HEART RHYTHM 21

BRINGING THE WORLD OF EP TOGETHER

Left Atrium Right Atrium Network (LARANet)

A Deep Neural Network for Biatrial Segmentation from MRI and CT Images

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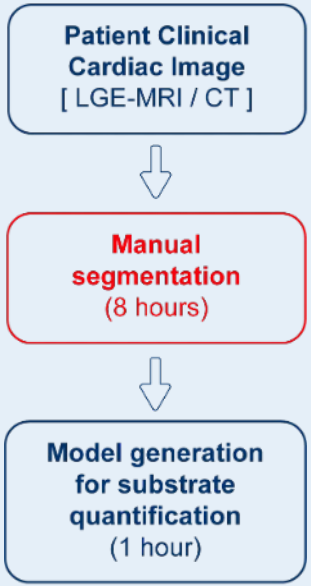
OBJECTIVE

1 Clinical Motivation

atrial segmentation bottleneck



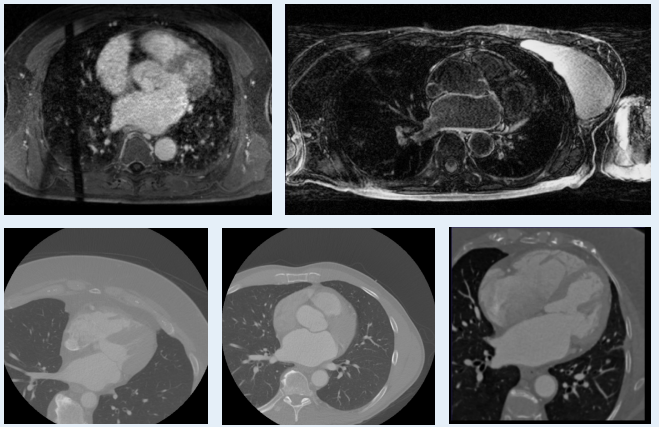
OBJECTIVE

1 Clinical Motivation

atrial segmentation bottleneck

2 Technical Motivation

low NN generalizability



OBJECTIVE

1 Clinical Motivation

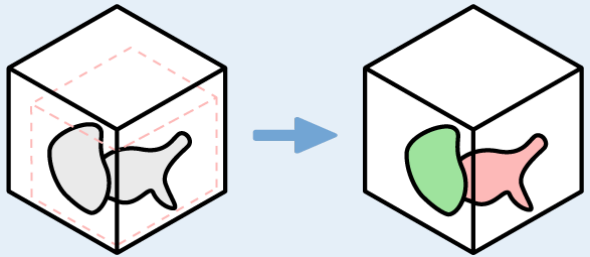
atrial segmentation bottleneck

2 Technical Motivation

low NN generalizability

3 Technical Background

ROI-dependent segmentations



OBJECTIVE

1 Clinical Motivation

2 Technical Motivation

3 Technical Background

AIM Define and implement a biatrial segmentation NN that successfully segments LA and RA of never-before-seen clinical images with high anatomical consistency.

AIM

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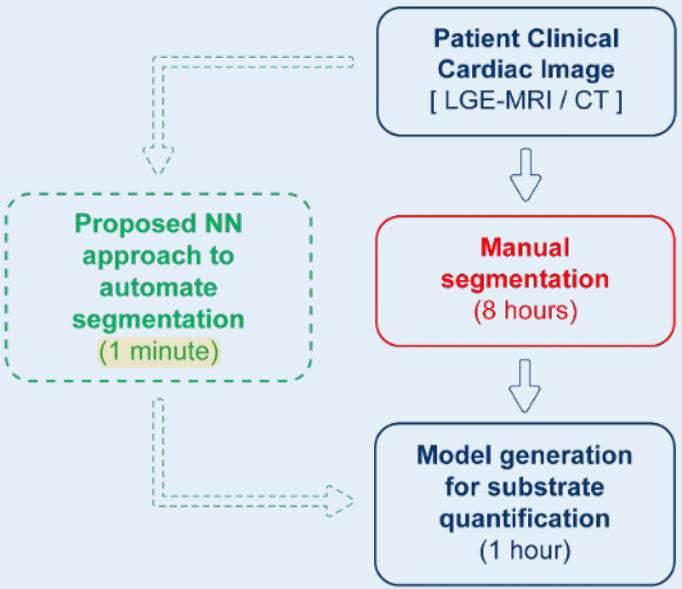


METHODS

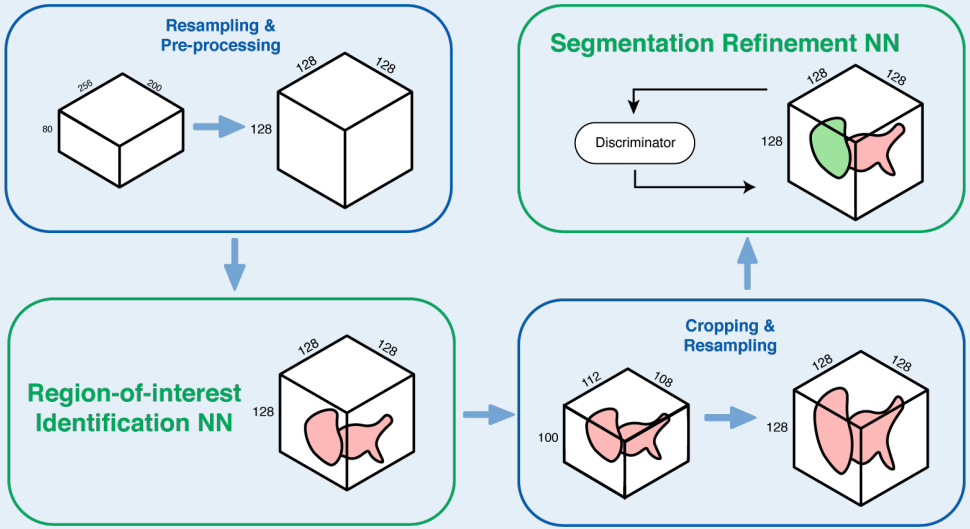
- Data
- Model
- Evaluation

Data

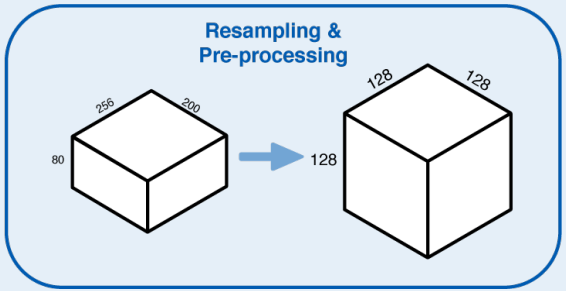
	LA+RA
LGE-MRI	91
CT	78
Total	169

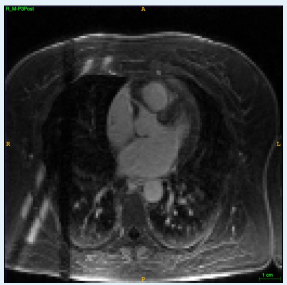
- LGE-MRI & CT images acquired at Johns Hopkins Hospital
- Manual LA + RA segmentations
- Mix of persistent and paroxysmal AF patients
- 70/20/10 data split

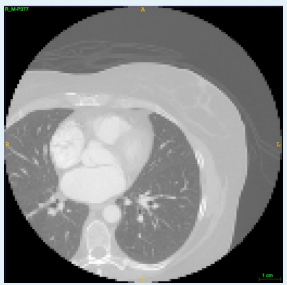
Model


Resampling &
Pre-processing
256
200
80
128
128
128
Segmentation Refinement NN
Discriminator
128
128
128
Region-of-interest
Identification NN
128
128
128
Cropping &
Resampling
112
109
100
128
128
128

Model

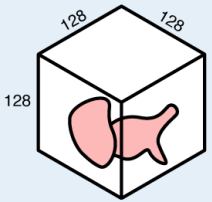


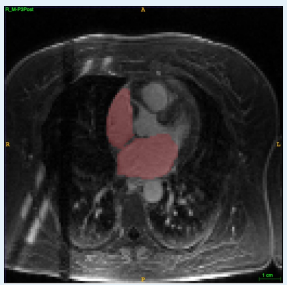


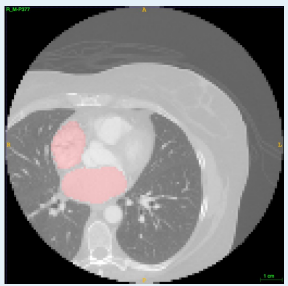


Model

Region-of-interest Identification NN







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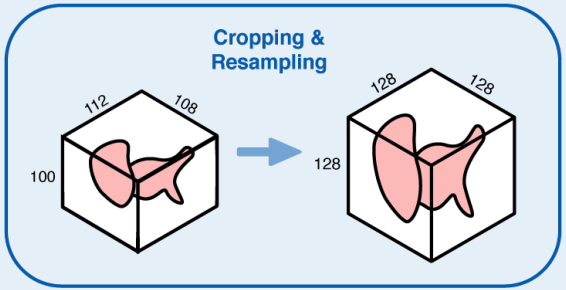

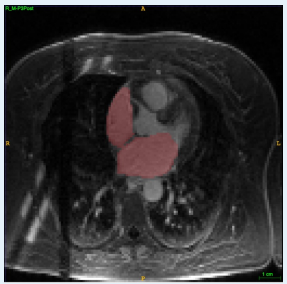

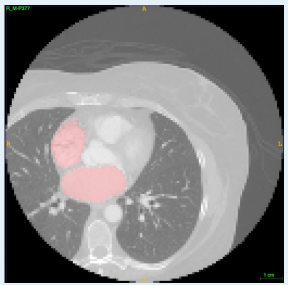

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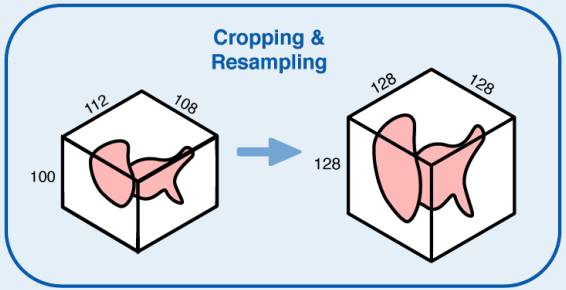

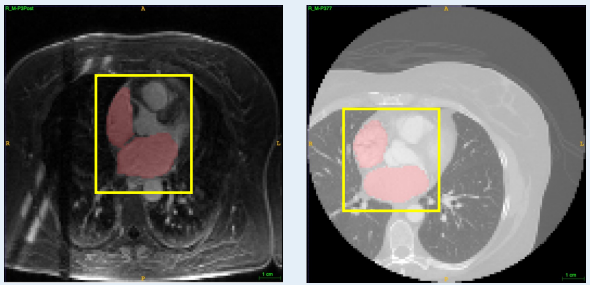

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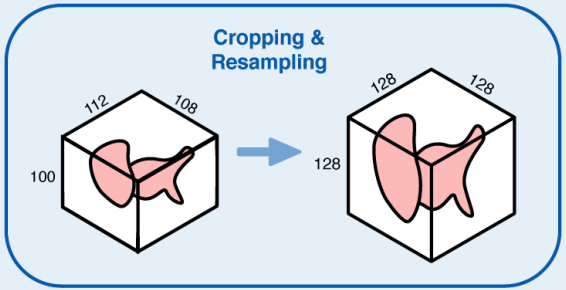

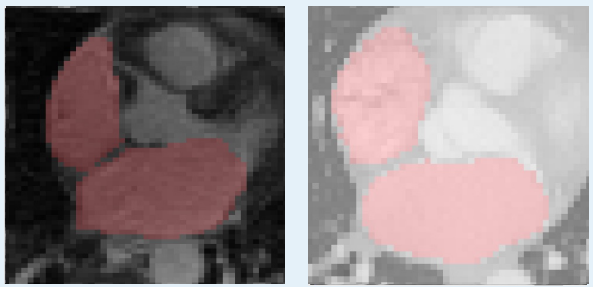

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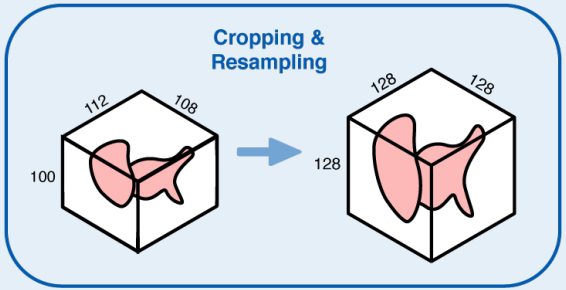

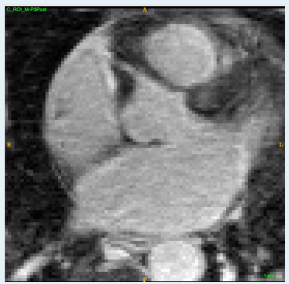

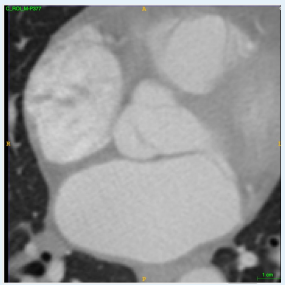

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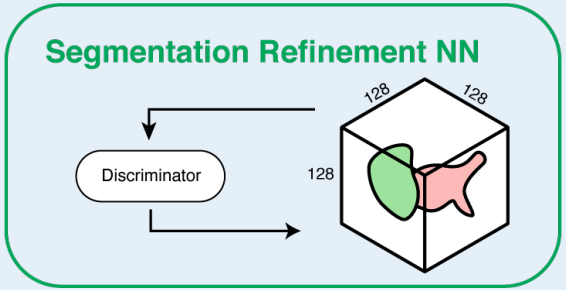

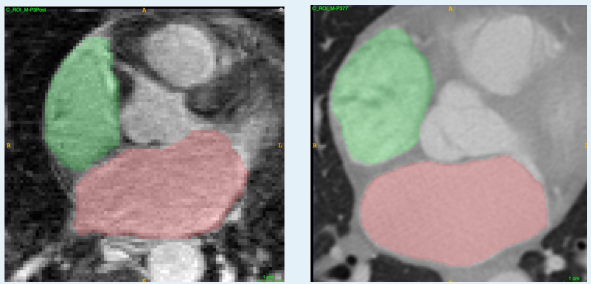

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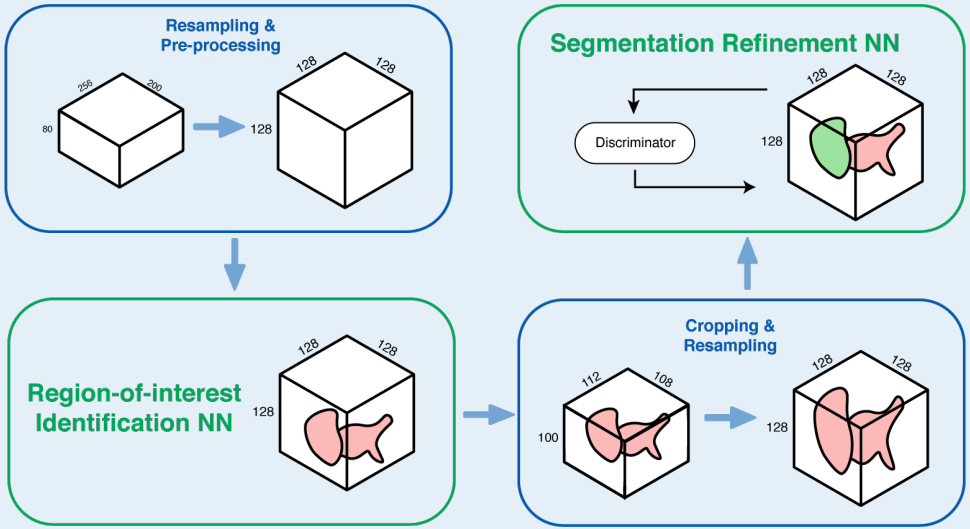
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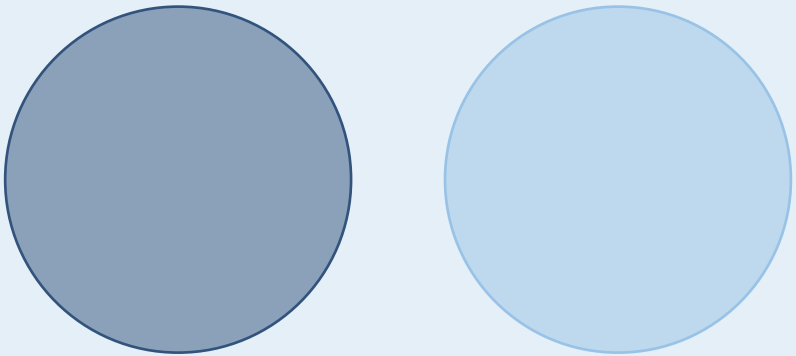
Evaluation

Dice Coefficient

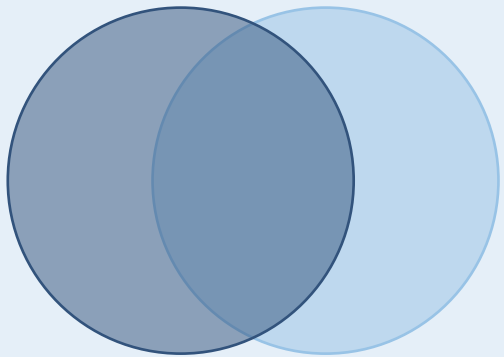
Evaluation

Dice Coefficient : *0*



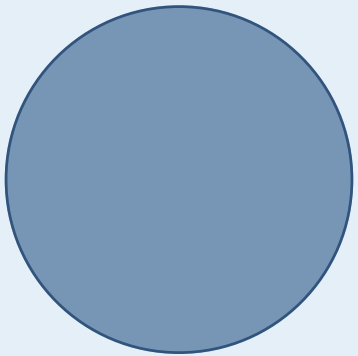
Evaluation

Dice Coefficient : *0.5*



Evaluation

Dice Coefficient : *1*



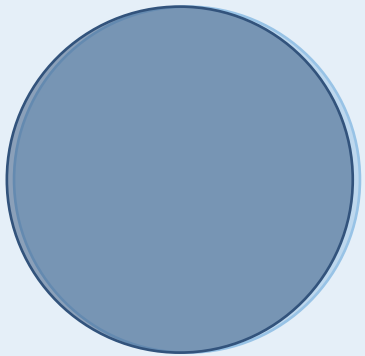
Evaluation

Dice Coefficient

Hausdorff Distance

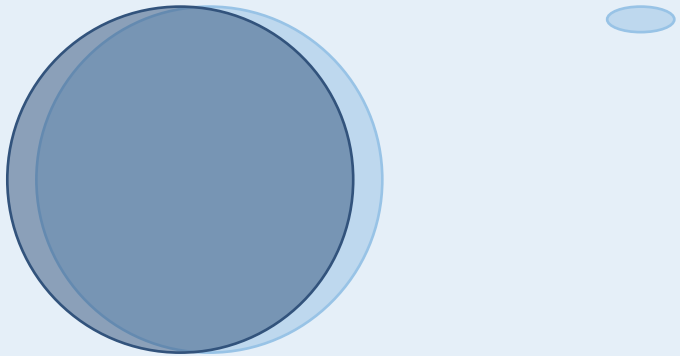
Evaluation

Hausdorff Distance : *Low*



Evaluation

Hausdorff Distance : *High*



Evaluation

Dice Coefficient

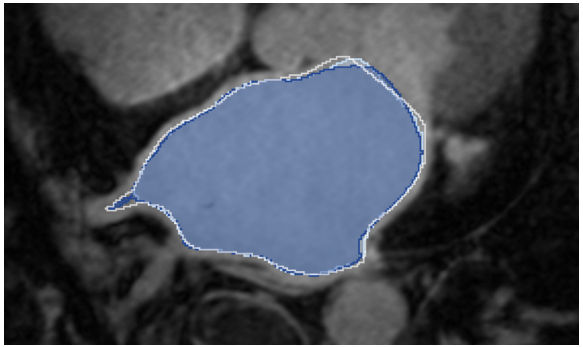
Hausdorff Distance

Anatomical Regions

RESULTS

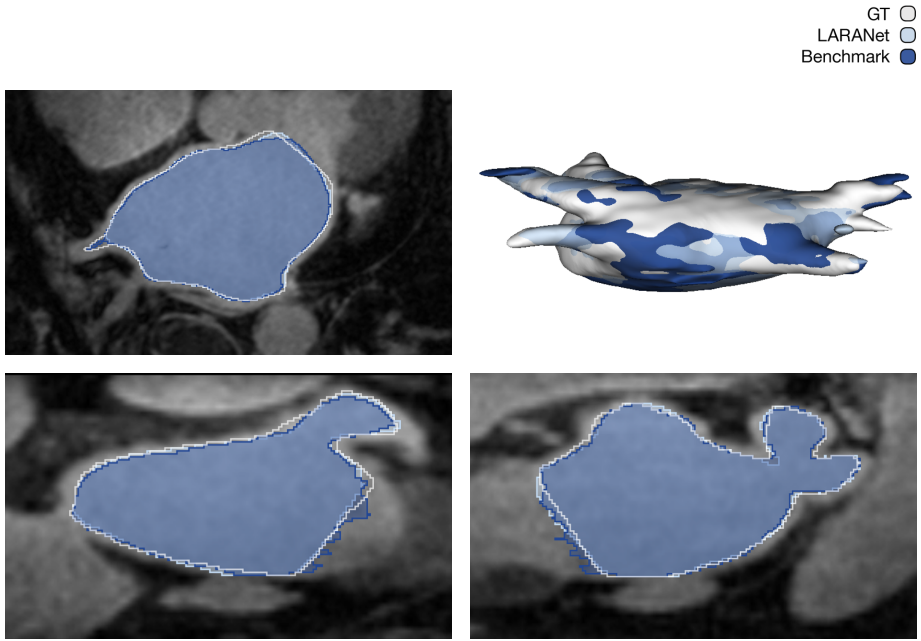
BENCHMARK LA SEGMENTATION (LGE-MRI) METRICS						
	Avg DC	**Max DC**	**Min DC**	**Avg HD**	**Min HD**	**Max HD**
BENCHMARK (CHEN ET AL.)	0.9151 ± 0.03	0.962	0.832	15.46 ± 18.11	5.08	107.94
LARANet	0.9177 ± 0.03	0.964	0.821	12.87 ± 4.59	6.15	29.08

Dice Coefficient : *0.964*



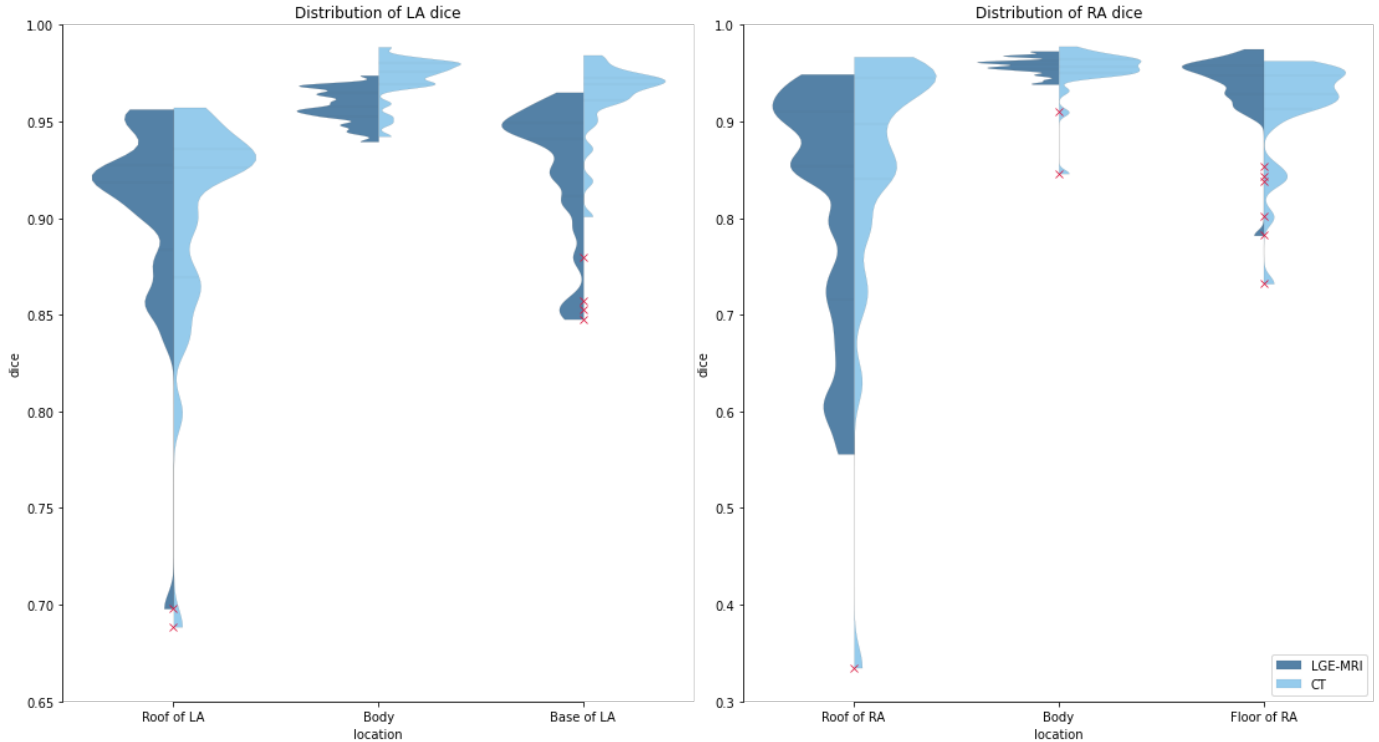
Benchmark DC: *0.961*

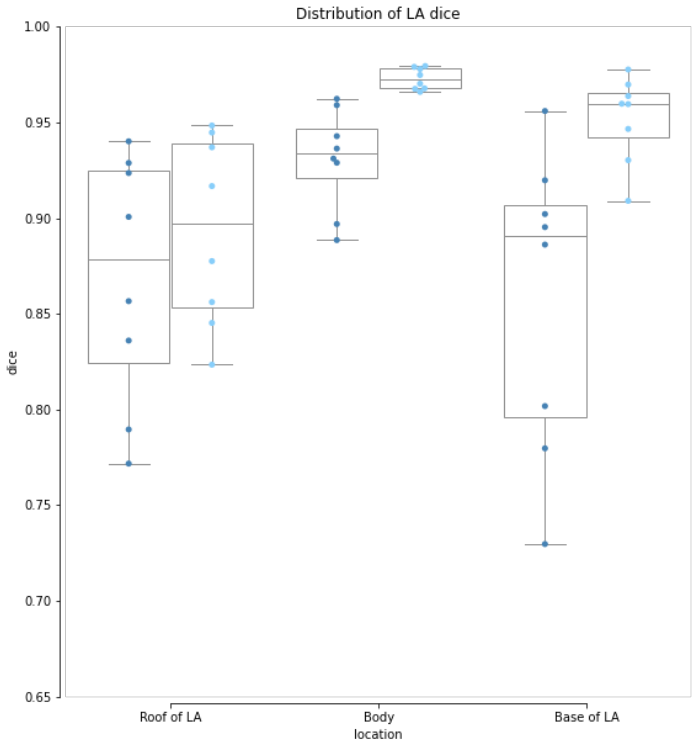
GT
LARANet
Benchmark

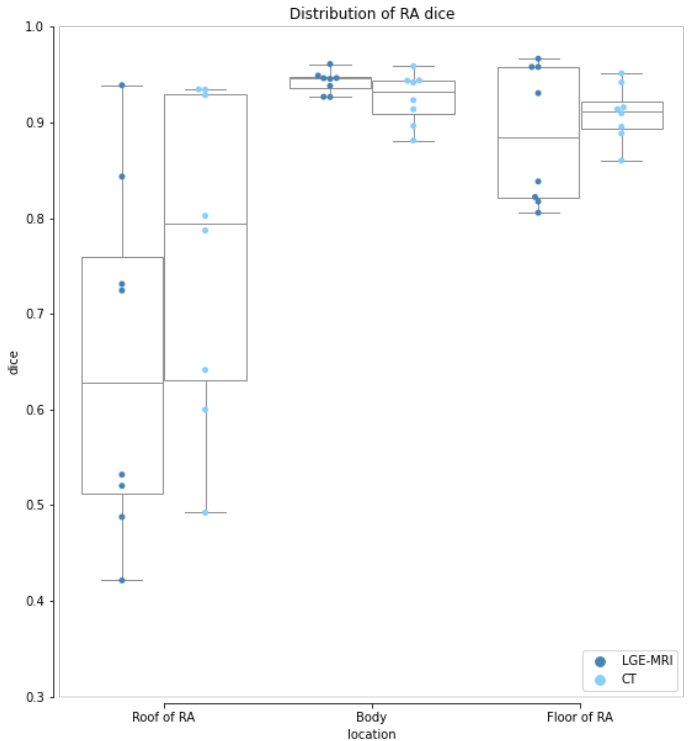

GT
LARANet
Benchmark

LARA SEGMENTATION (NEVER-BEFORE-SEEN IMAGES, LGE-MRI + CT) METRICS

	Avg DC	Max DC	Min DC	Avg HD	Min HD	Max HD
LA	0.9300 ± 0.03	0.974	0.851	15.68 ± 8.82	1.77	117.46
RA	0.895 ± 0.03	0.964	0.499	19.96 ± 11.60	1.88	157.67


Distribution of LA dice
dice
location
Roof of LA
Body
Base of LA
Distribution of RA dice
Roof of RA
Body
Floor of RA
LGE-MRI
CT


Distribution of LA dice
dice
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
Roof of LA
Body
Base of LA
location


Distribution of RA dice
dice
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
Roof of RA
Body
Floor of RA
location
LGE-MRI
CT

Thank You

Rebecca Yu

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