Heart Disease Prediction — End-to-End MLOps Case Study

Date: January 06, 2026

This report summarizes the MLOps implementation for a Heart Disease Prediction system and appends evidence images covering EDA, model evaluation, and API endpoints.

1. Project Overview

This project implements an end-to-end MLOps pipeline for a Heart Disease Prediction system. The objective is to demonstrate best practices across data processing, model training, experiment tracking, CI/CD, containerization, deployment, and monitoring.

2. Setup & Installation Instructions

• OS: Linux VM (Docker + Minikube)
• Python: 3.9
• Tools: Docker, Minikube, kubectl, GitHub Actions
Steps:
1. git clone
2. cd mlops-heart
3. docker build -t heart-api:latest .
4. docker run -p 8000:8000 heart-api:latest
5. minikube start --driver=docker
6. minikube image load heart-api:latest
7. kubectl apply -f k8s/

3. Exploratory Data Analysis (EDA) & Modeling Choices

• Dataset: Heart Disease dataset (tabular clinical features)
• EDA: Missing value checks, feature distributions, correlation analysis
• Model: RandomForestClassifier
• Scaling: StandardScaler
• Threshold: Probability >= 0.5 → Disease classification
Random Forest was chosen for its robustness and interpretability on tabular data.

4. Experiment Tracking Summary

• Tool: MLflow (local tracking)
• Tracked Parameters: model type, number of estimators
• Metrics: accuracy, probability score
• Artifacts: trained model (.pkl), scaler (.pkl)
MLflow enables reproducibility and comparison across experiments.

5. Architecture Diagram (Logical Flow)

User → FastAPI → Preprocessing → ML Model → Prediction
↑ Docker
↑ Kubernetes (Minikube)
↑ CI/CD (GitHub Actions)

6. CI/CD Pipeline Workflow

GitHub Actions Pipeline:
• Linting (flake8)
• Unit tests (pytest)
• Dependency installation
• Model training
• Artifact storage
Each commit triggers automated validation ensuring code quality and reproducibility.

7. Deployment Workflow

• Dockerized FastAPI application
• Kubernetes Deployment + NodePort Service
• Exposed endpoints: /health, /predict
Deployment validated using Minikube service URL.

8. Monitoring & Logging

• Logging integrated using Python logging module
• Logs include request payload, prediction output, and timestamps
• Logs verified via: docker logs and kubectl logs
This demonstrates basic production observability.

9. Code Repository

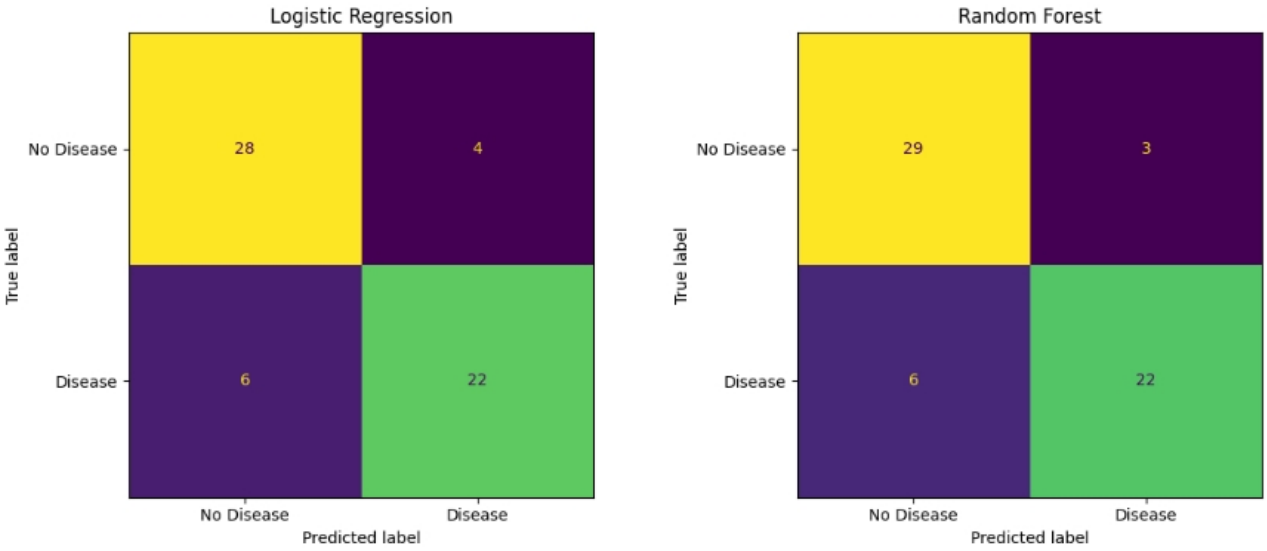
GitHub Repository: https://github.com/Jigyansh87/mlops-heart

10. Conclusion

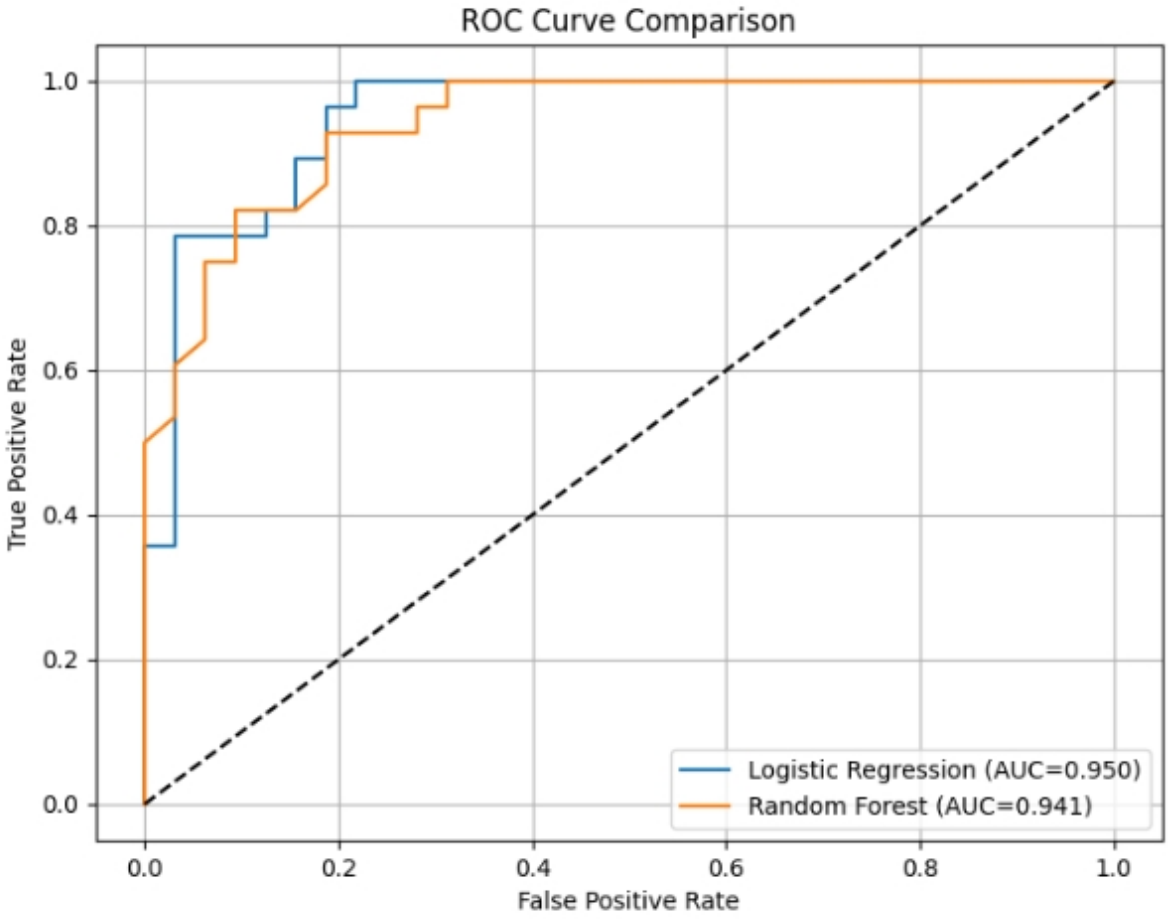
This project successfully demonstrates a complete MLOps lifecycle from development to deployment.

Evidence

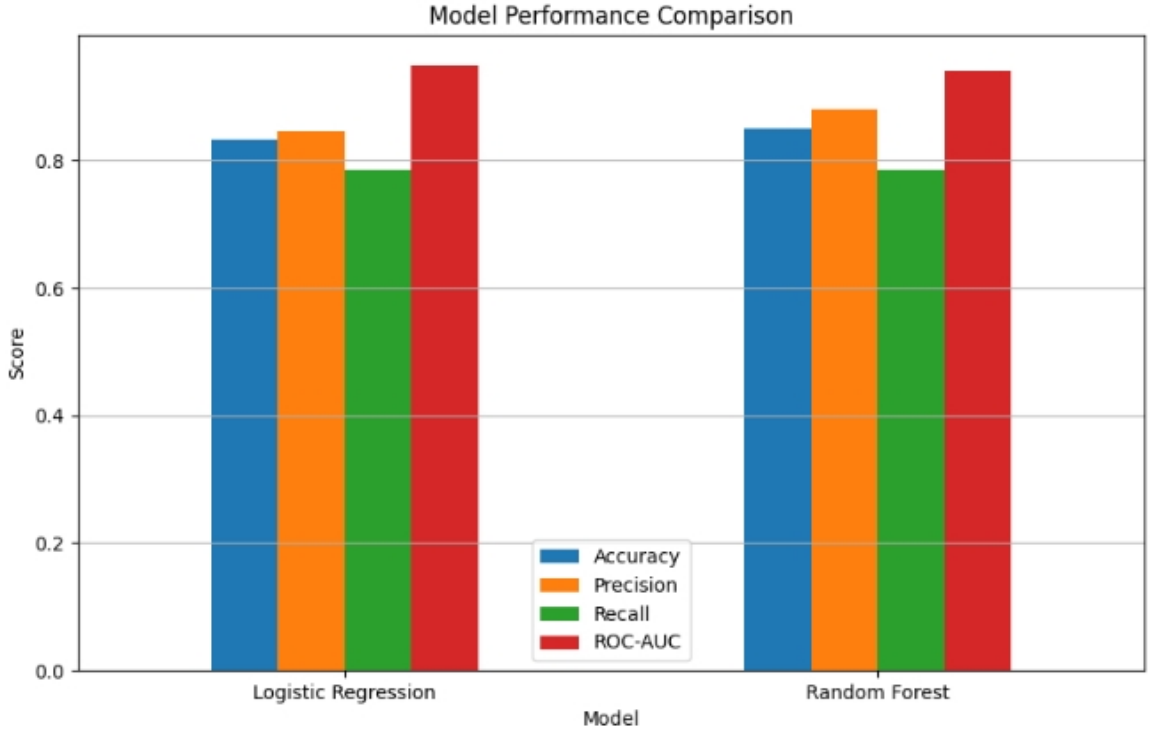
The following images provide visual evidence of EDA results, model evaluation, class balance, and API Swagger screenshots.



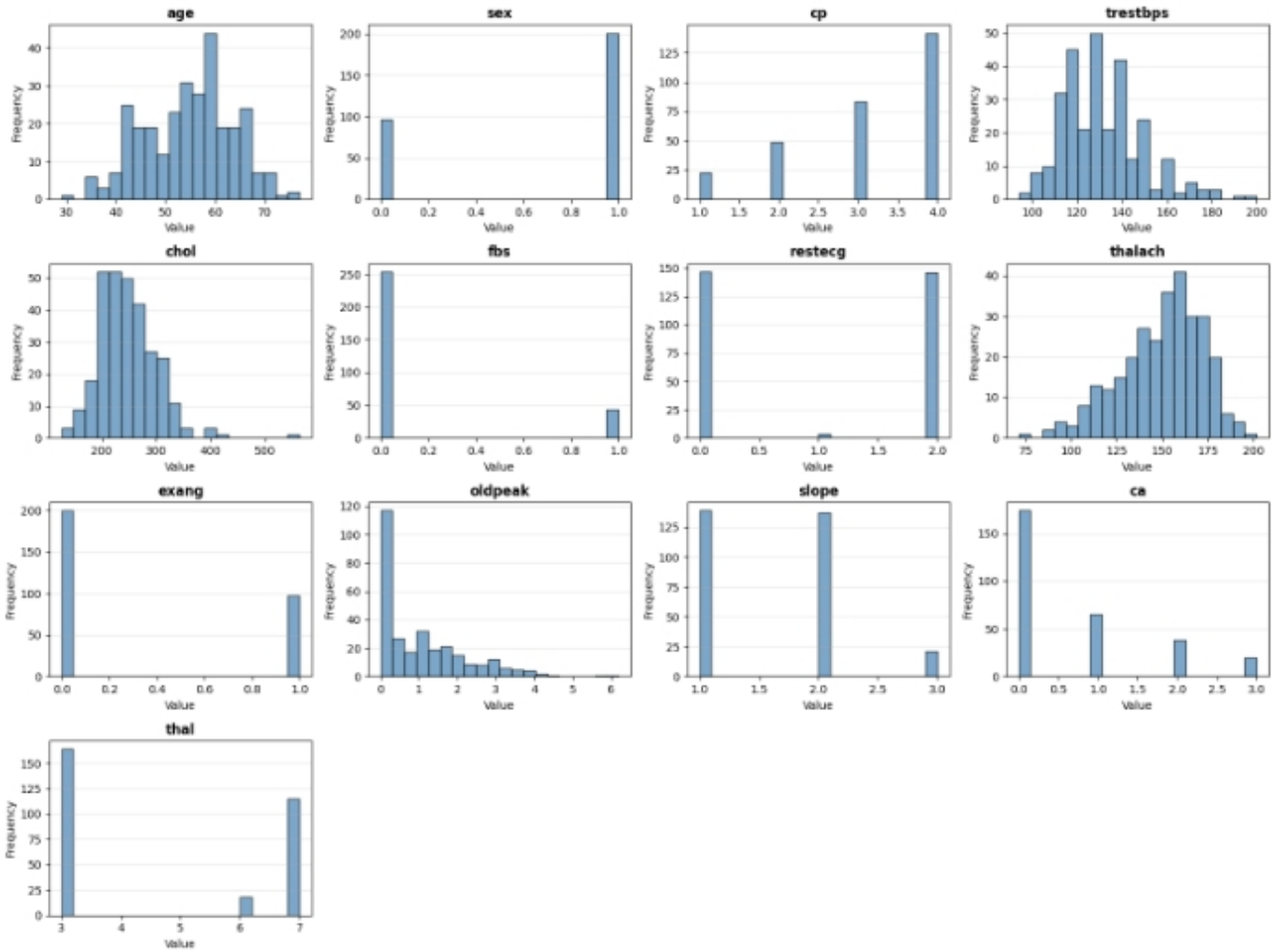
Confusion Matrices: Logistic Regression vs Random Forest



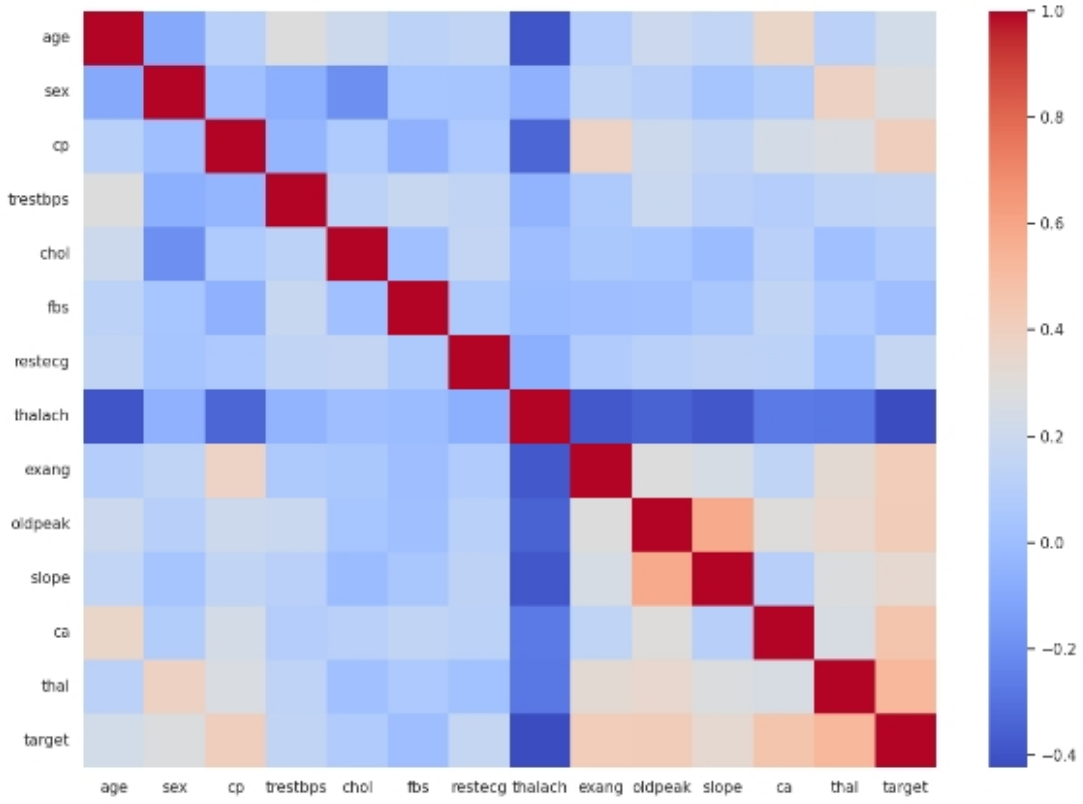
ROC Curve Comparison and AUC



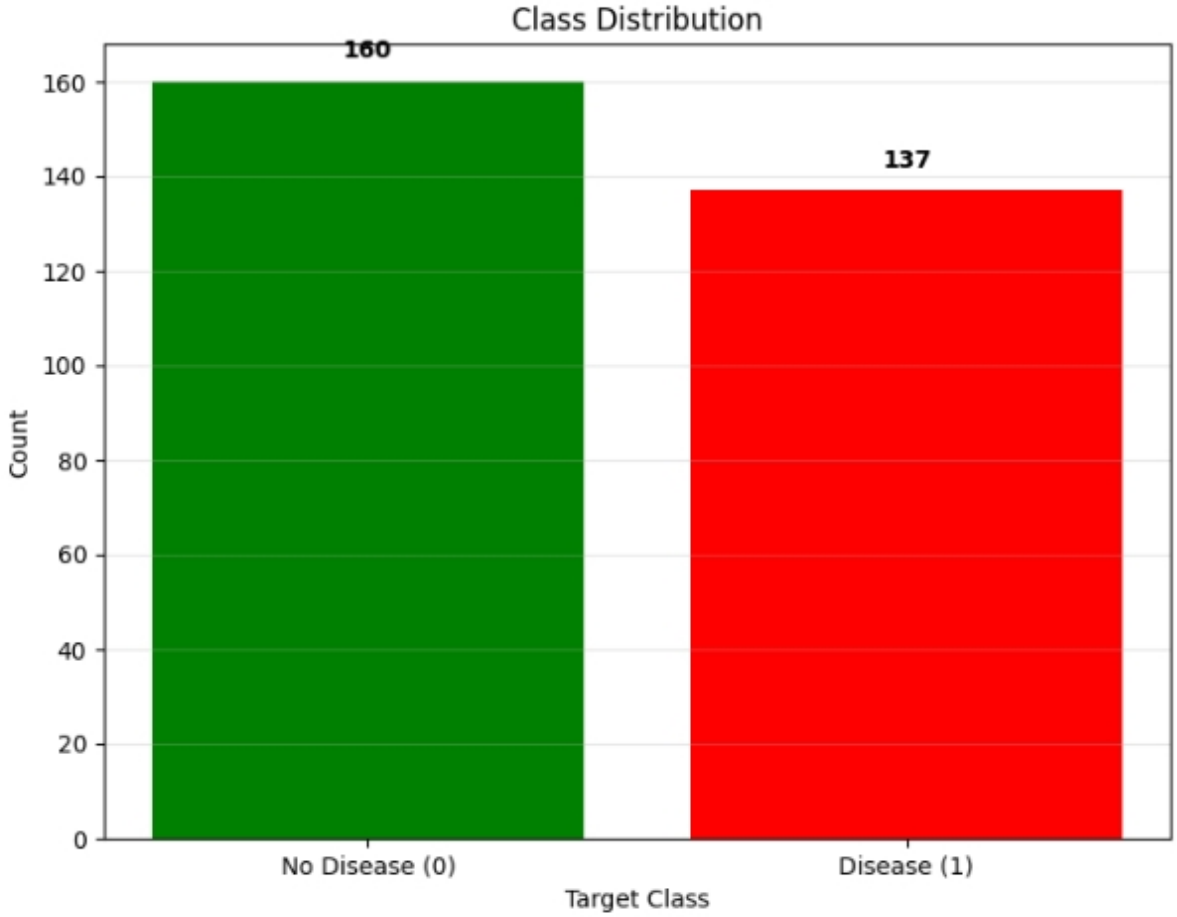
Model Performance Comparison: Accuracy, Precision, Recall, ROC-AUC



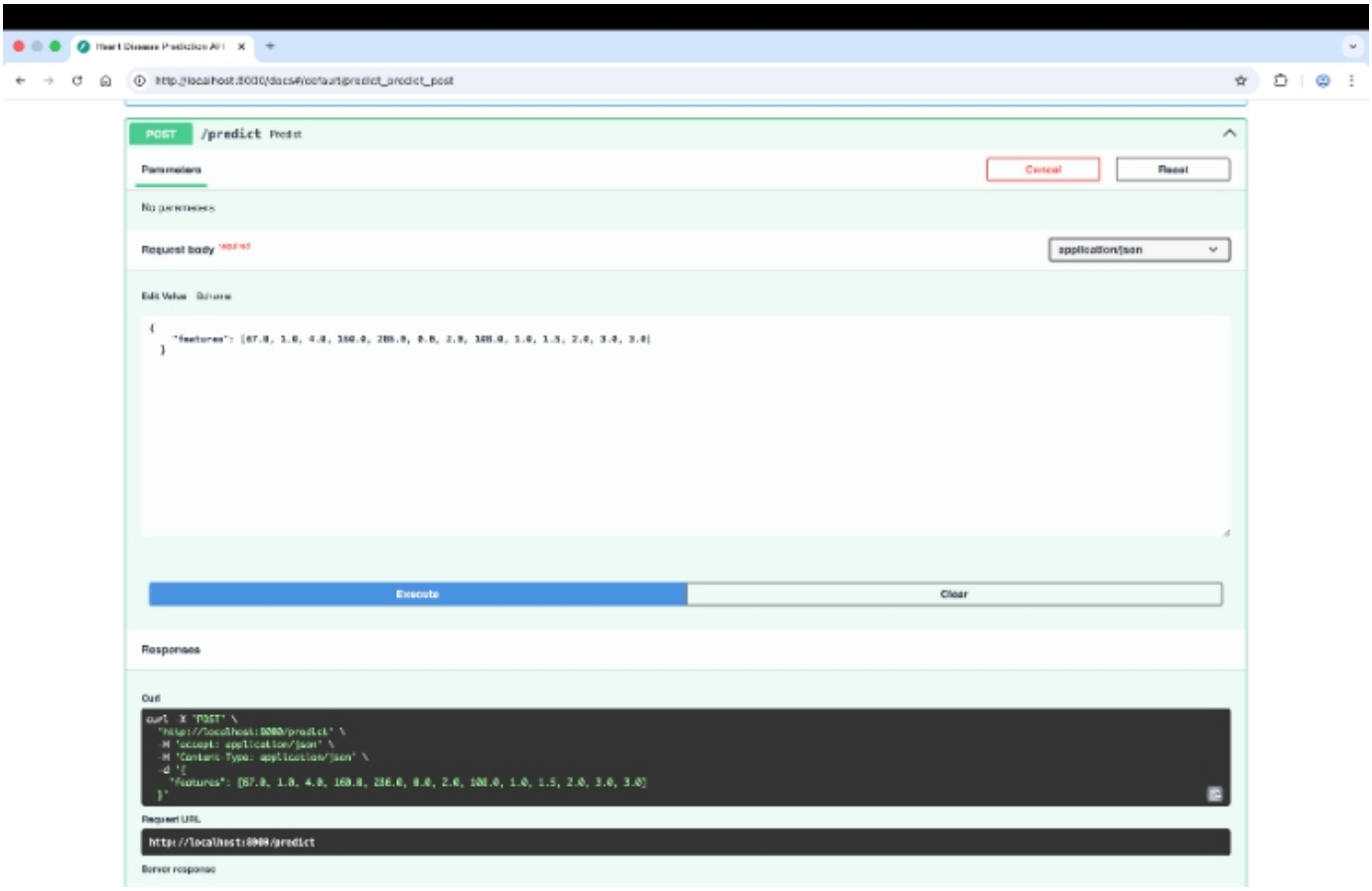
Feature Distributions (Histograms) for Clinical Variables



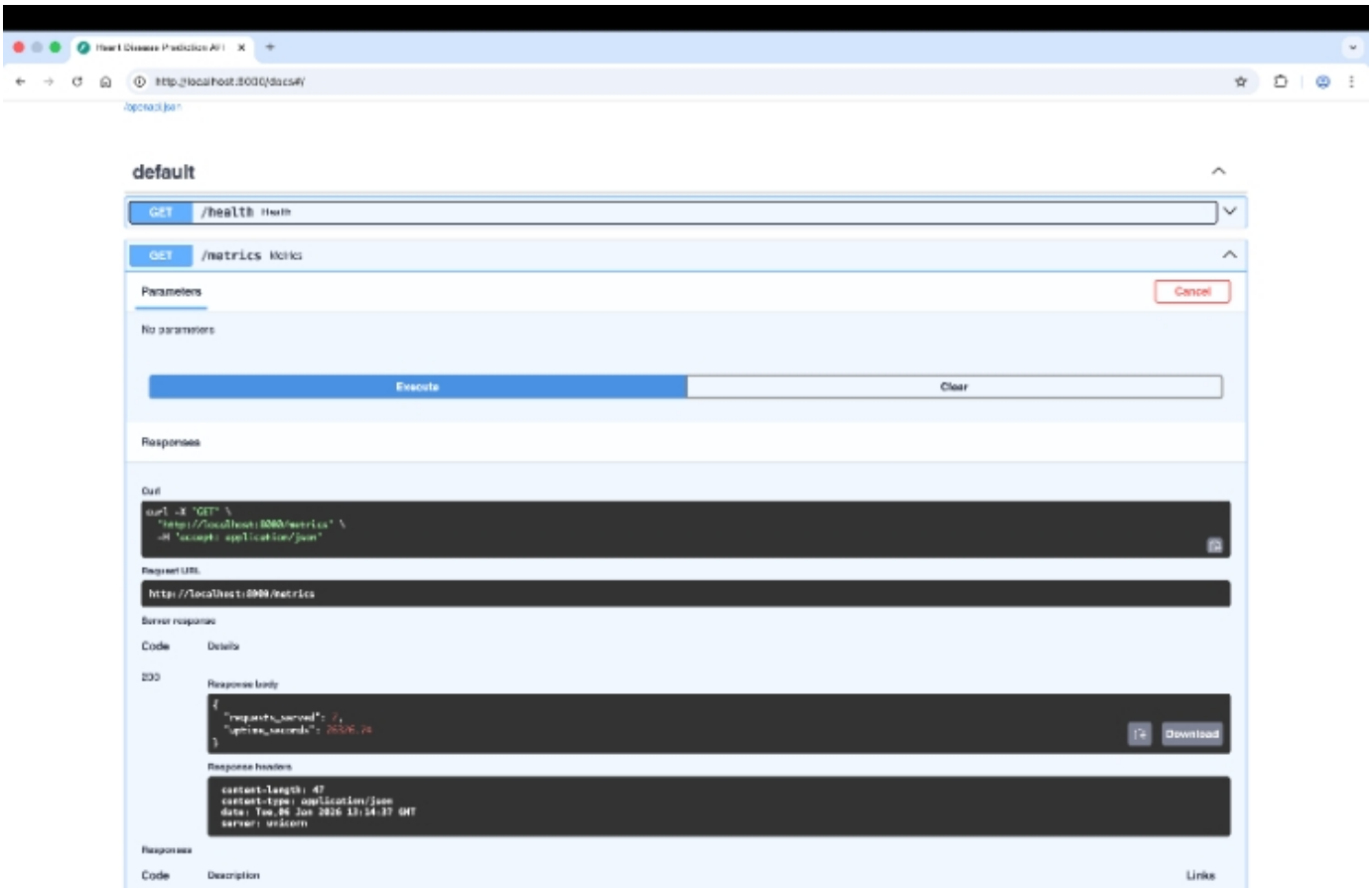
Correlation Heatmap of Features and Target



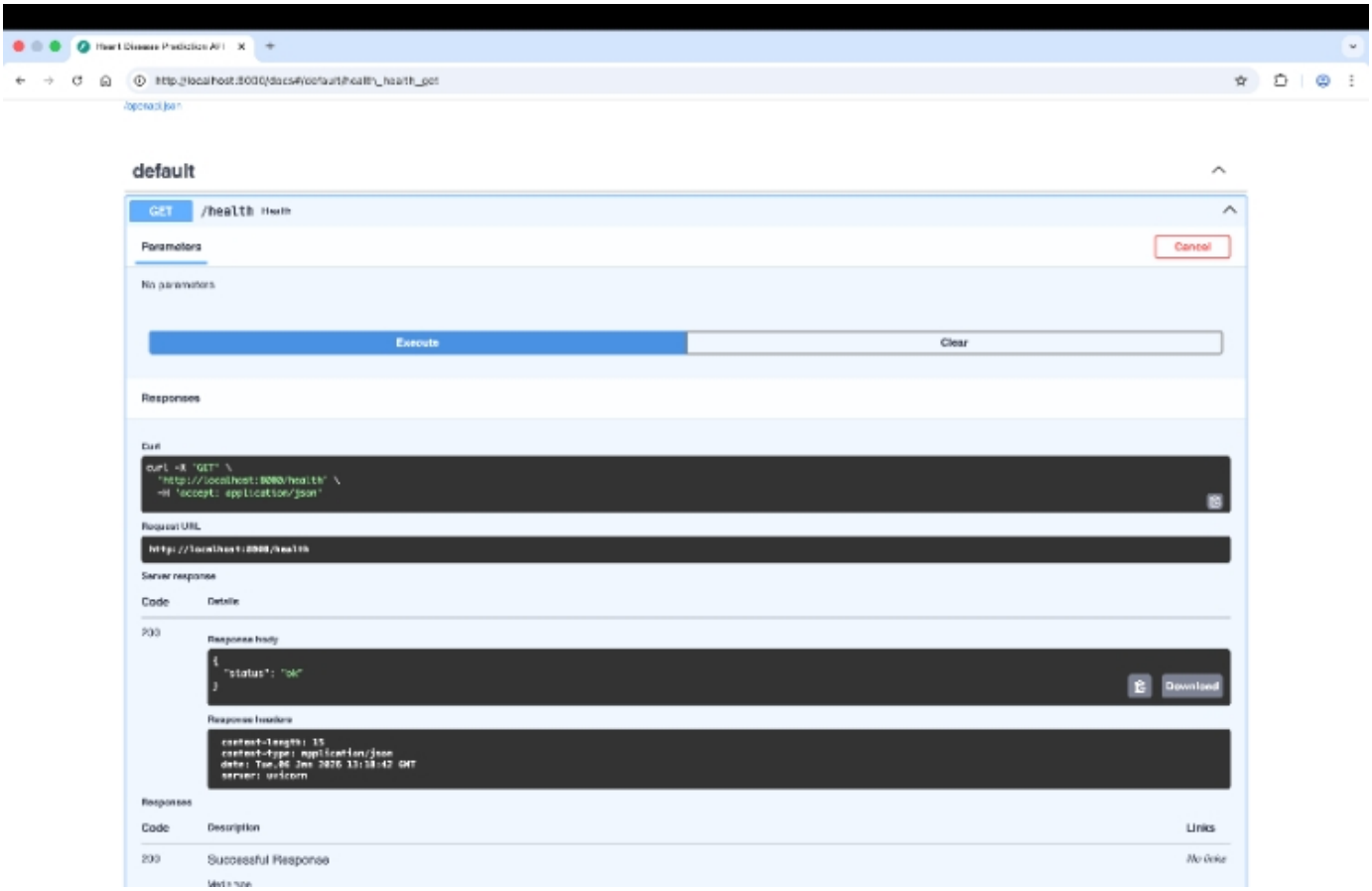
Class Distribution (Target Balance)



Swagger UI: /predict endpoint demonstration



Swagger UI: /metrics endpoint output



Swagger UI: /health endpoint output