Automatic Detection of Left Ventricle in 4D MRI Cardiac Images using Autoencoders

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Problem and Motivation
- Automatic detection of Left Ventricle
- LV detection can aid in segmentation
  - Segmentation can help calculate volume of heart
  - Can determine rate of blood flow

Dataset
- Kaggle Cardiac MRI Dataset [1]
  - 4D Images of the heart
    - Varying dimensions for each image
    - 2D images with about 7-11 different slices of the heart per image and 30 frames in time
- 21 patients for training
- 1 test subject

Method / Pipeline

Visualization of Random Forest Predictions

Left Ventricle Detection

Heart Detection

These images show a 3d bounding box surrounding the heart.
The blue dot in each frame shows the average location of white pixels in the
threshold image (center image)
The green dot shows the average location of blue dots across all time frames.

Stacked Autoencoders

6 Autoencoders with 2D patches from 4D images as input:
- XY (21 x 21), XS (21 x 5), XT (21 x 5), YS (21 x 5), YT (21 x 5), ST (5 x 5)
Length of feature vectors in Autoencoder 1 and 2, respectively:
- XY [64, 36], XS [36, 16], XT [36, 16], YS [36, 16], YT [36, 16], ST [16, 9]

References
[1] Kaggle MRI Heart Dataset
[2] Stacked Autoencoder Images