

Predicting Left Ventricular Diastolic Volume

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Agenda

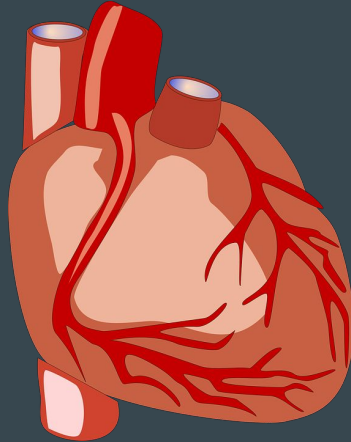
- ❖ Problem Statement
- ❖ Background Information
- ❖ Methods & Models
- ❖ Model Evaluation
- ❖ Conclusions
- ❖ Next Steps

Problem Statement

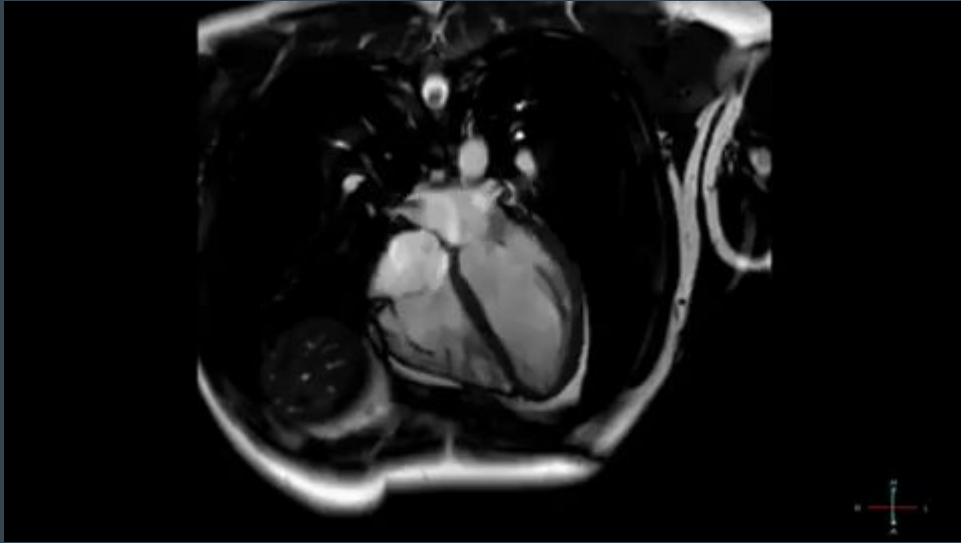
Left ventricular dilation is a serious condition because the muscular wall of the ventricle thins and becomes less able to pump blood. This is a major contributor to left-sided congestive heart failure & indication of heart function. Being able to predict the left ventricular volume would give cardiologists an idea of who needs therapy the most and help increase efficiency in the healthcare system.

Background

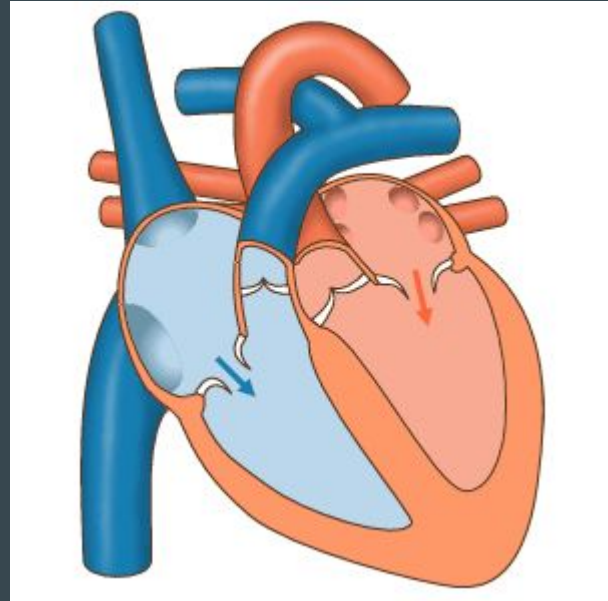
- ❖ The left ventricle pumps oxygenated blood into systemic circulation
- ❖ If the left ventricle cannot pump efficiently, blood will back up into the lungs causing further cardiac and pulmonary problems
- ❖ Diagnosis of dilation is typically done by cardiac MRI
 - Cardiac MRIs are expensive and unpleasant



Background

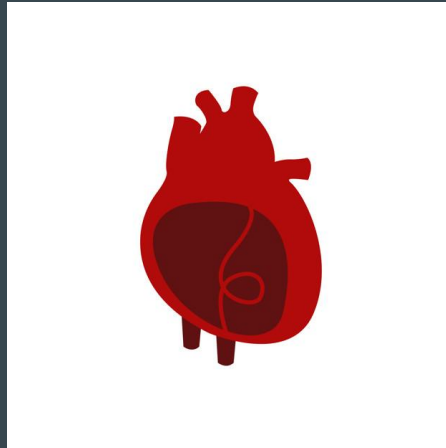


MRI [source](#)



Preprocessing

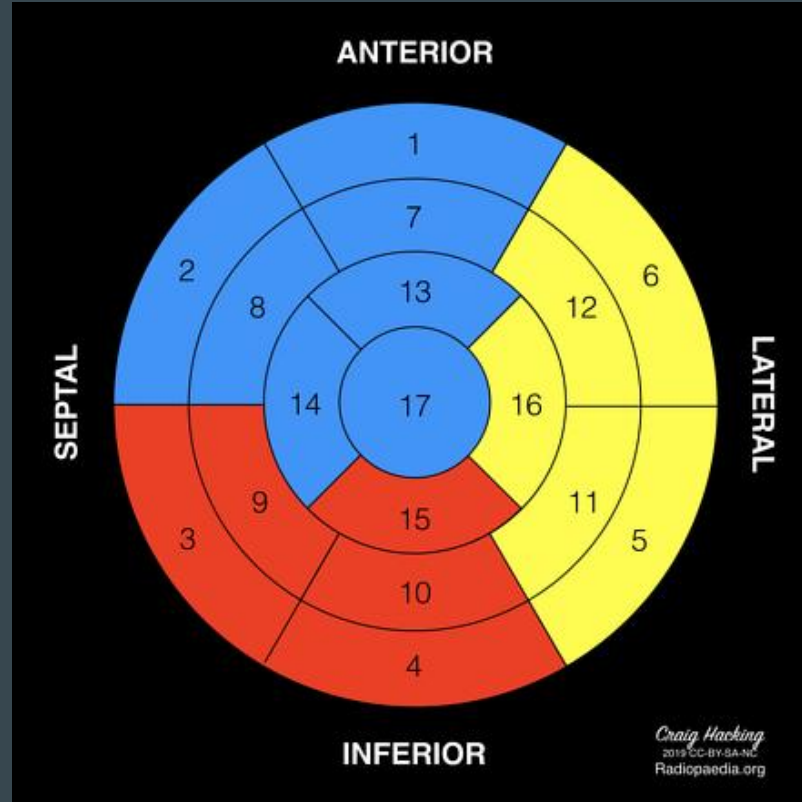
- ❖ Minimal cleaning was needed
- ❖ Most of the cleaning was making ordinal columns were numeric
- ❖ Some values did not make sense & had to be removed
- ❖ Missing data was imputed via a KNN method from the fancyimpute library



Feature Engineering

- ❖ We were able to identify two primary groups of data
- ❖ They are segmental features for HE and ischemia
- ❖ The left ventricle can be divided into 17 segments
- ❖ We intended to create interaction columns based off of the segmentation
- ❖ We ended up having to create “summary” columns instead
- ❖ There were only 3 summary columns: basal, mid, & apex

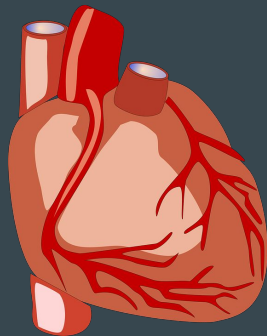
Feature Engineering



Source

Models

- ❖ We began with a simple linear model
- ❖ Branched into regularized linear models: Ridge, LASSO, ElasticNet, XGBoost
- ❖ We used a random forest regressor as well
- ❖ The models were run on a set containing the original & engineered features
- ❖ Models were evaluated on four metrics
- ❖ Model performance was determined by metric scores & residual plots

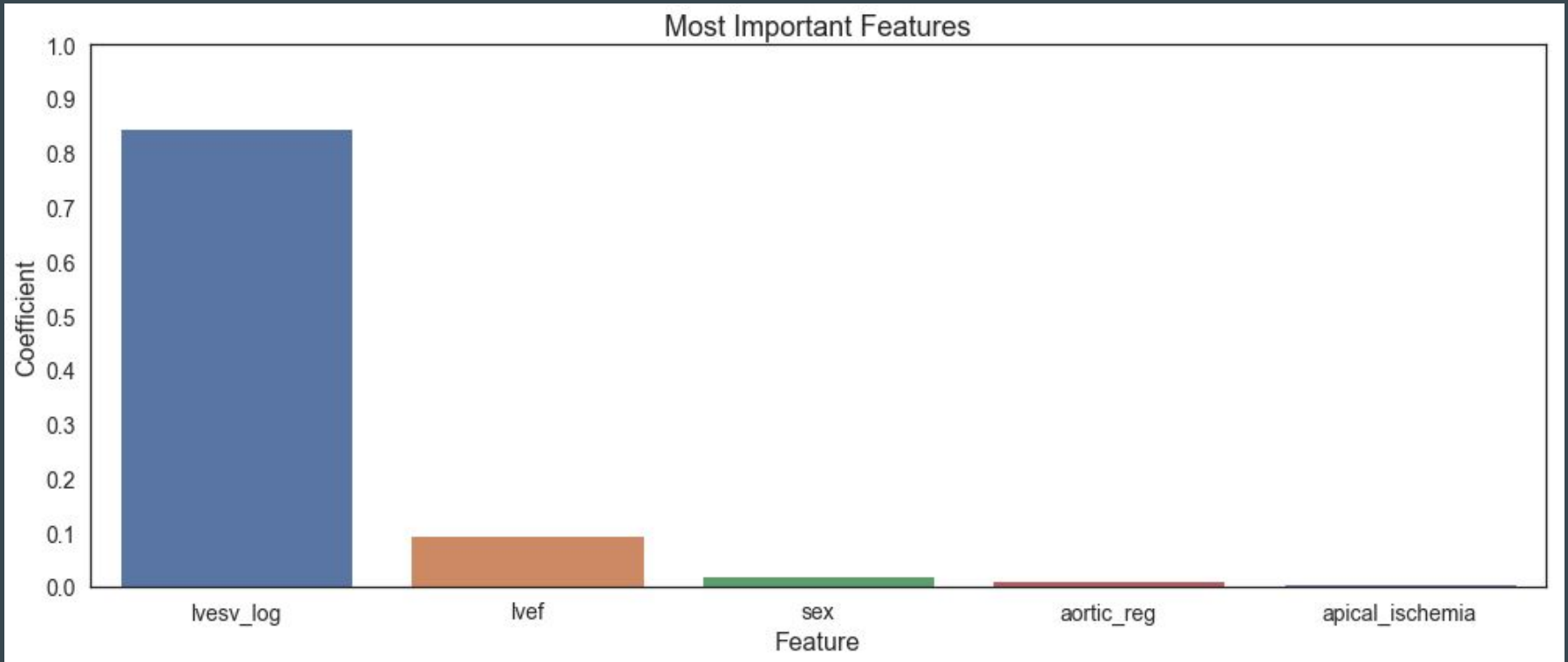


Conclusions

- ❖ An XGBoost regressor with engineered features was our best model
 - It had the best results & gives coefficients

Metric	XGBoost
RMSE	4.601
MAE	2.559
R^2	0.9947
Adjusted R^2	0.9946

Conclusions



Next Steps

- ❖ Model on information from patient charts
- ❖ Continue optimizing the random forest & XGBoost models
- ❖ Continue feature engineering



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Definitions Of Some Terms

- ❖ Ventricle → two lower chambers that pump blood out of the heart
- ❖ End Diastolic Volume (EDV) → maximum volume of blood when filling
- ❖ End Systolic Volume (ESV) → volume at the end of contraction
- ❖ Ejection Fraction (EF) → how much blood is pumped during contraction
- ❖ Regurgitation → blood flowing back through a valve
- ❖ Hyper-Enhancement (ρ_{he}) → scarification/infarction
- ❖ Ischemia → restriction of blood flow