AutoML Final Report

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1. Dataset Overview

Original Dataset:

• Rows: 1025
• Columns: 14
• Missing Values: 0 (0.00%)
• Duplicate Rows: 723

Column Summary:

• Numeric Columns (14): age, sex, cp, trestbps, chol, fbs, restecg, thalach, exang, oldpeak, slope, ca, thal, target
• Categorical Columns (0):

After Preprocessing:

• Rows: 1025
• Columns: 14
• Rows Removed: 0

2. EDA Findings

Numeric Features Statistics:

Feature	Mean	Median	Std	Min	Max
age	54.43	56.00	9.07	29.00	77.00
sex	0.70	1.00	0.46	0.00	1.00
cp	0.94	1.00	1.03	0.00	3.00
trestbps	131.61	130.00	17.52	94.00	200.00
chol	246.00	240.00	51.59	126.00	564.00
fbs	0.15	0.00	0.36	0.00	1.00

restecg	0.53	1.00	0.53	0.00	2.00
thalach	149.11	152.00	23.01	71.00	202.00
exang	0.34	0.00	0.47	0.00	1.00
oldpeak	1.07	0.80	1.18	0.00	6.20
slope	1.39	1.00	0.62	0.00	2.00
ca	0.75	0.00	1.03	0.00	4.00
thal	2.32	2.00	0.62	0.00	3.00
target	0.51	1.00	0.50	0.00	1.00

3. Data Quality Issues Detected

Issues Summary:

• High Severity: 3
• Medium Severity: 2
• Low Severity: 3

Issues Detected:

• [HIGH] DUPLICATE_ROWS in 'N/A': 723 (70.54%)
• [MEDIUM] OUTLIERS in 'trestbps': 30 (2.93%)
• [MEDIUM] OUTLIERS in 'chol': 16 (1.56%)
• [HIGH] OUTLIERS in 'fbs': 153 (14.93%)
• [LOW] OUTLIERS in 'thalach': 4 (0.39%)
• [LOW] OUTLIERS in 'oldpeak': 7 (0.68%)
• [HIGH] OUTLIERS in 'ca': 87 (8.49%)
• [LOW] OUTLIERS in 'thal': 7 (0.68%)

Recommendations:

• Remove duplicate rows from dataset
• Consider removing or capping outliers using IQR method

4. Preprocessing Decisions

Methods Applied:

• Missing Values Strategy: Median
• Outlier Handling: Remove
• Scaling Method: Standard
• Encoding Method: OneHot
• Test Size: 0.2

Impact Summary:

• Rows Removed: 0
• Missing Values Reduced: 0 → 0
• Features Modified: 14 (from 14)

5. Model Configurations & Hyperparameters

Training Configuration:

• Test Size: 0.2
• Random State: 42
• Hyperparameter Tuning: Yes

Models Trained: 14 total

Hyperparameter Tuned Models (7):

• Logistic Regression (Tuned)

- C: 1
- max_iter: 100
- penalty: l2
- solver: lbfgs

• K-Neighbors Classifier (Tuned)

- metric: manhattan
- n_neighbors: 5
- weights: distance

• Decision Tree Classifier (Tuned)

- criterion: gini
- max_depth: 10
- min*samples*leaf: 1
- min*samples*split: 2

• Gaussian Naive Bayes (Tuned)

- var_smoothing: 0.012915496650148827

• Random Forest (Tuned)

- criterion: gini
- max_depth: None
- min*samples*leaf: 1
- min*samples*split: 2

- n_estimators: 50

• **Support Vector Machine (Tuned)**

- C: 100
- gamma: scale
- kernel: rbf

• **Decision Tree Rule-based (Tuned)**

- criterion: gini
- max_depth: 10
- min*samples*leaf: 1
- min*samples*split: 2

Non-Tuned Models (7):

• Logistic Regression (default parameters)
• K-Neighbors Classifier (default parameters)
• Decision Tree Classifier (default parameters)
• Gaussian Naive Bayes (default parameters)
• Random Forest (default parameters)
• Support Vector Machine (default parameters)
• Decision Tree Rule-based (default parameters)

6. Model Performance Comparison

Model	Accuracy	Precision	Recall	F1-Score	Training Time
Logistic Regression	0.7951	0.8023	0.7951	0.7938	0.01s
K-Neighbors Classifier	0.8341	0.8387	0.8341	0.8335	0.01s
Decision Tree Classifier	0.9854	0.9858	0.9854	0.9854	0.01s
Gaussian Naive Bayes	0.8000	0.8105	0.8000	0.7982	0.00s
Random Forest	0.9854	0.9858	0.9854	0.9854	0.36s
Support Vector Machine	0.8878	0.8923	0.8878	0.8875	0.23s
Decision Tree Rule-based	0.8439	0.8604	0.8439	0.8420	0.01s
Logistic Regression (Tuned)	0.7951	0.8023	0.7951	0.7938	26.84s
K-Neighbors Classifier (Tuned)	1.0000	1.0000	1.0000	1.0000	1.51s
Decision Tree Classifier (Tuned)	0.9854	0.9858	0.9854	0.9854	2.32s
Gaussian Naive Bayes (Tuned)	0.8000	0.8105	0.8000	0.7982	0.28s
Random Forest (Tuned)	0.9854	0.9858	0.9854	0.9854	153.91s
Support Vector Machine (Tuned)	0.9854	0.9858	0.9854	0.9854	18.65s

Decision Tree Rule-based (Tuned)	0.9854	0.9858	0.9854	0.9854	2.17s

7. Best Model Summary & Justification

Selected Model: K-Neighbors Classifier (Tuned)

Reason: Best F1 score: 1.0000

Performance Metrics:

- Accuracy: 1.0
- Precision: 1.0
- Recall: 1.0
- F1-Score: 1.0
- ROC-AUC: 1.0
- Training Time: 1.5126826763153076s

Hyperparameters:

- metric: manhattan
- n_neighbors: 5
- weights: distance