



# The Use of Ultrasound Imaging in 3D Holographic Heart Construction



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## Background

Minimally invasive surgery has become a growing technique in the medical field. With the visualization on the surgical plane hindered, surgeons must rely on prior scans to view the area of interest.

Physicians will be able to utilize this research in ultrasound data segmentation in order to capture images in real-time for image guided surgery.

## Objective

1. Perform ultrasounds of 10 different mice.
2. Collect B-Mode, M-Mode, 3D-Mode, and Tissue Doppler Images.
3. Segment the left ventricle of each mouse heart using the VevoLab software.
4. Use this segmentation data in the construction of the holographic heart model.

## Subject Information

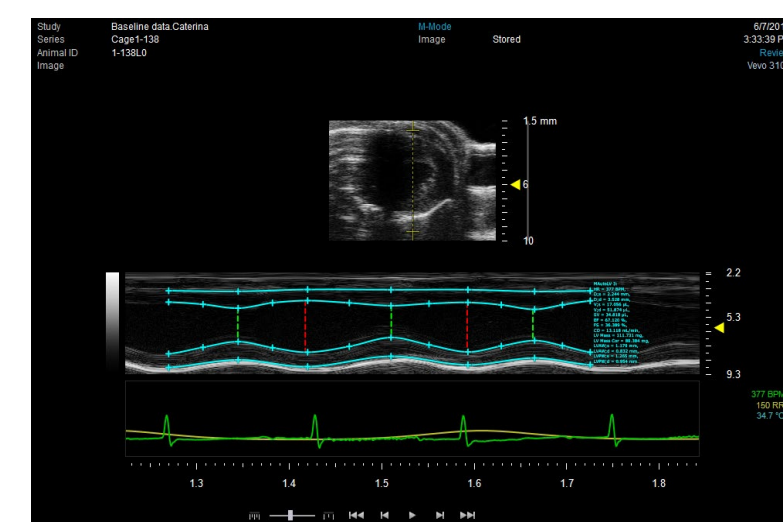
Test Subject Information:

- Five Female Wild-Type (WT) Mice
- Five Male Wild-Type (WT) Mice
- Age: ~6 Weeks (Born 4/27/2019)
- Strain: C57bl/6J
- Test Date: 6/7/2019

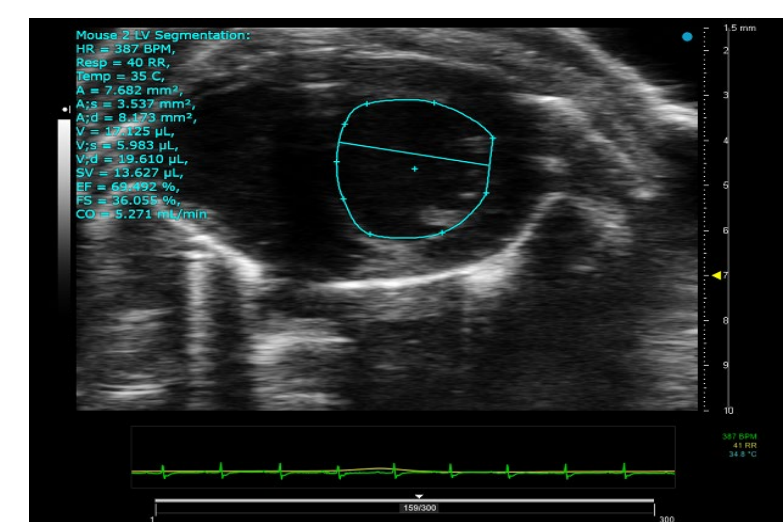
## Methods

Collect cardiac data (morphology and function) and doppler imaging (vascular flow). Then, use VevoLab software to segment the left ventricle (short axis and long axis) of the mouse heart in B-Mode.

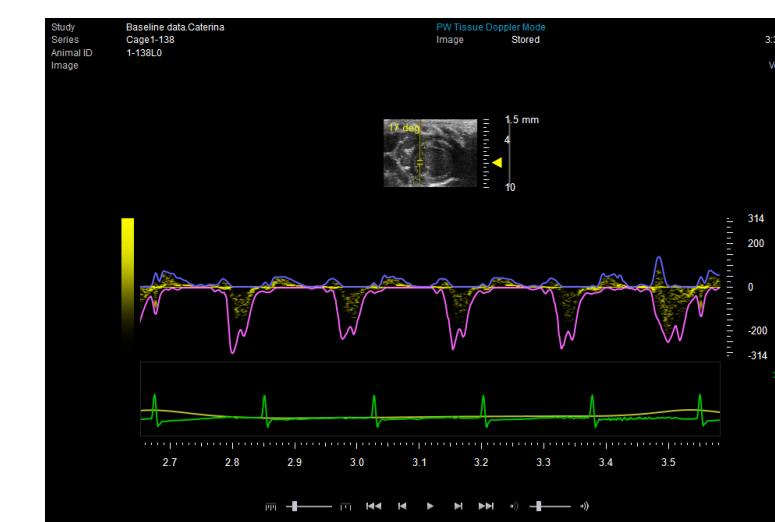
M-Mode



B-Mode



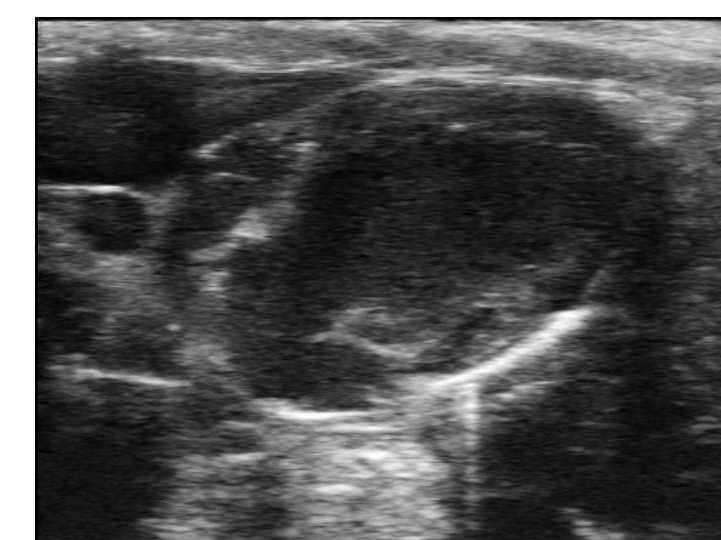
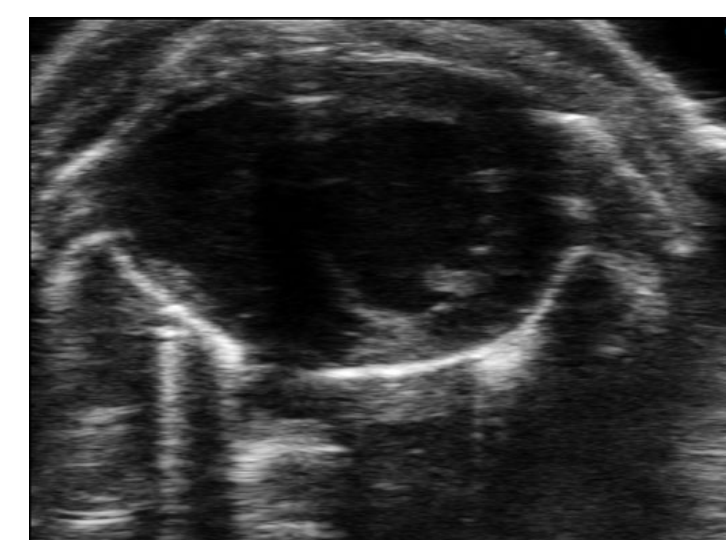
Tissue Doppler



## Results

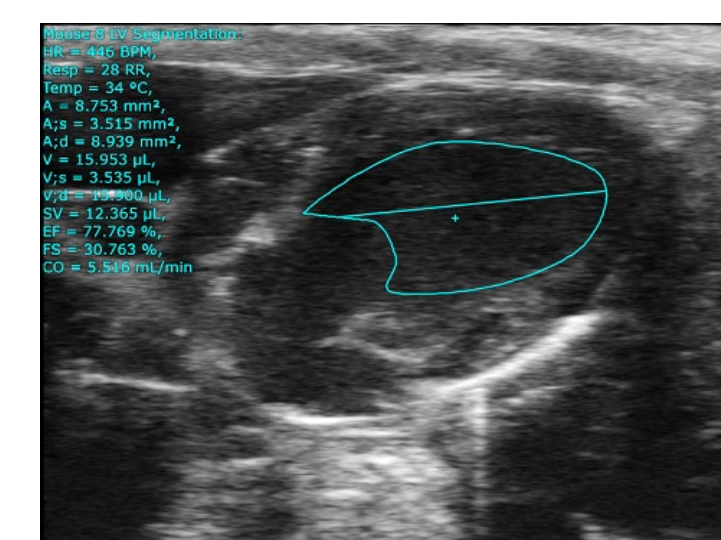
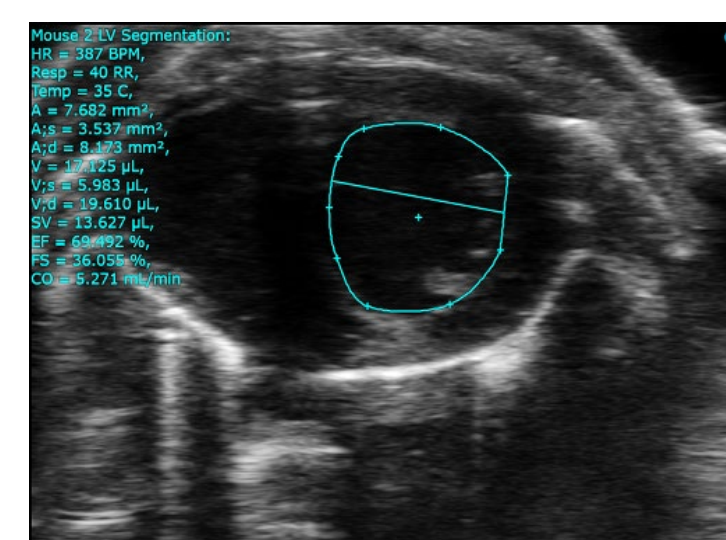
Data was segmented using AutoLV first to test locate region. This feature was deemed inaccurate and the points were then drawn and adjusted manually to trace around the left ventricle as shown. The individual images frames were then exported together as a Dicom video file.

Short Axis (without Segmentation)    Long Axis (without Segmentation)



Short Axis (with Segmentation)

Long Axis (with Segmentation)



## Discussion

After performing each ultrasound test, B-Mode images were deemed the best for segmentation. The VevoLab software is effective in segmentation, yet the automatic segmentation program (AutoLV) is not consistently accurate.

Further research could be conducted with diseased hearts. In this research, the B-Mode manual segmentation would be used while understanding that the anatomy would change as heart defects progress.

These conclusions would aid physicians in the transition to using real-time image techniques during surgery.

## Future Directions

This work will be continued as a part of the Physician Immersion into and Manipulation of Holographic Imaging-based Medical Data Project in the MRI Lab.

## Acknowledgements

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