4D Heart

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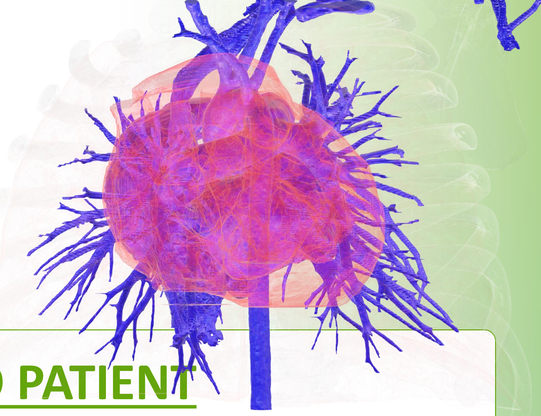
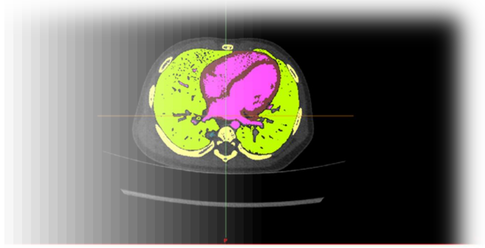
UICOMP[1], Jump Simulation[2], UIUC[3]

TODAY



PROBLEM TRYING TO SOLVE

- Congenital heart disease is a complex 3D puzzle problem.
- Dynamic problems require dynamic visualization.
- Need standardized CT imaging protocols.
- To create one beating heart from CT manually would take roughly 80 man-hours. (manual segmentation)
- Need automated segmentation.
- Need automated stitching of 20 heart models to make a beating heart.

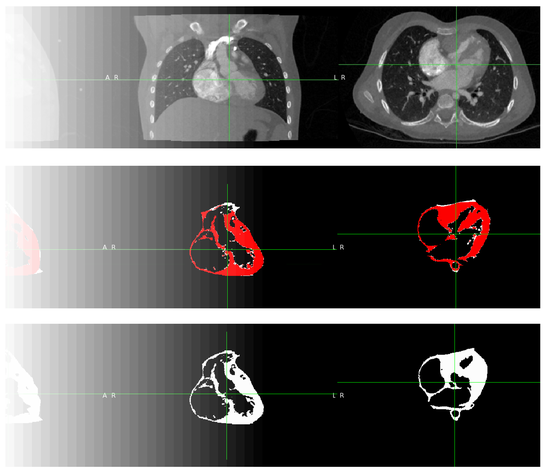


OUTCOME/GOALS/IMPACT TO PATIENT

- Main goal is to visualize patient-specific beating hearts in 3D. **(4D)**
- Transform CT storage in PACS.
- Prepare 3D heart library for ML training.
- Using ML, train automated segmentation algorithm.
- Automate 4D heart from segmented 3D hearts.
- Deploy in clinical workflow.
- Advance derivative research efforts.

JOURNEY TO GET THERE/PLANNED JOURNEY

- Since 2014, we have created over 220 3D hearts for pre-surgical planning.
- 64 of these CT-based 3D models were prepped for ML training.
- Machine learning (ML) training 1000 epochs x 4 = successful automated segmentation.
- Automate stitching together of 3D models into 4D beating heart in blender.
- CT goes into computer, in 3 hours, out comes a beating heart.



DIRECT IMPACT TO PATIENT/FAMILIES

- Only lab in the nation with this capability.
- DICE coefficient of 90%+
- We now have over 20 beating hearts and have more 3D heart models generated in 2 weeks than over the past 10 years.
- Utilized in clinical workflow on two patients.
- Complex pediatric case reviewed by five congenital heart surgeons from three children's hospitals. All five changed from surgery A to surgery B!
- We have invented a new imaging modality.

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