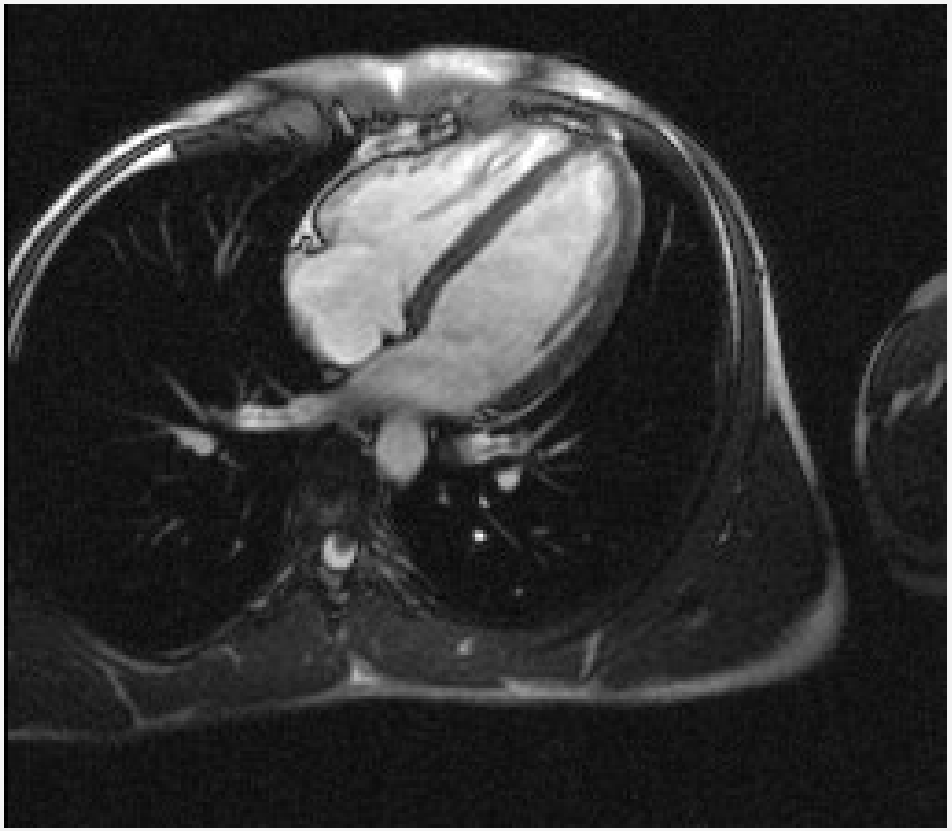
MRI Cardiac Segmentation for the Left Ventricle



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Working with:
Ali Mortazi & Dr. Bagci

Purpose

- Measuring the rate of blood flow can help determine illnesses in a person
- Measuring the size of the left ventricle in the systole and diastole state can determine the rate of blood flow
- Current techniques to segment the left ventricle:
  - Time consuming
  - Low accuracy
  - Semi-automatic
  - Not reproducible
- Automated techniques using machine learning can help speed up the process

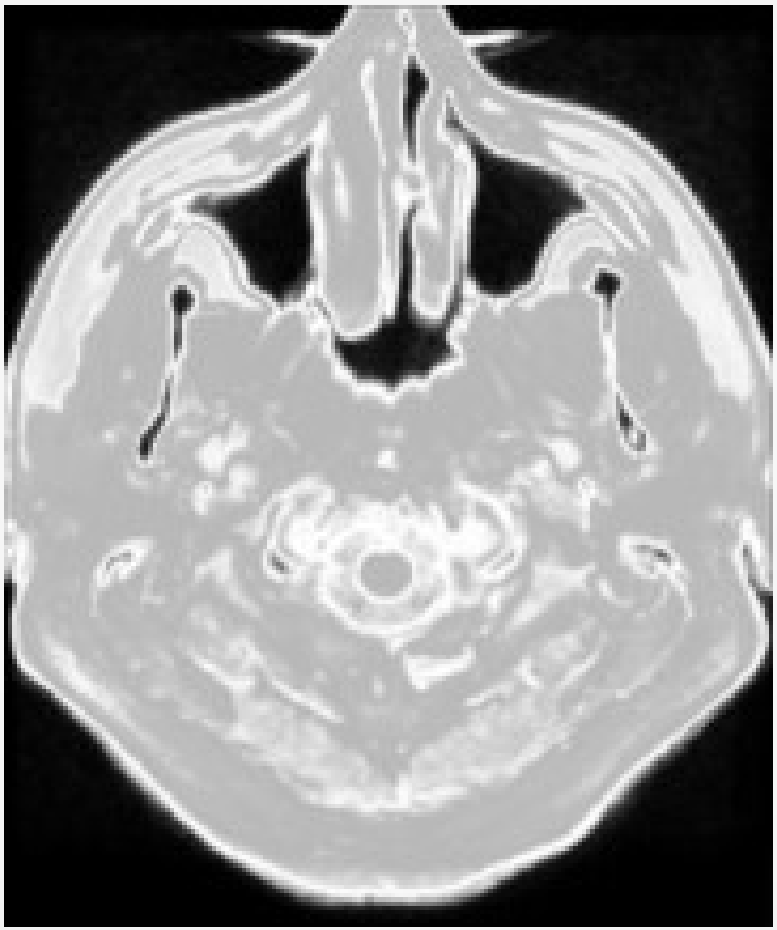
Project

- Testing segmentation using data from the Kaggle MRI Heart dataset
- Compare classification algorithms using both deep-learning features and hand-crafted features
- Deep-learning techniques:
  - Autoencoder
  - Convolutional Neural Networks
- Hand-crafted features:
  - Haar-like features
  - Local binary pattern
  - Histogram of Gradient
- Use different techniques to segment the left ventricle and compare results
  - Support Vector Machines
  - Random Forests

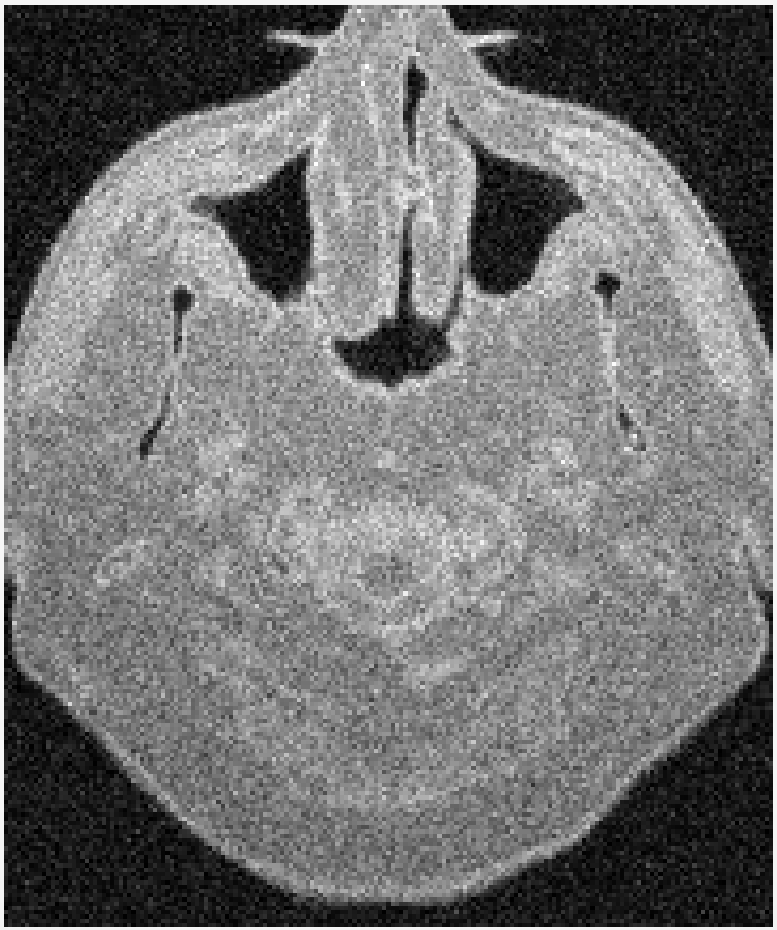
Progress

- Installed Insight Segmentation and Registration Toolkit (ITK)
  - Software designed for image viewing and analysis
  - Can support medical image formats, high resolution, and 3 and 4 dimensional images
  - Will be using ITK to view 4D MRI Heart images
- Used ITK to preprocess images
  - Medical images are often “unclean”
  - Preprocessing images helps to remove noise, reduce inhomogeneity, and standardize intensity levels

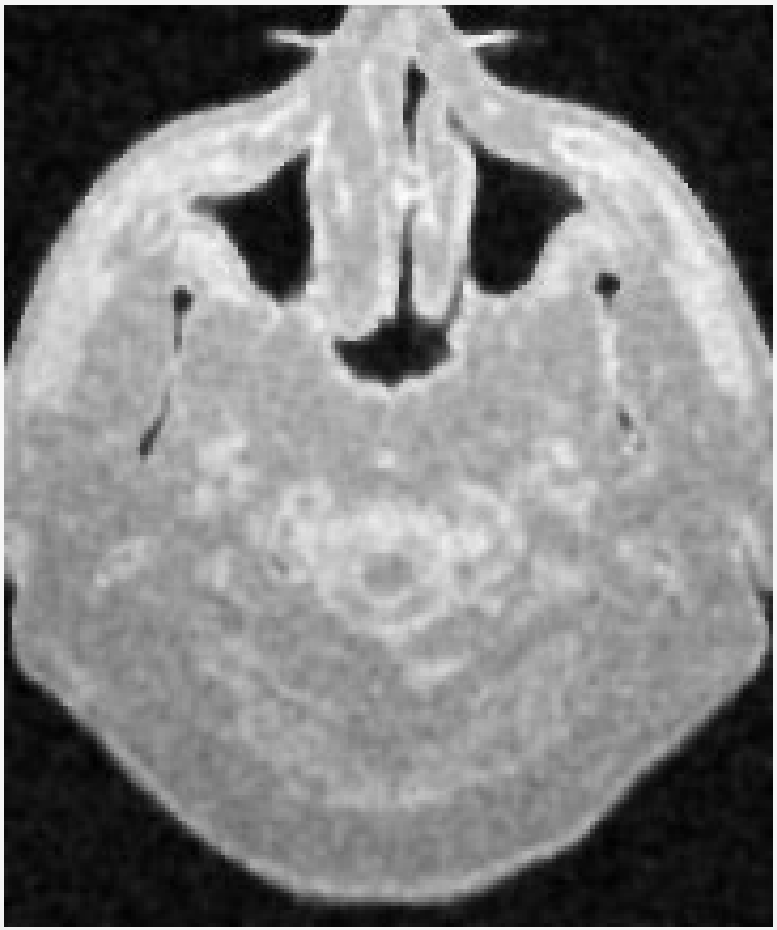
Preprocessing – Clean image



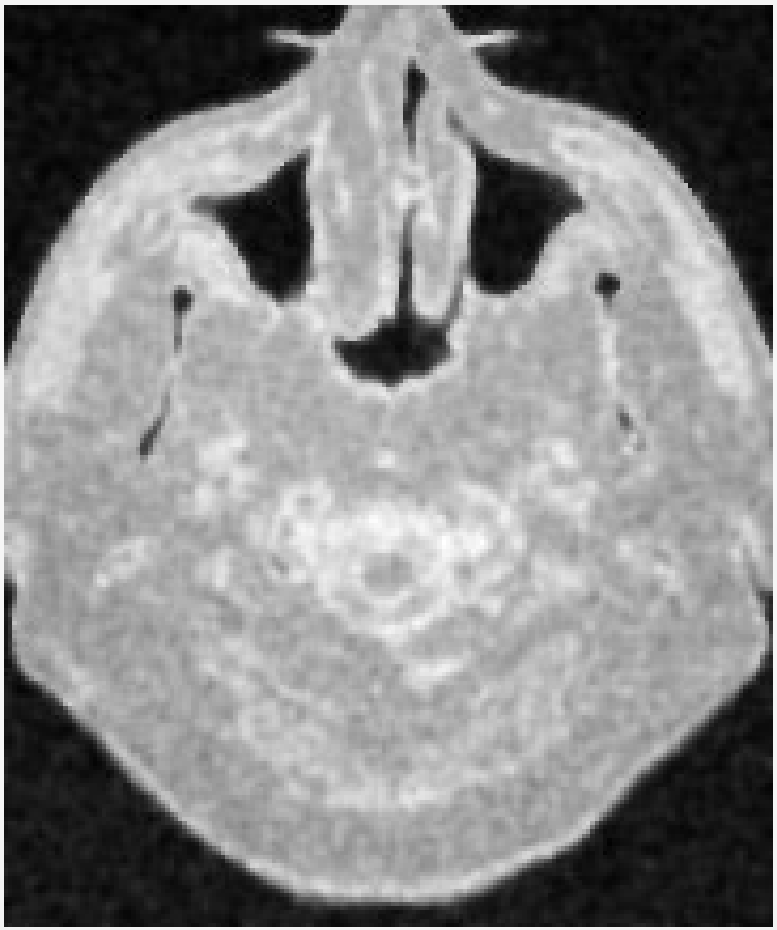
Preprocessing – Unclean image



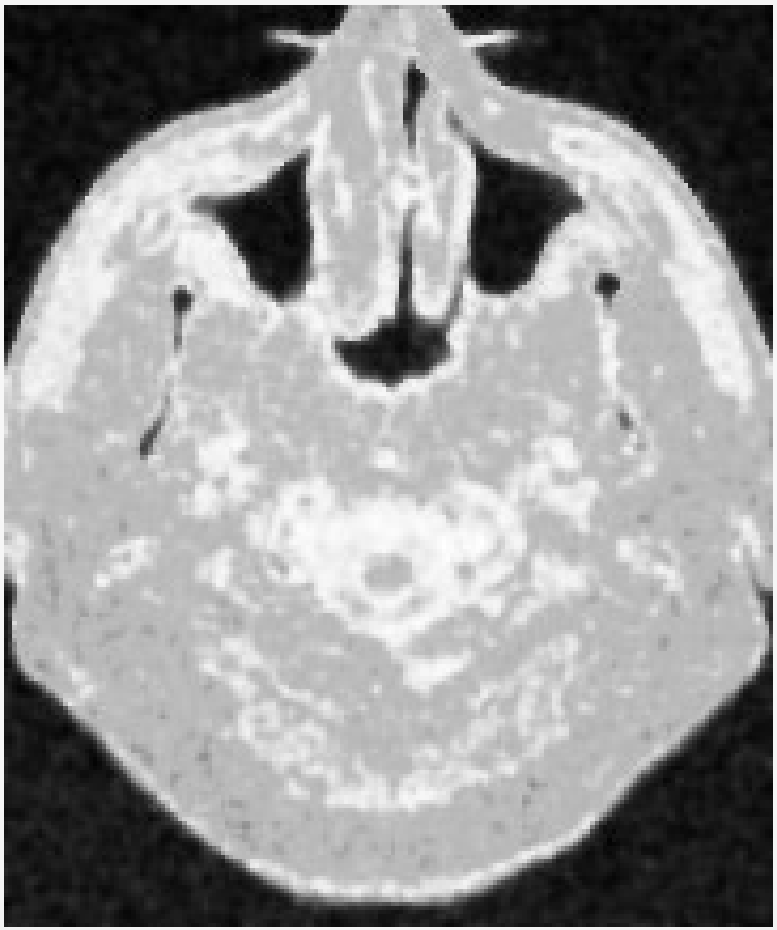
Preprocessing – Anisotropic Filter



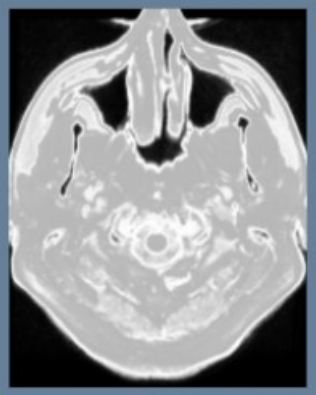
Preprocessing – Inhomogeneity correction



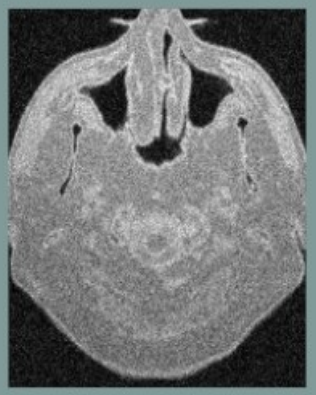
Preprocessing – Intensity standardization



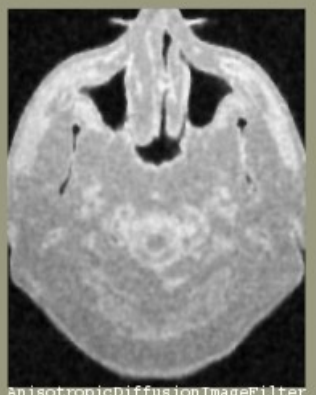
Preprocessing



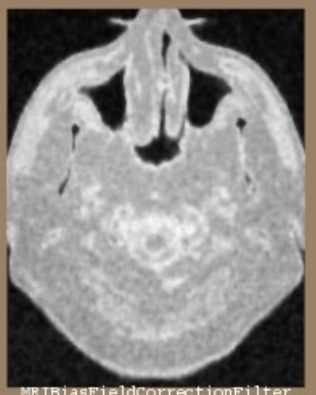
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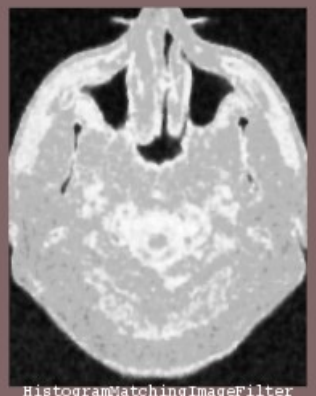
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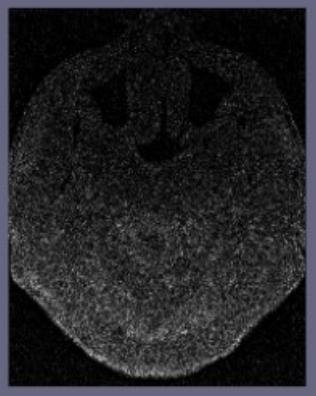
AnisotropicDiffusionImageFilter
iterations: 4 conductance: 4



MRIBiasFieldCorrectionFilter



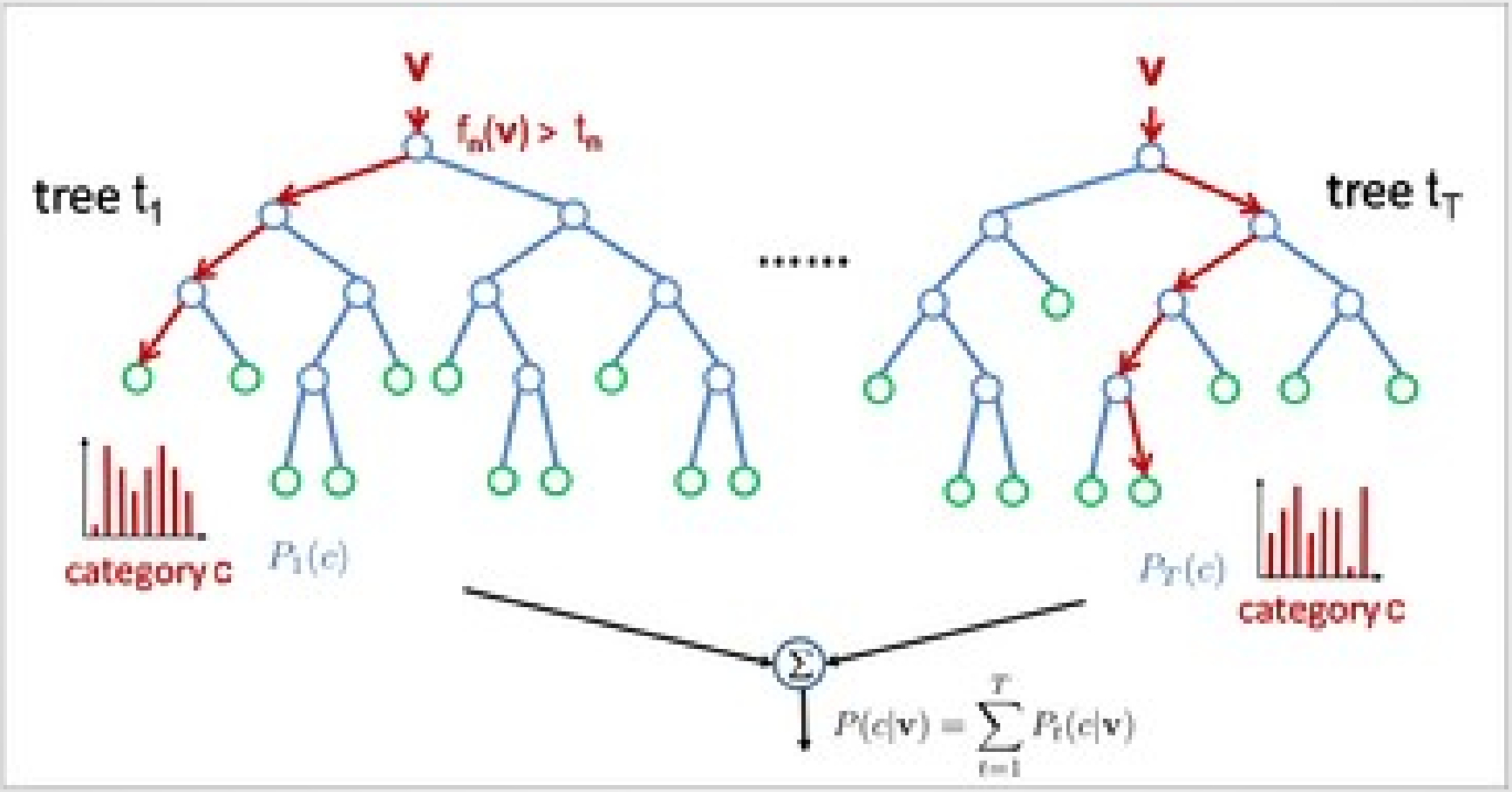
HistogramMatchingImageFilter
Levels: 100 match points: 15





Progress

- Researched Random Forests



Progress

- Read research paper on Mondrian Forests
  - On-line Random Forest implementation
  - Use Mondrian processes to create random decision trees
  - Fast learning techniques
- Implemented Mondrian Forests in python
  - Used library from code used in the research paper
  - Tested classification on dataset using Mondrian Forests

Plan for next week

- Download MRI Heart dataset from Kaggle
- Preprocess images to create a working set
- Start applying different techniques to extract feature descriptors
  - Learned features
    - Autoencoders
    - Convolutional Neural Networks
  - Hand-crafted features
    - Haar-like features
    - Local Binary Pattern
    - Histogram of Gradient