How to leverage data to reduce costs for inpatients visits of patients with cardiovascular diseases?

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Contents

Heart Dataset

303 rows, 14 columns
with only one duplicate

Description	Values	Type
Age	29-77	Numerical
Sex	0, 1	Categorical
Chest pain type	0, 1, 2, 3	Categorical
Resting blood pressure	94-200	Numerical
Cholesterol	126-564	Numerical
Fasting blood sugar	0, 1	Binary
Rest ECG	0, 1, 2	Categorical
Max HR	71-202	Numerical
Exercise included angina	0, 1	Binary
ST depression	0-6.2	Numerical
ST segment slope	0, 1, 2	Categorical
Number major vessels	0, 1, 2, 3, 4	Ordinal
Thallium stress test	0, 1, 2, 3	Categorical
Target	0, 1	Boolean

Some of parameters are correlated with target in the opposite direction. HOW?

Expectation: patients with heart diseases

- Are older
- Have higher ST depression
- Have higher resting BP
- Have higher Cholesterol
- Their maximum achieved HR is smaller
- Have more number of vessels recognised in fluoroscopy

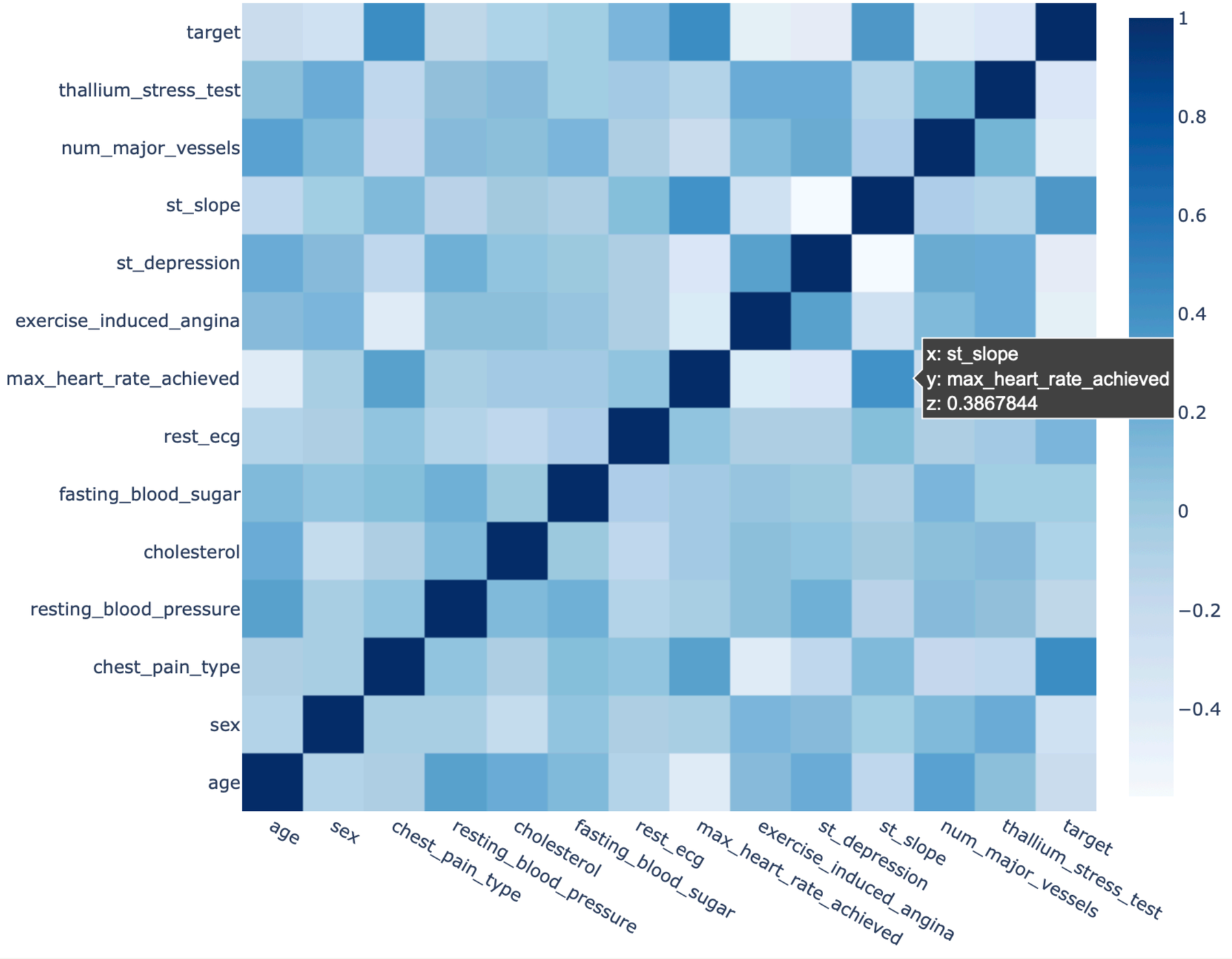
Target = 0	Age	ST Dep	Rest BP	Chol	Max HR	Num Vess
Mean	56.6	1.58	134.39	251.08	139.01	1.16
Std	7.96	1.3	18.72	49.45	22.59	1.04

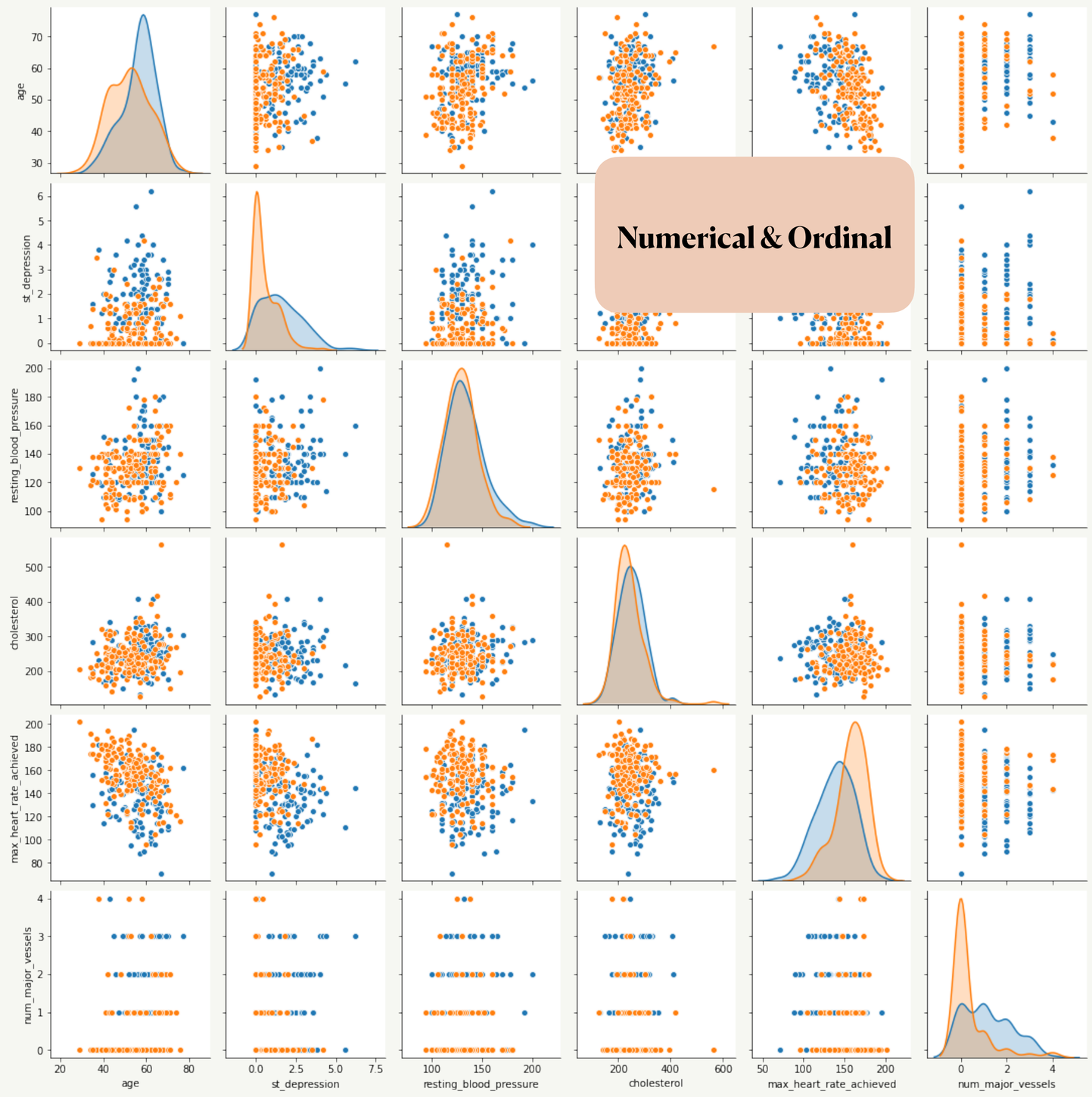
Target = 1	Age	ST Dep	Rest BP	Chol	Max HR	Num Vess
Mean	52.49	0.58	129.3	242.23	158.46	0.36
Std	9.55	0.78	16.16	53.55	19.17	0.84

HeatMap

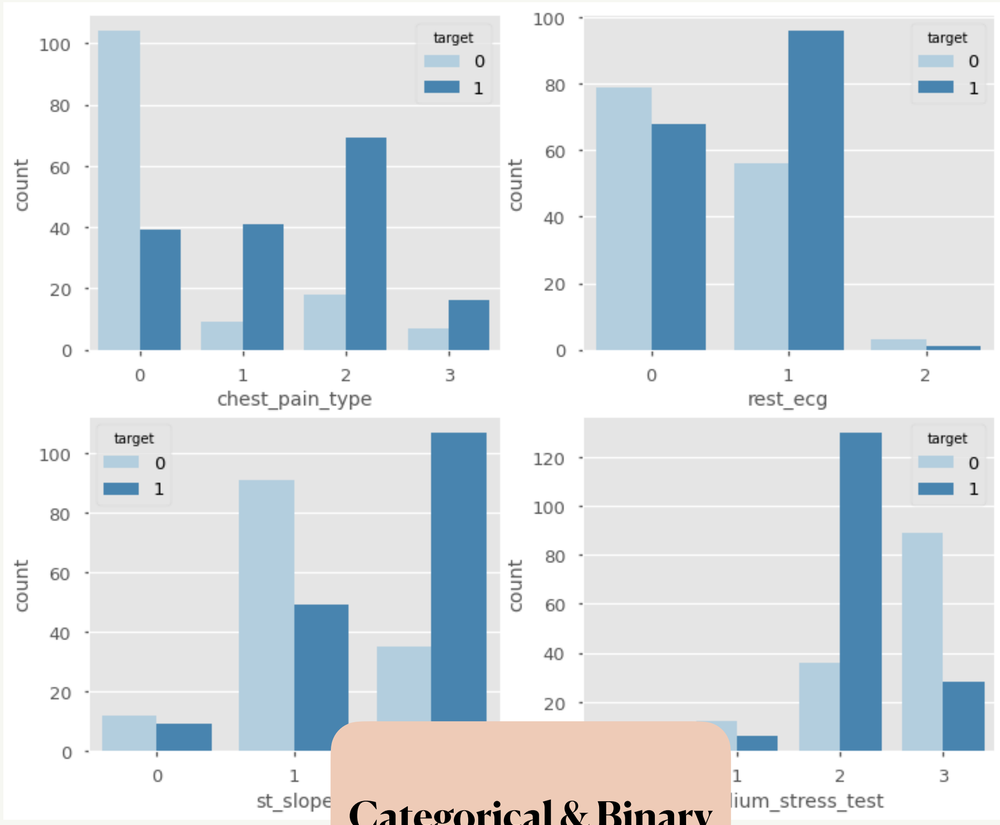
Correlation between all variables

- Parameters seem to be poorly correlated with one another
- No need for eliminating highly correlated features or applying PCA

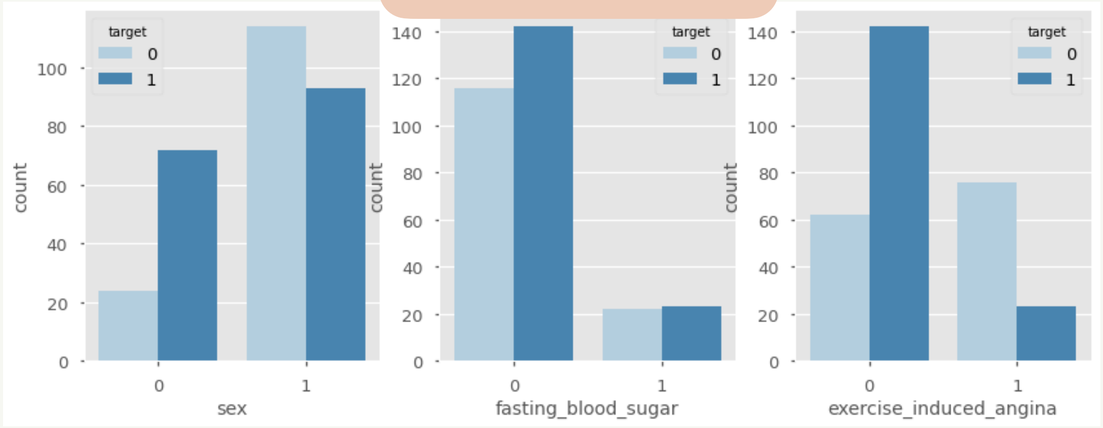




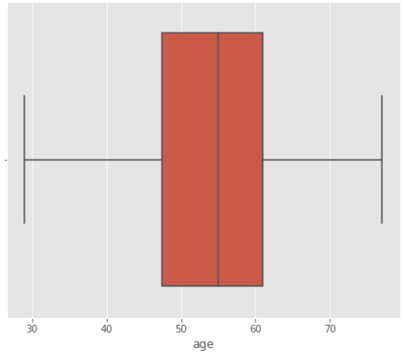
Numerical & Ordinal

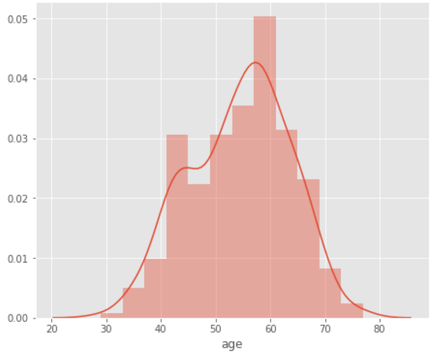


Categorical & Binary

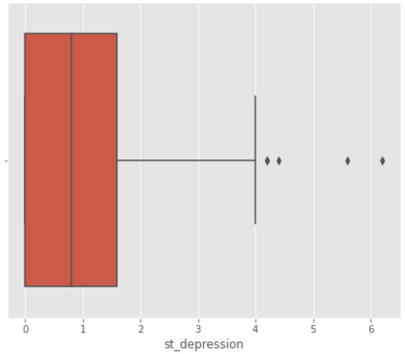


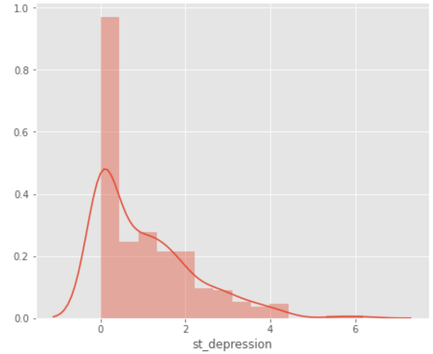
Age



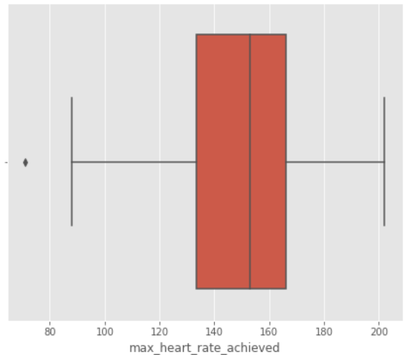


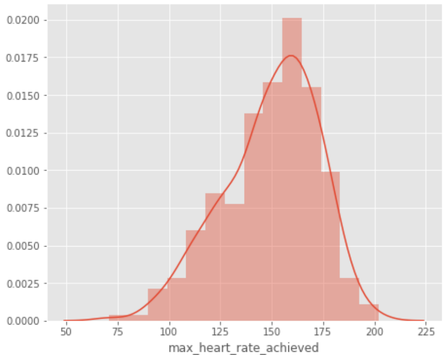
ST Depression



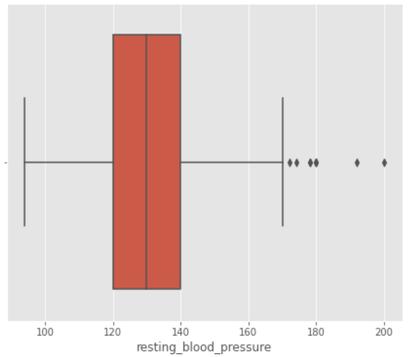


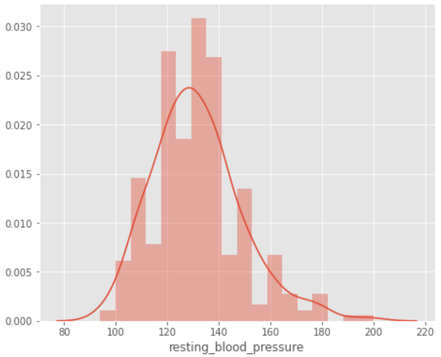
Max HR

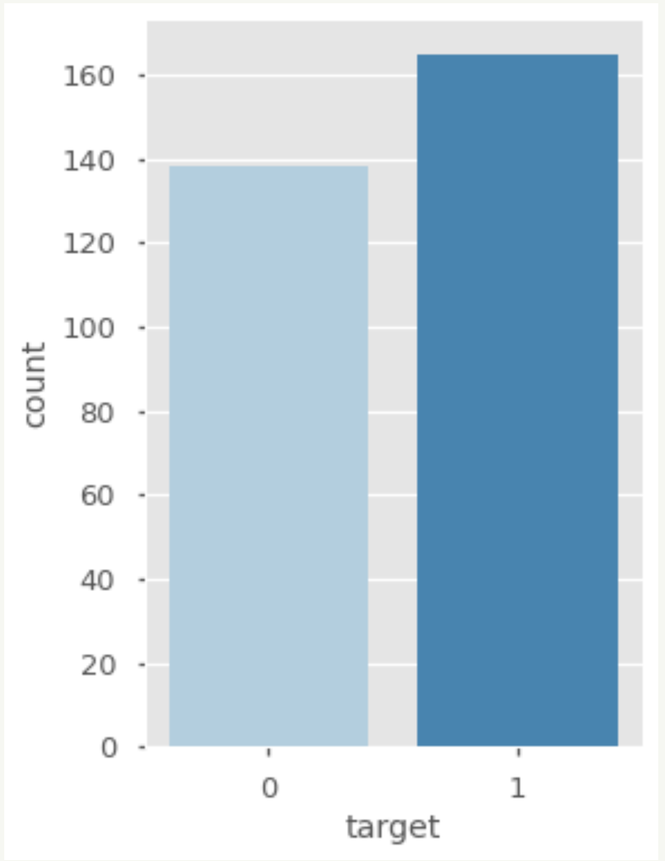




Rest BP







Target (healthy/patient)

Balanced dataset

Feature Encoding & Normalization

- Categorical features: One hot encoding (dummy variables, dropping first column)
- Numerical features: Standard Scaling (mean 0 and std 1)

Model training

Split data —> 80% training, 20% validation

Model —> Random Forest

```
Training Accuracy : 0.8966942148760331
Testing Accuracy : 0.8852459016393442
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              precision    recall  f1-score   support

           0       0.88      0.85      0.87        27
           1       0.89      0.91      0.90        34
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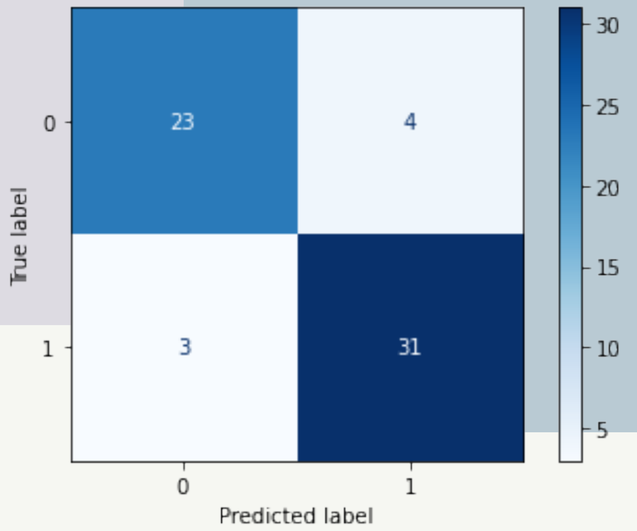
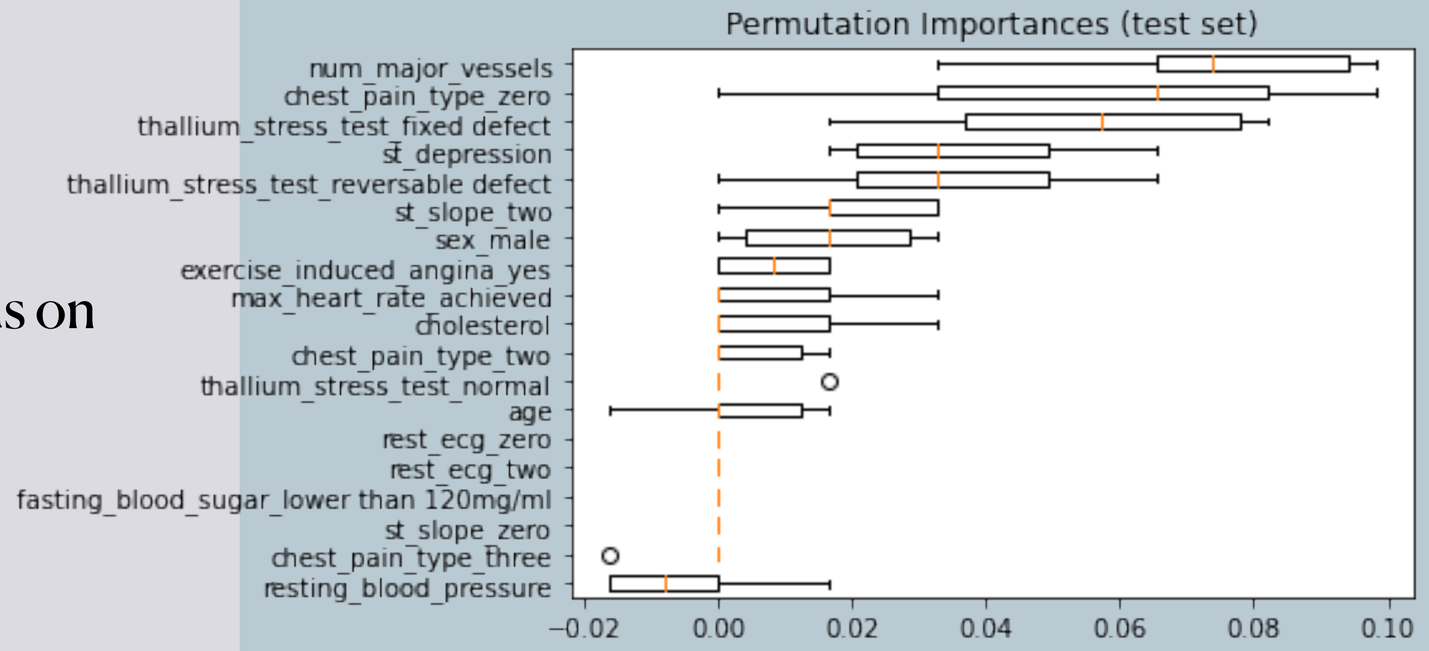


Sensitivity : 0.88, Specificity: 0.87

In medical diagnosis, **sensitivity** is the ability to correctly identify those with the disease (true positive rate), whereas **specificity** is the ability to correctly identify those without the disease (true negative rate).

Permutation Feature Importance

- Computed on a held out test set
- Shows how much the model depends on the feature



HOW AI-driven tool can improve patient safety, avoid unnecessary spending, and enable medical experts to deliver the best possible care in the most efficient manner?

- ✦Identify unnecessary treatments steps
- ✦Identify the best treatment methodologies based on historical data

- ✦Identify patients at risk for death or congestive heart failure
- ✦Identify patients with possible rehospitalization after initial treatment in near future