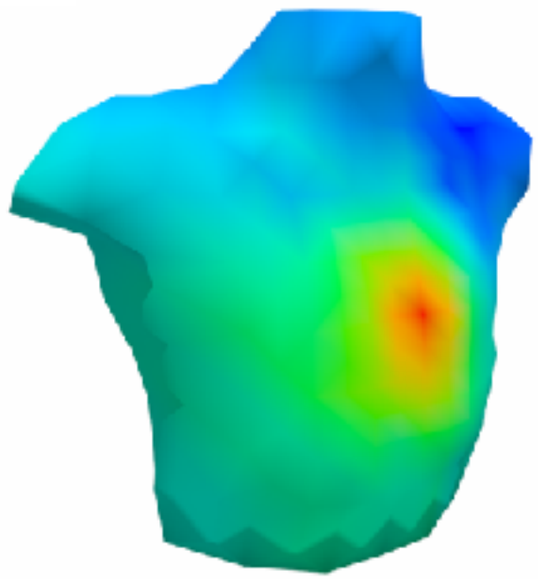
Heart Mesh

x6

the EDGAR Time Signal Catalog

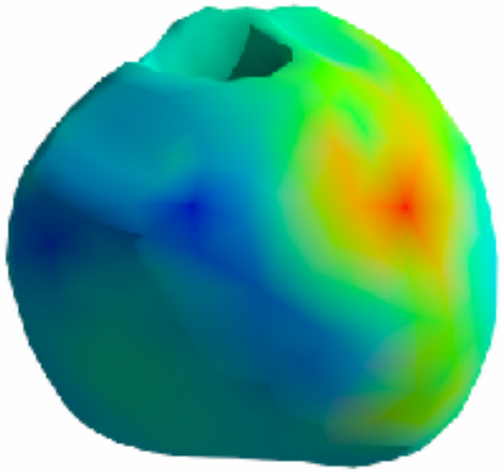


Torso Mesh

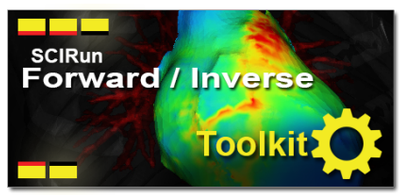


BSPM

Forward Matrix



ECGI



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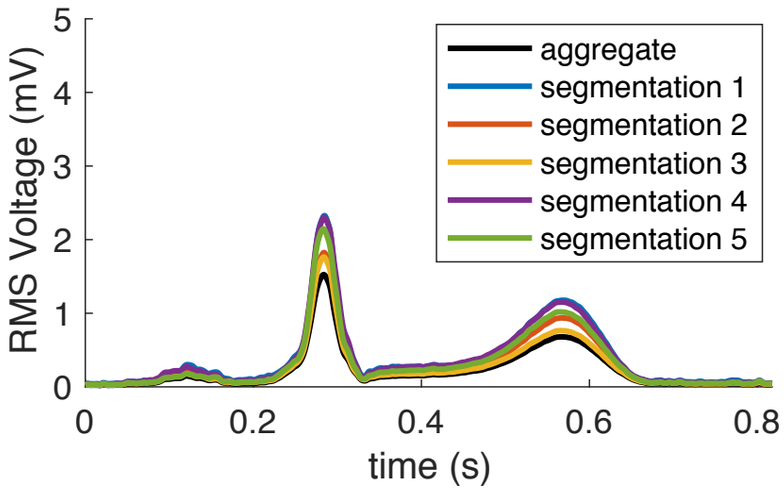
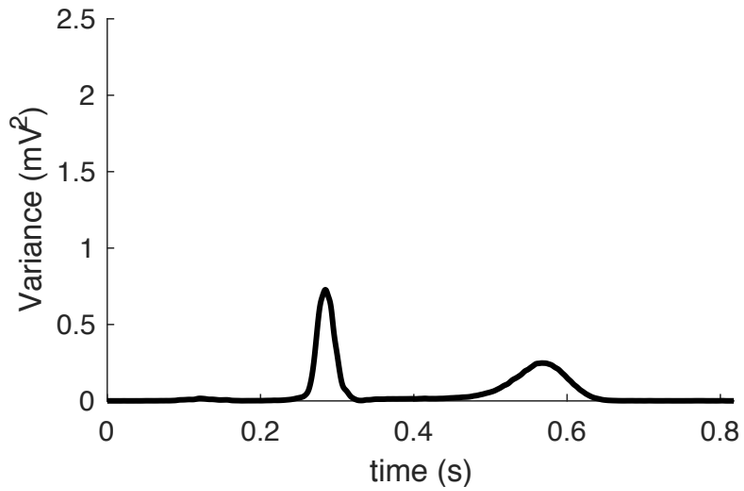
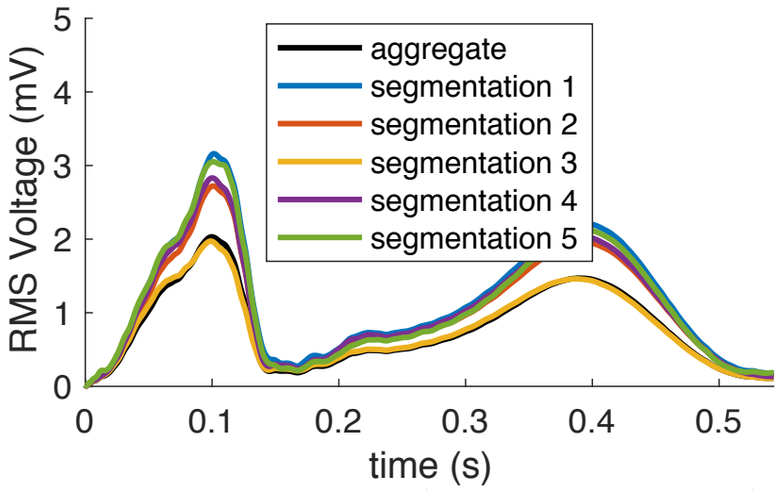
Variance Over Time

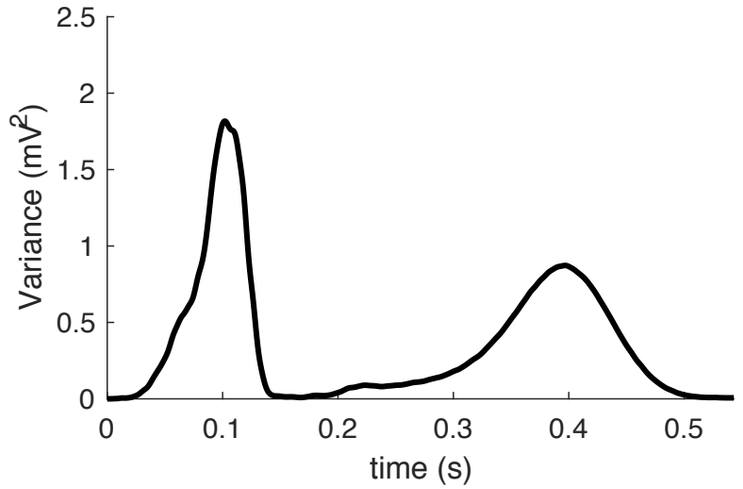
Sinus



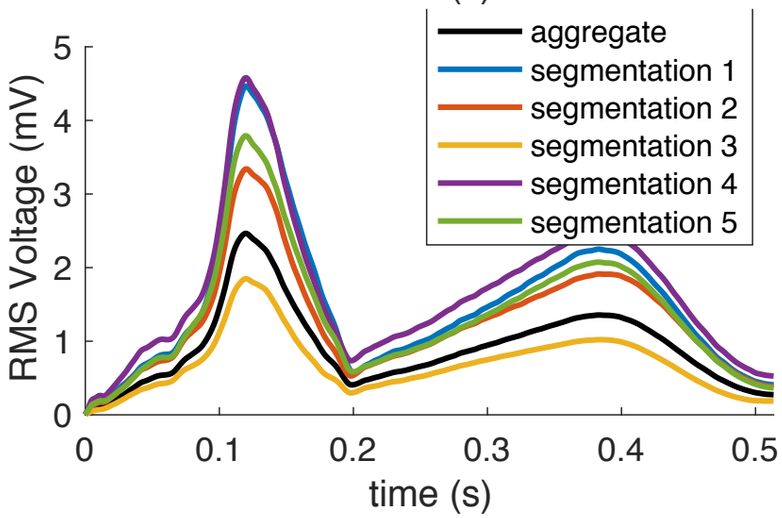


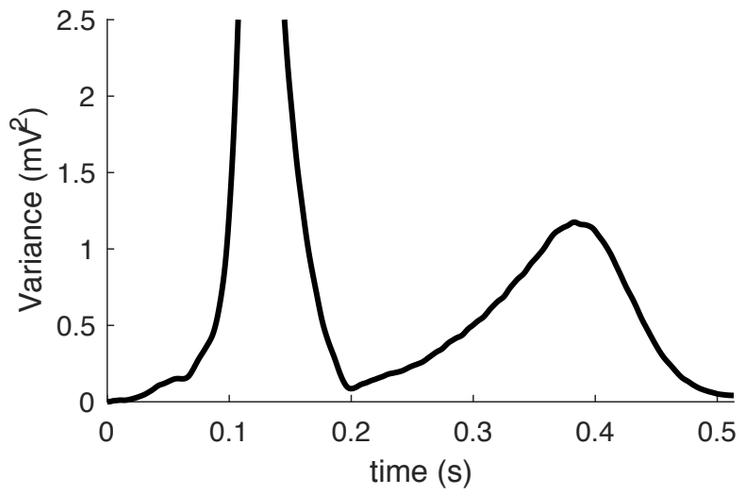
LV stim





RV stim





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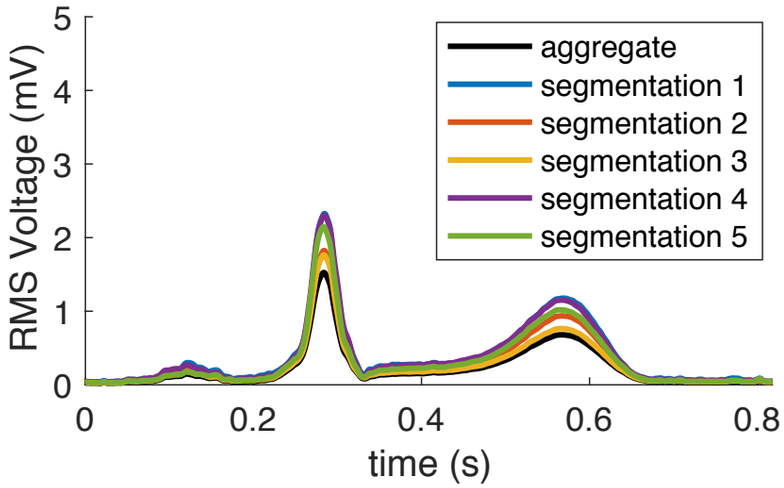
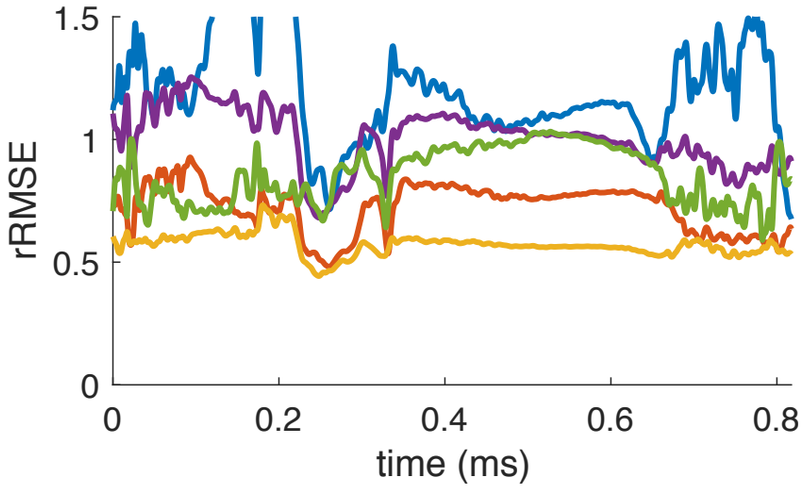
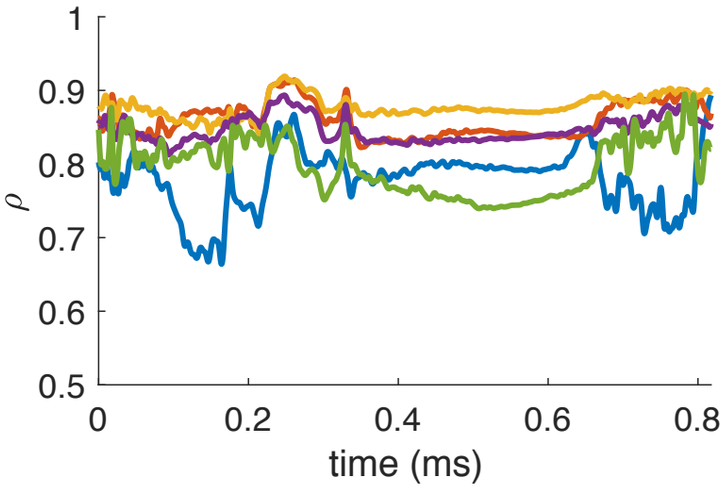
Variation Over Time

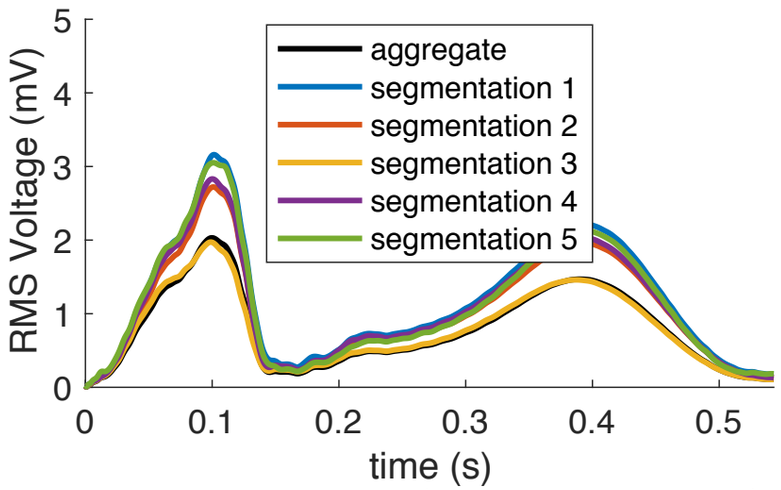
Sinus

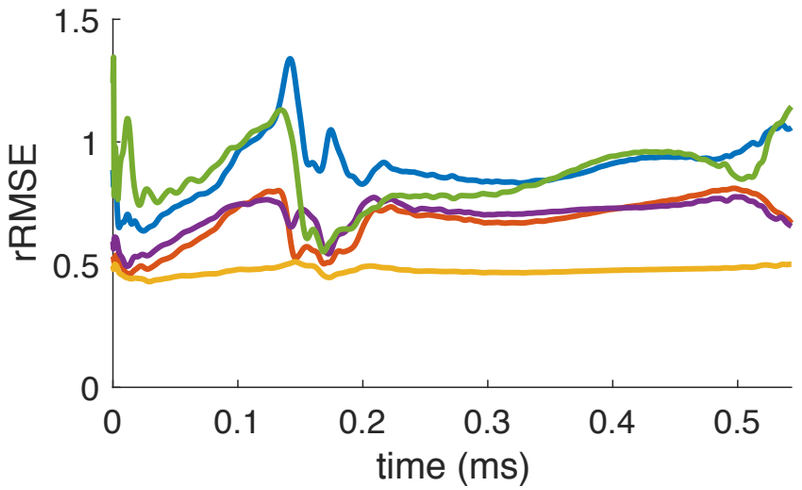


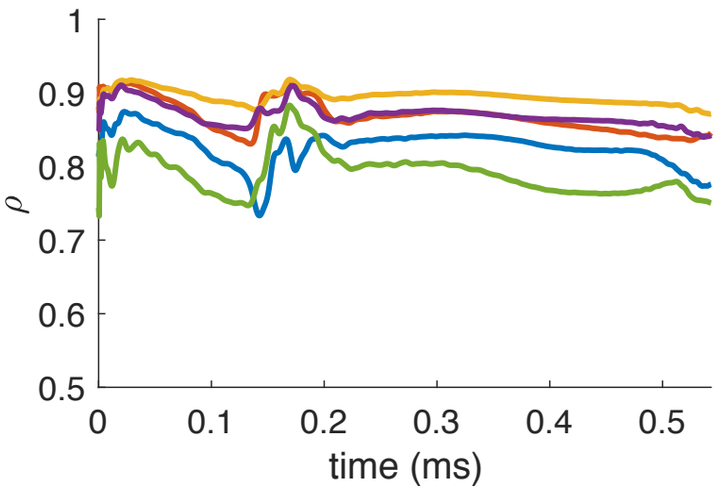




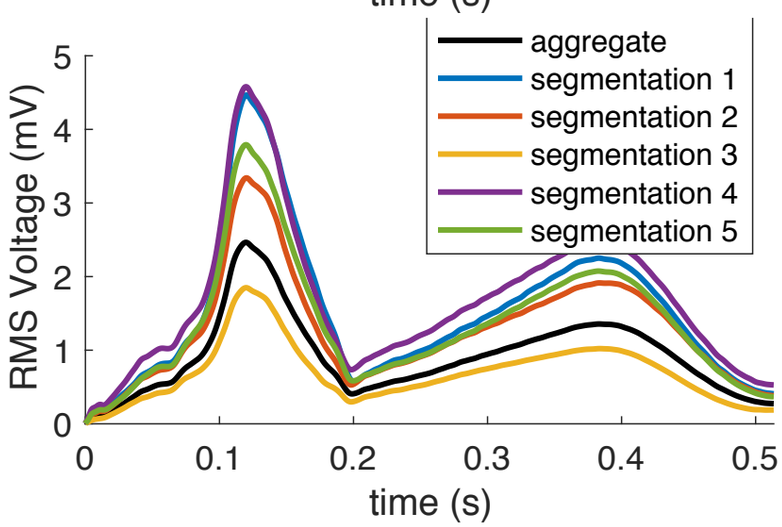
LV stim

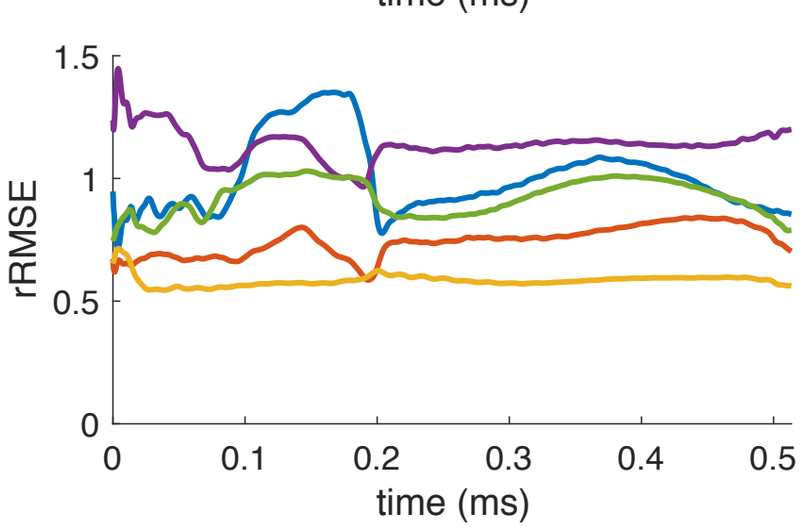


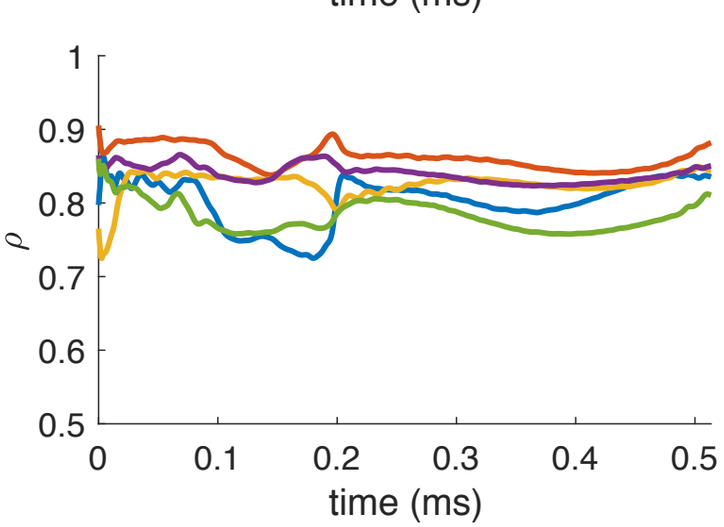




RV stim







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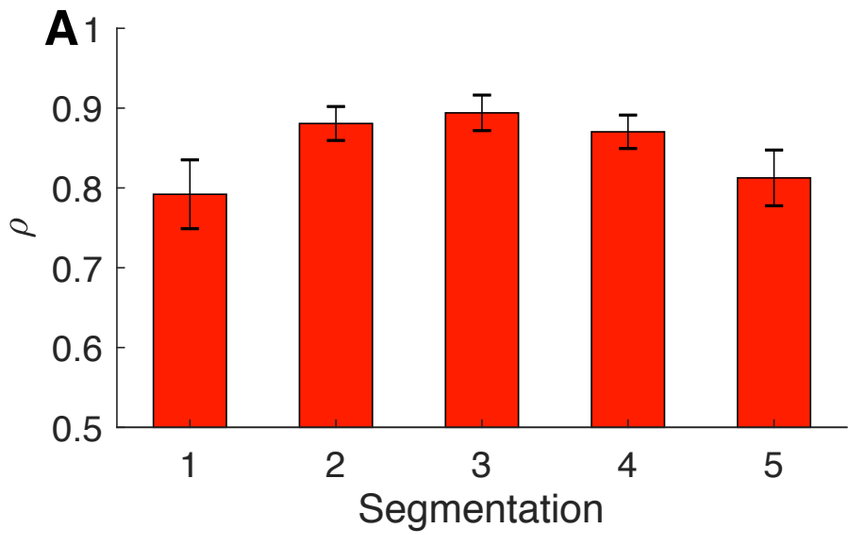
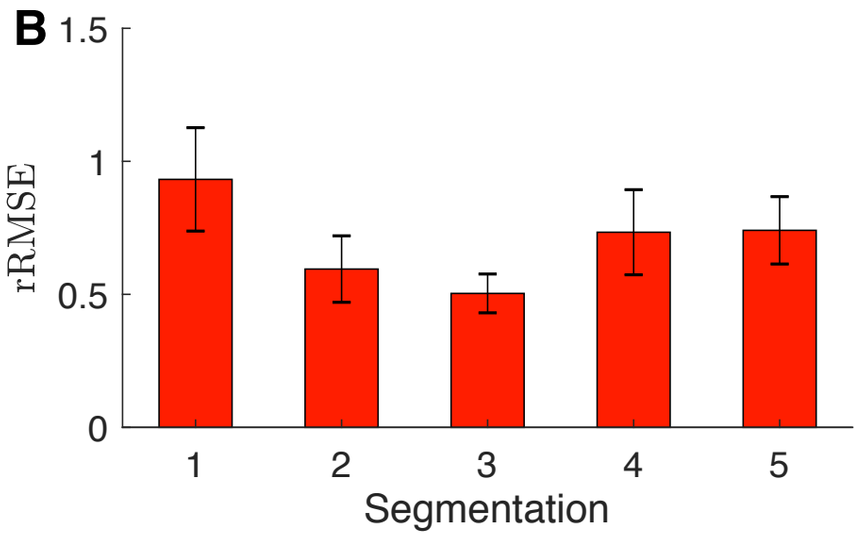
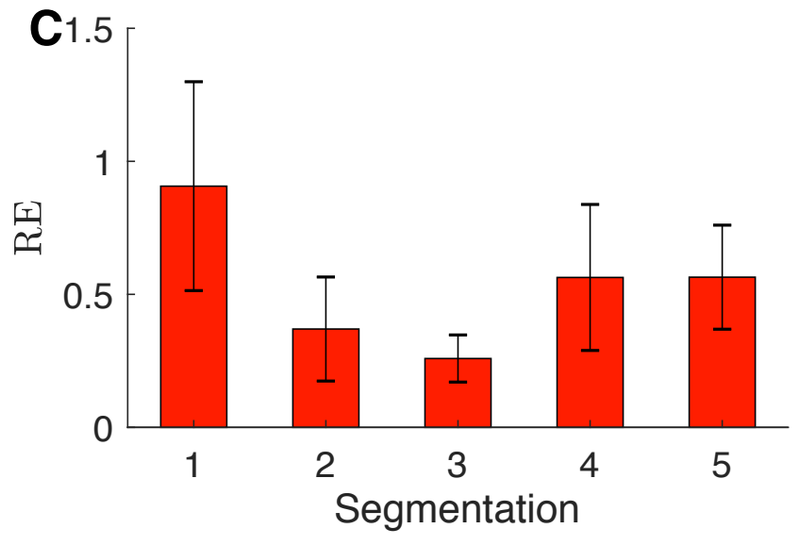
Total Error







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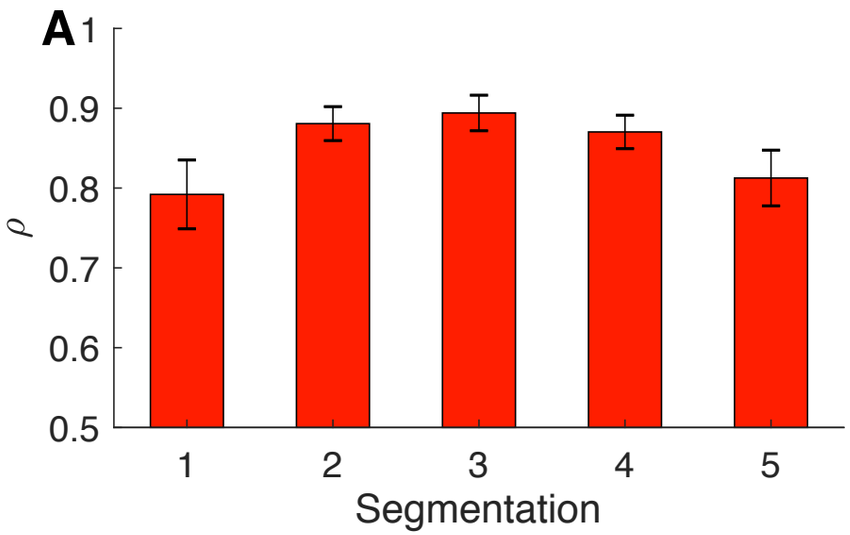

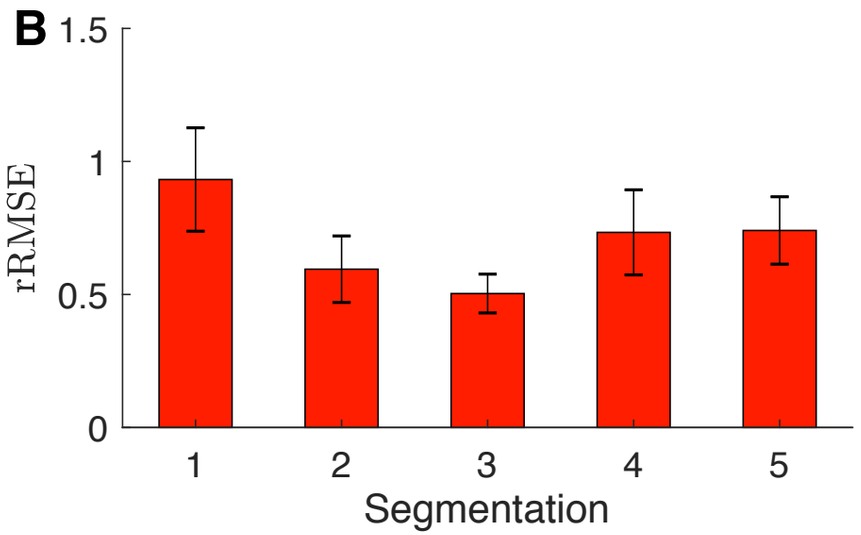

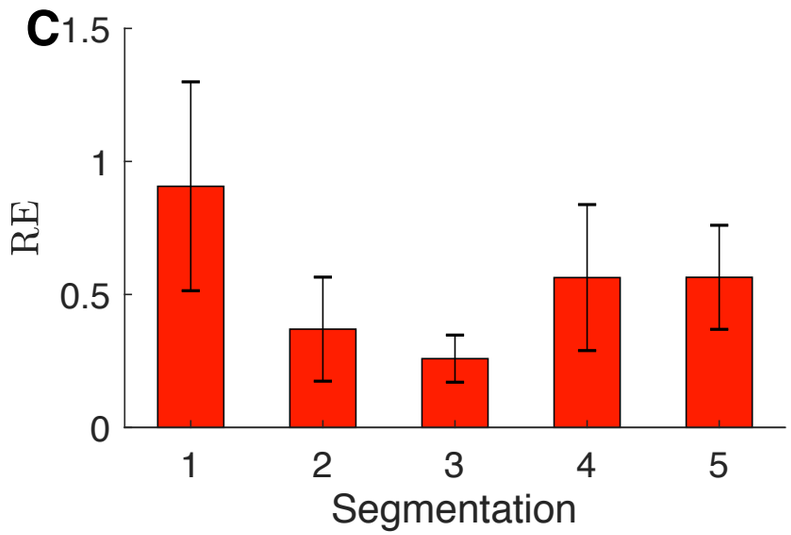

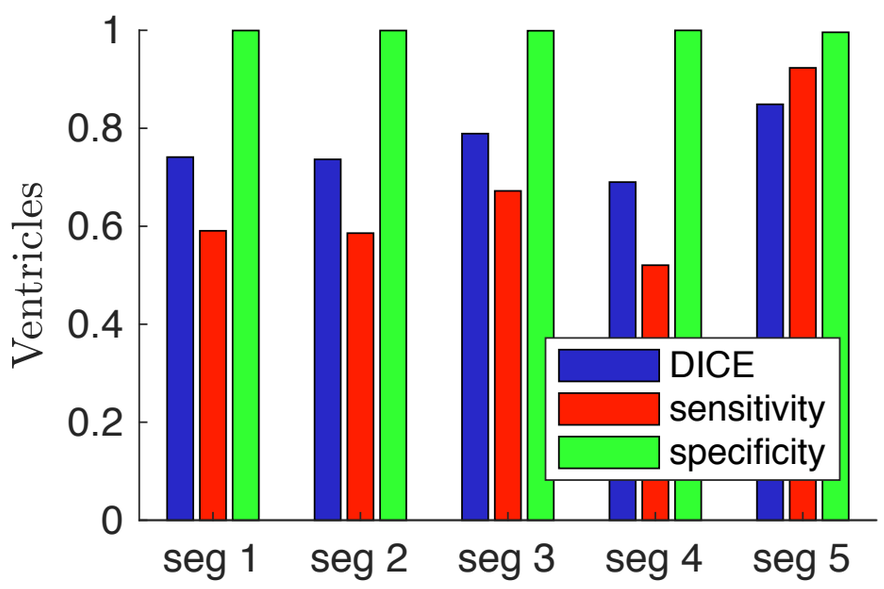

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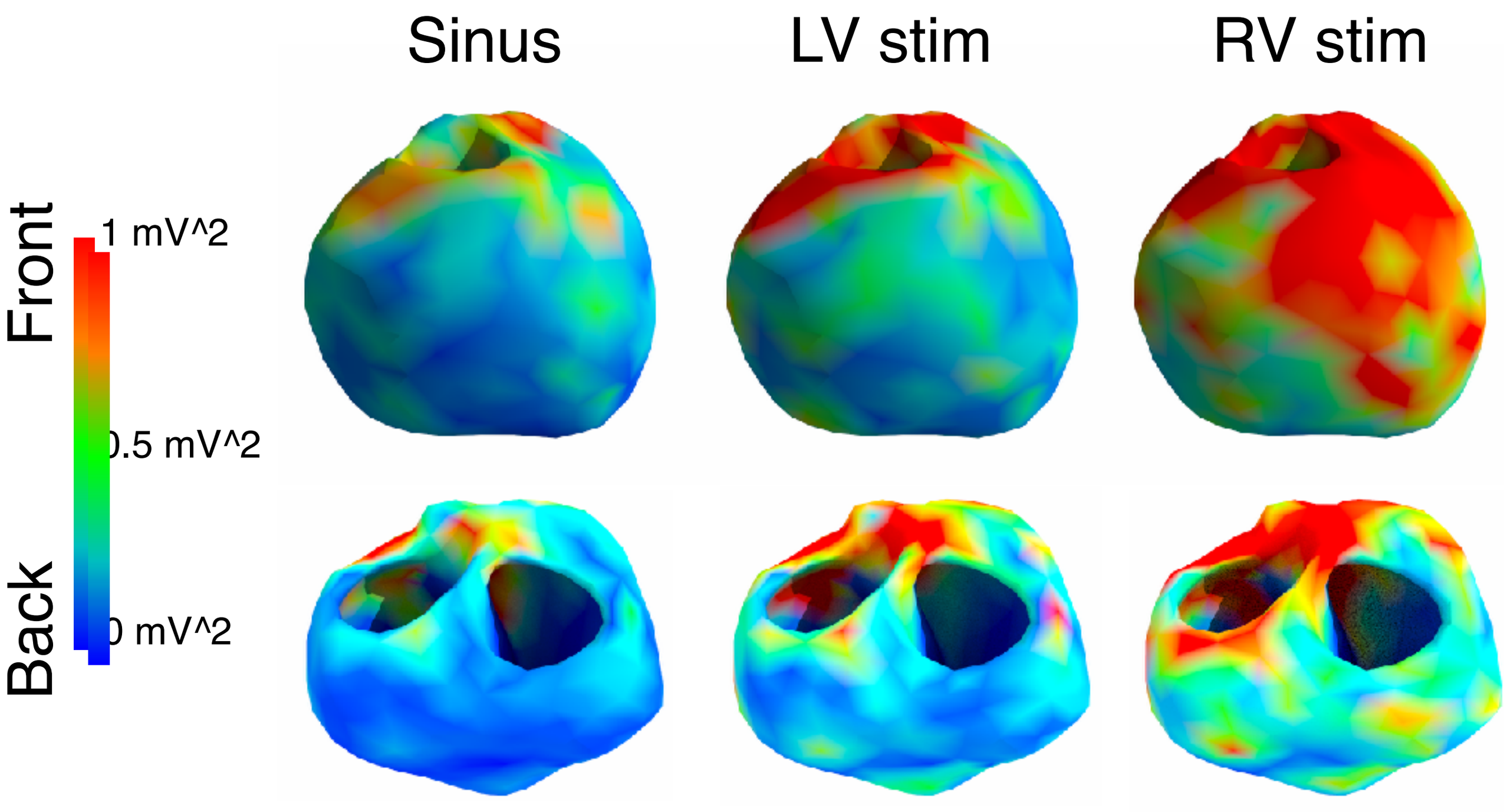
Locations of High Variance



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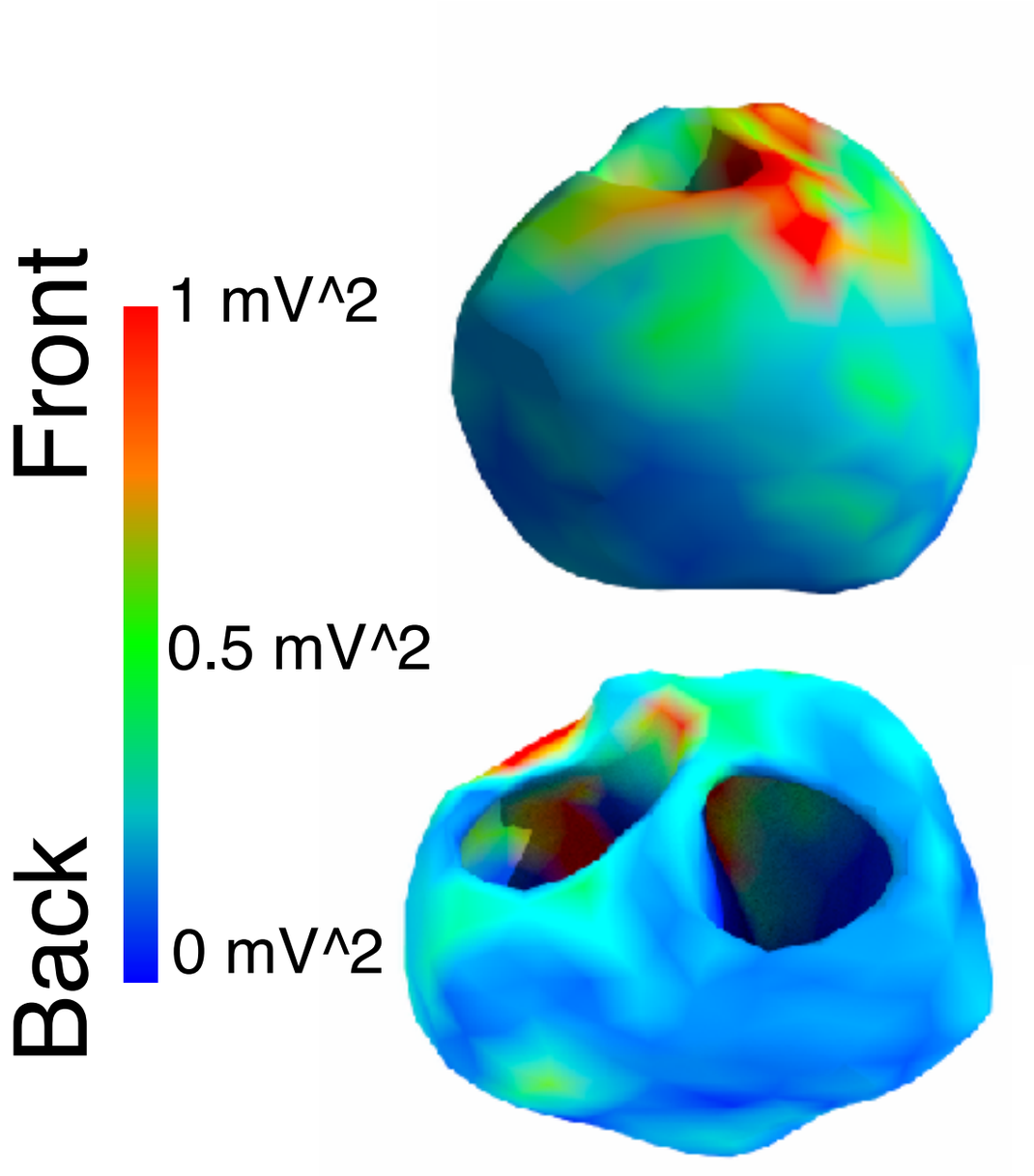
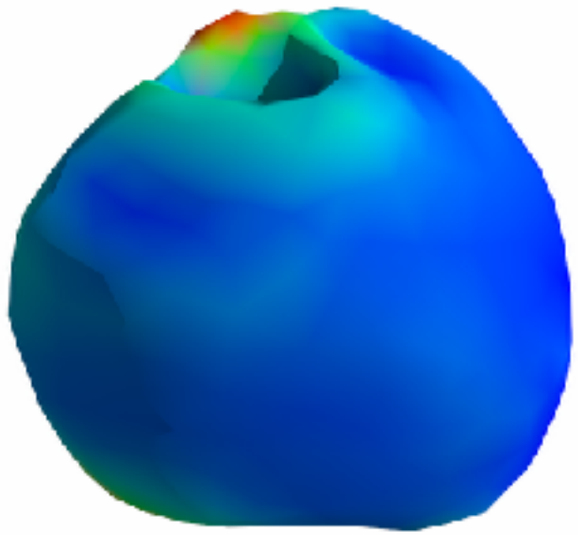
Variance of Solutions and Meshes

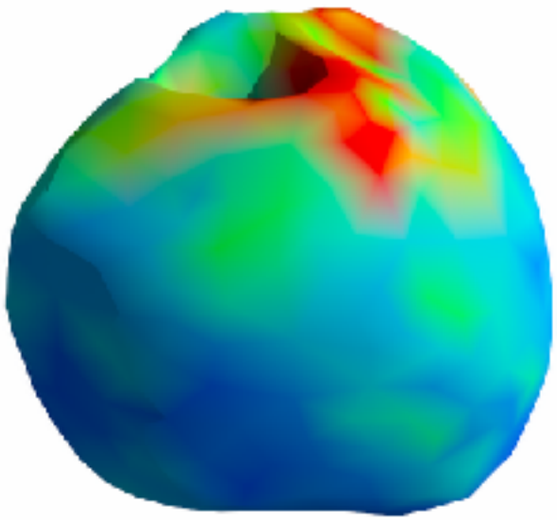


Solution Variance

Variance of Solutions and Meshes

Front



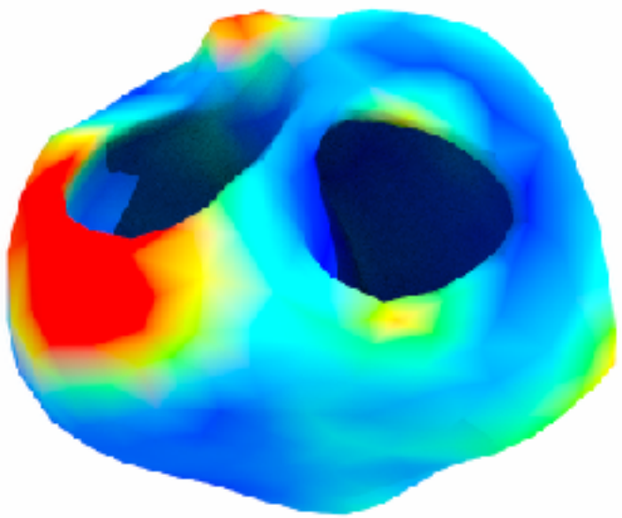


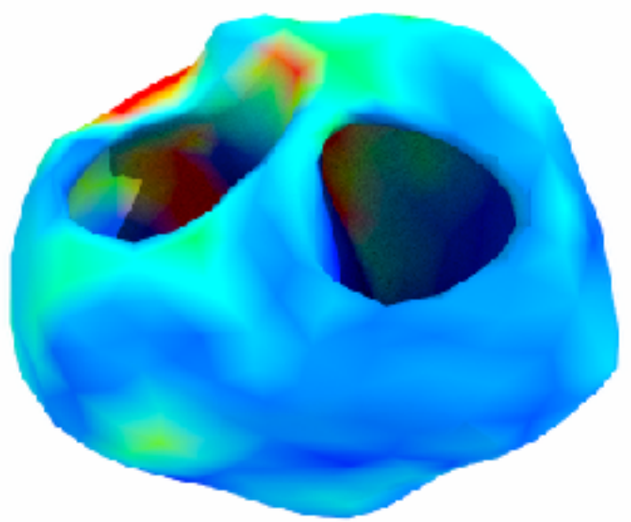
80 mm^2 — 1 mV^2

40 mm^2 — 0.5 mV^2

0 mm^2 — 0 mV^2

Back





Mesh Variance

Solution Variance

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ECGI can be sensitive to segmentation errors

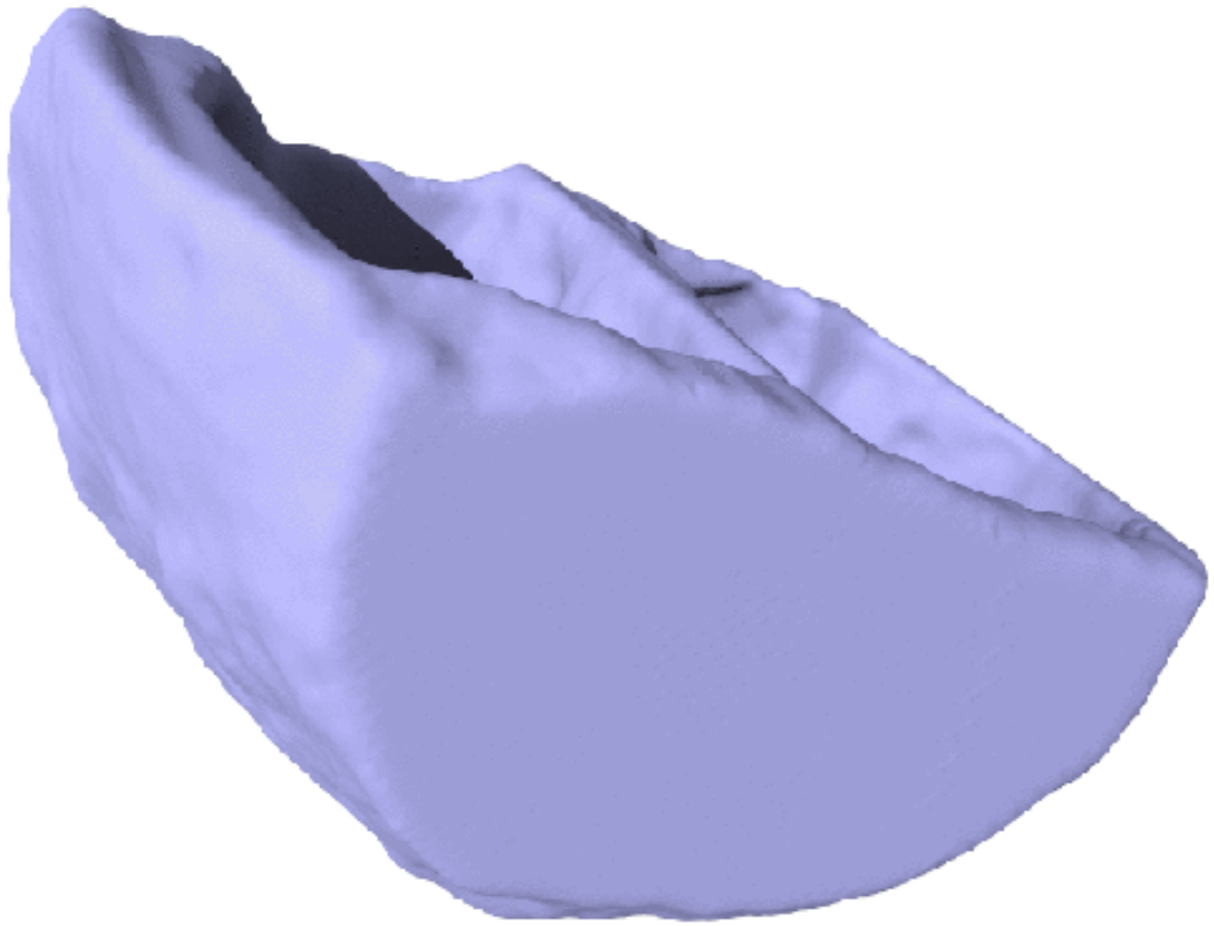
High variance in ECGI solution corresponds to high variance in Segmentation

High variance in ECGI solution corresponds to high variance in Segmentation

Anterior region is more sensitive to segmentation variation

What's Next?

Shape Analysis



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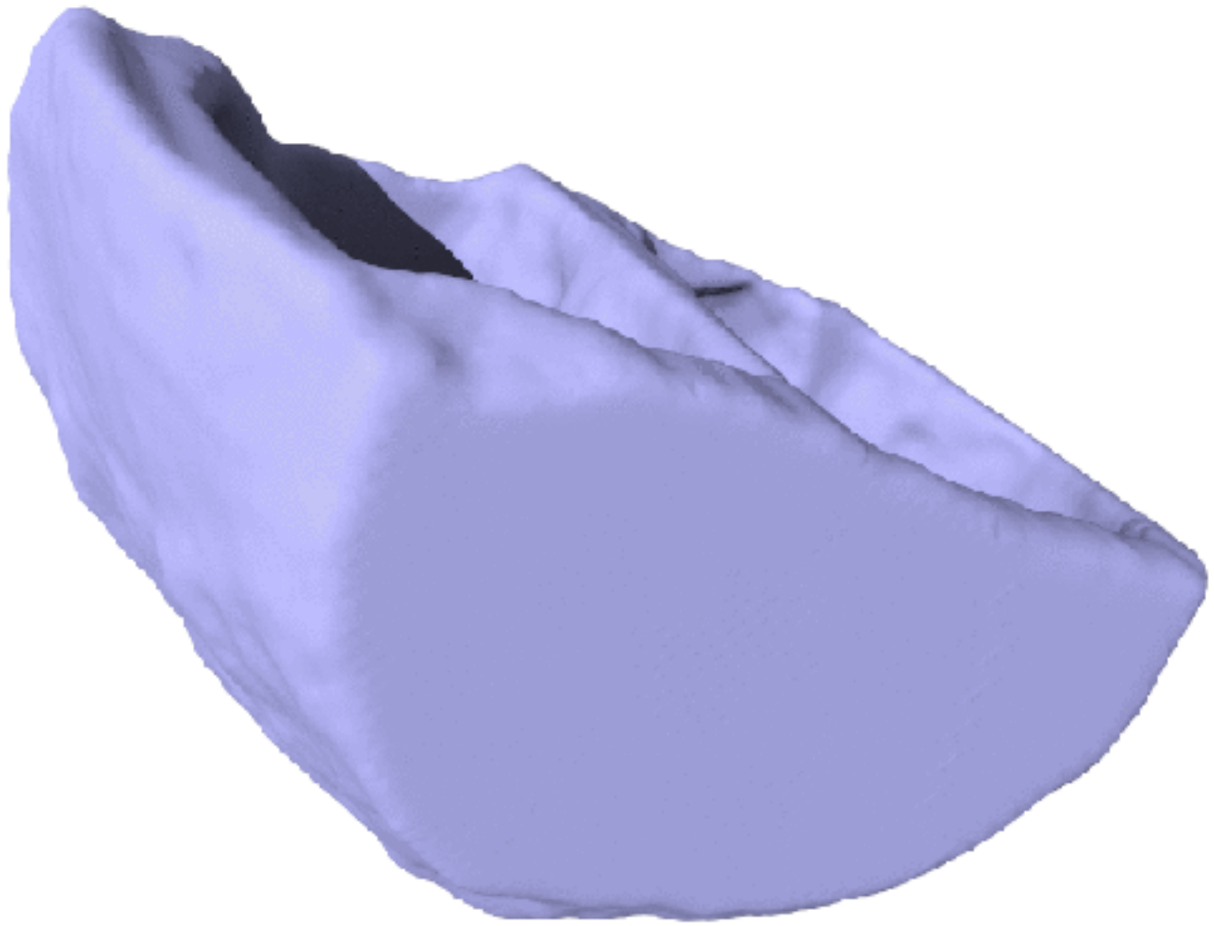
What's Next?

Shape Analysis



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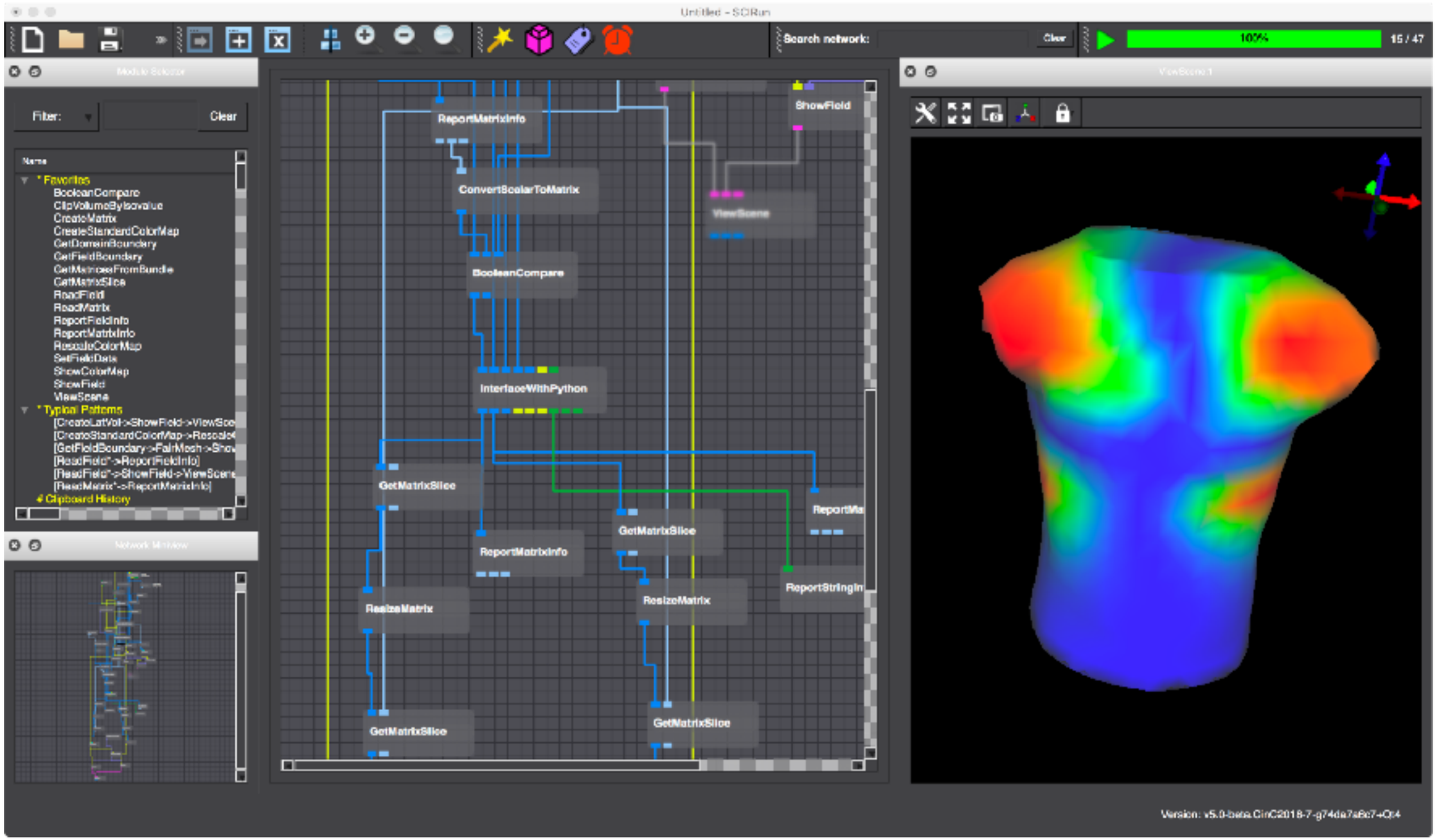
What’s Next?



Uncertainty Quantification

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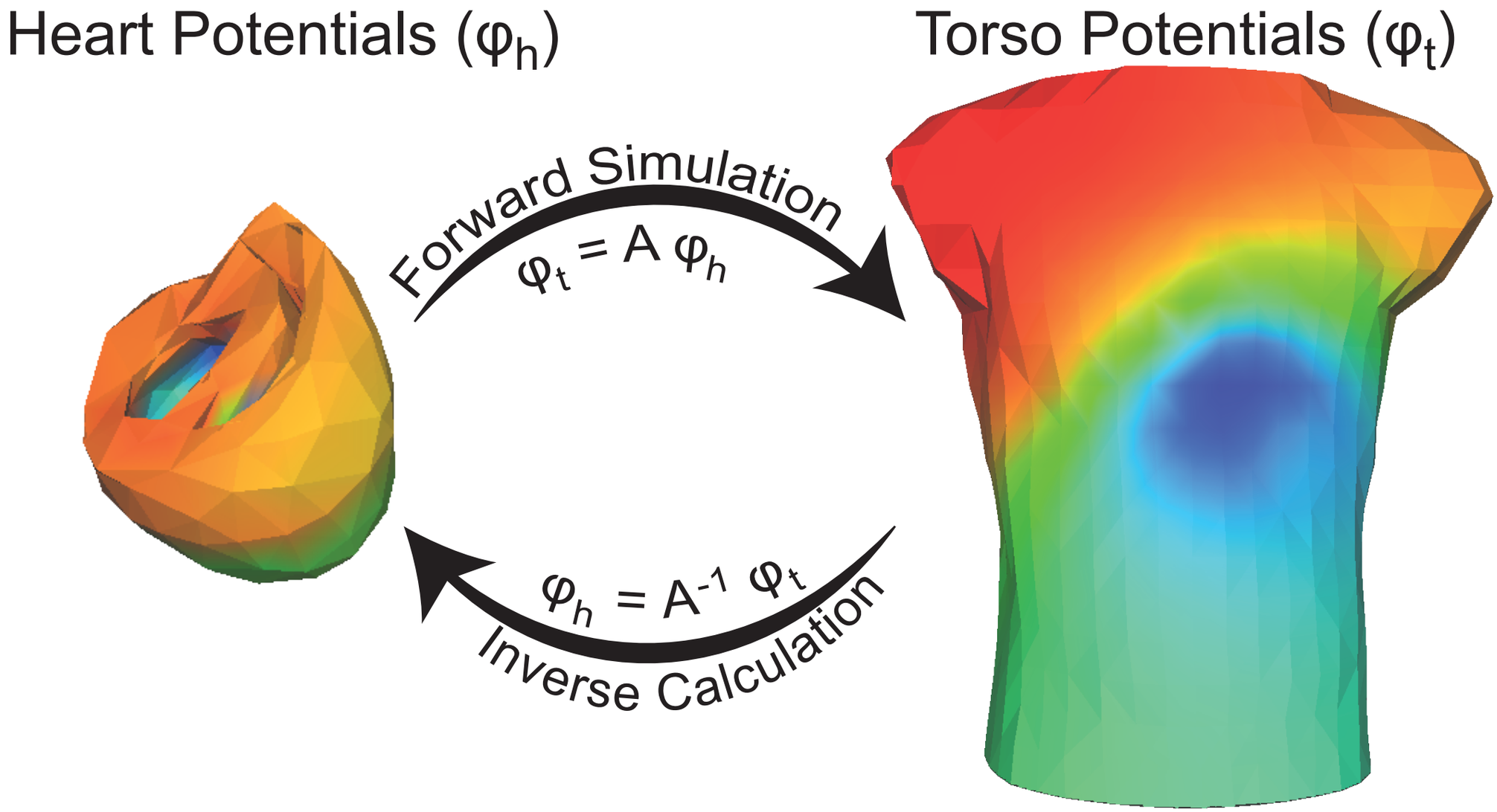
Improve ECGI



Quantify Uncertainty

Acknowledgements

People

Jaume Coll-Font

Sandesh Ghimire

Data Submissions

Wilson Good

Nejib Zemzemi

Sophie Giffard-Roisin

Eric Perez-Alday

Peter van Dam

Clinical Data

John Sapp and Milan Horáček and
Dalhousie University

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Center for Integrative Biomedical Computing
NIGMS NIH P41 GM103545-18

Consortium for ECG Imaging (ecg-imaging.org)

More Submission Needed

https://challenge.kitware.com/

The image data for a nrrd file is a stream of numbers. The order of the data should iterate x first, then y, then z. If the data is a 3D matrix `M` of size `nx` by `ny` by `nz`, the data array (`D`) should match to the matrix index (`M[i,j,k]`) as:

```
D[i*nx*ny + j*nx + k] = M[i, j, k]
```

assuming zero based indexing and `i,j,k` are the indices for the `x,y,z` directions respectively. Make sure that the data type field in the header matches the value that the data will be written in. Now to write the file, write the header string , with a new line at the end, then write the data.

If there are questions, do not hesitate to ask.

Stage 2: Mesh Generation

With this stage we will quantify differences in meshing techniques used by different groups. We will be making the meshes based of an average of the submissions from Stage 1, therefore, we will have more details on this stage at a later time.

Stage 3: Forward Transform Matrix

With this stage we will quantify differences in techniques of calculating the forward matrix for ECG used by different groups. Again, we will base this calculation on a common input from the submissions from Stage 2, therefore, we will have more details on this stage at a later time.

PHASES FOR THIS CHALLENGE +

- Stage 1: Dalhousie Segmentation
- Stage 1: Auckland Segmentation
- Stage 1: Nijmegen Segmentation