



PREVENTIVE MAINTANENCE

DEEP LEARNING



APRIL 2024

Canva



Overview

- Importance of predictive maintenance in industry
- Objective: Develop a deep learning model to predict failures
- Benefit: Prevent costly downtime, optimize maintenance



Business Understanding

Objective

OBJECTIVE: DEVELOP A DEEP LEARNING MODEL TO PREDICT FAILURES

BENEFIT: PREVENT COSTLY DOWNTIME, OPTIMIZE MAINTENANCE

Goal

GOAL: ACCURATE PREDICTIONS TO ENABLE PROACTIVE MAINTENANCE

IMPACT: REDUCE BREAKDOWNS, EXTEND EQUIPMENT LIFE, OPTIMIZE SCHEDULES

Data Set

- Analyzed sensor data from industrial machines
- Identified key sensors with significant readings variability
- Detected patterns linked to machine health and potential faults



Data Insight

ATTRIBUTES

- Total Entries: 220.320
- Total Columns: 55
- Unnamed: 0Column:ID/Index
- Sensor 15 column: Removing

DISTRIBUTION

- Normal: 205,836
- Recovering: 14,477
- Broken: 7

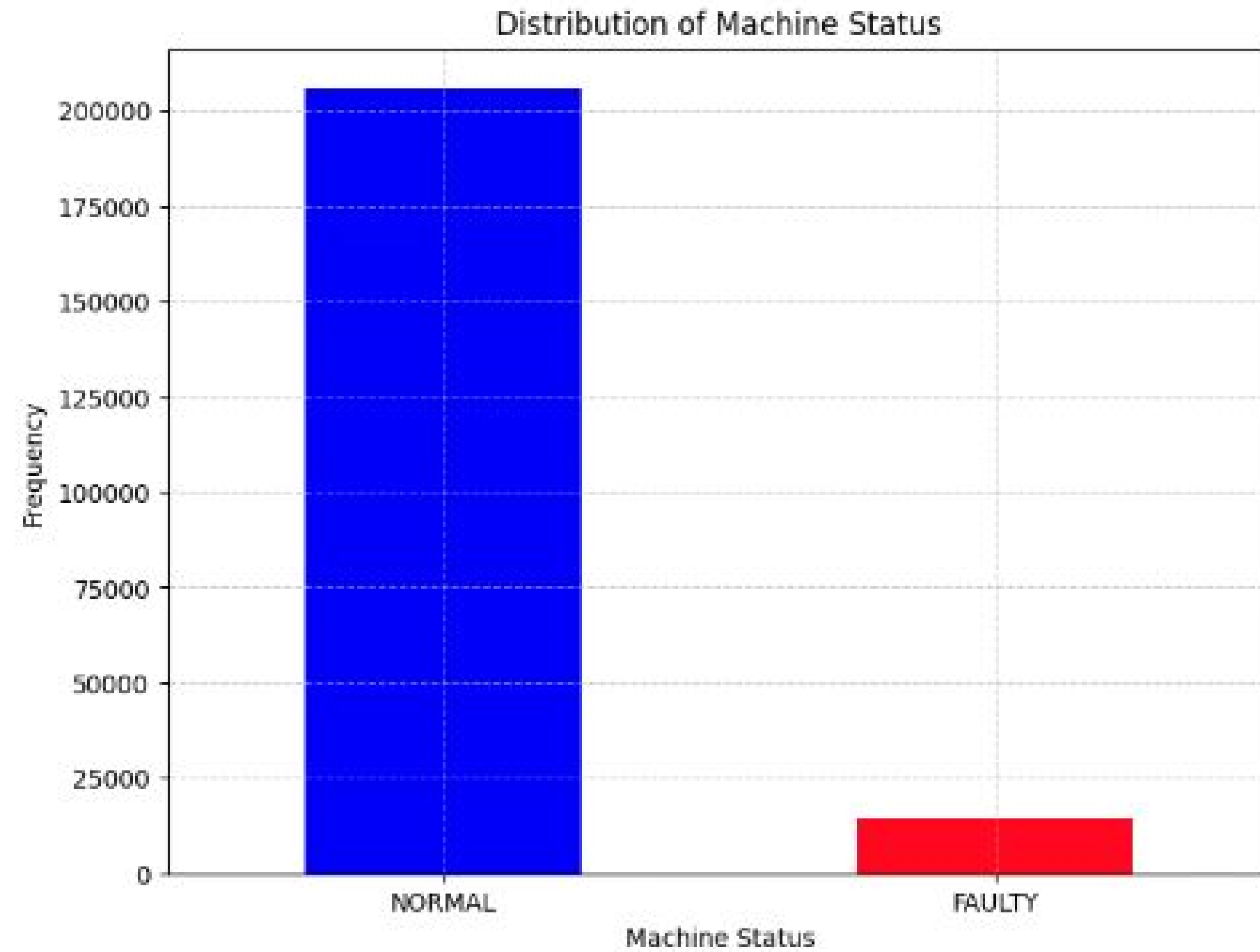
MISSING VALUES

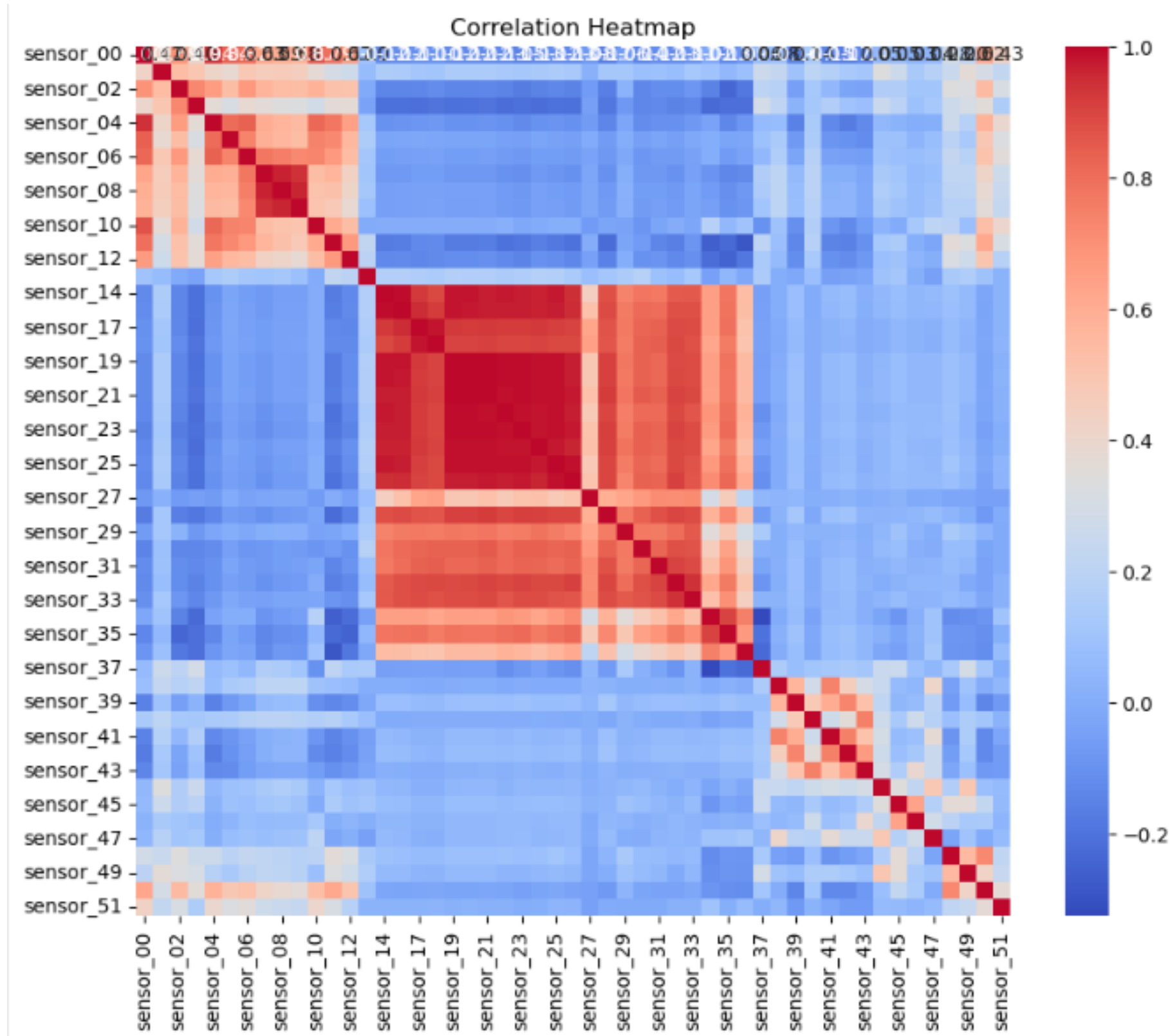
- 77.017 and 220,320 missing
- Checked for duplicates

Data Prep

- Cleaned and preprocessed data for quality and consistency
- Merged similar machine statuses to simplify the target variable
- Visualized data distribution and sensor correlations
- Utilized exploratory data analysis for a deeper understanding of data

Data







Model Process



01

Feedforward Neural Network(FNN)

- Developed a baseline neural network with dropout layers to prevent overfitting.

02

Tested ensemble machine learning models

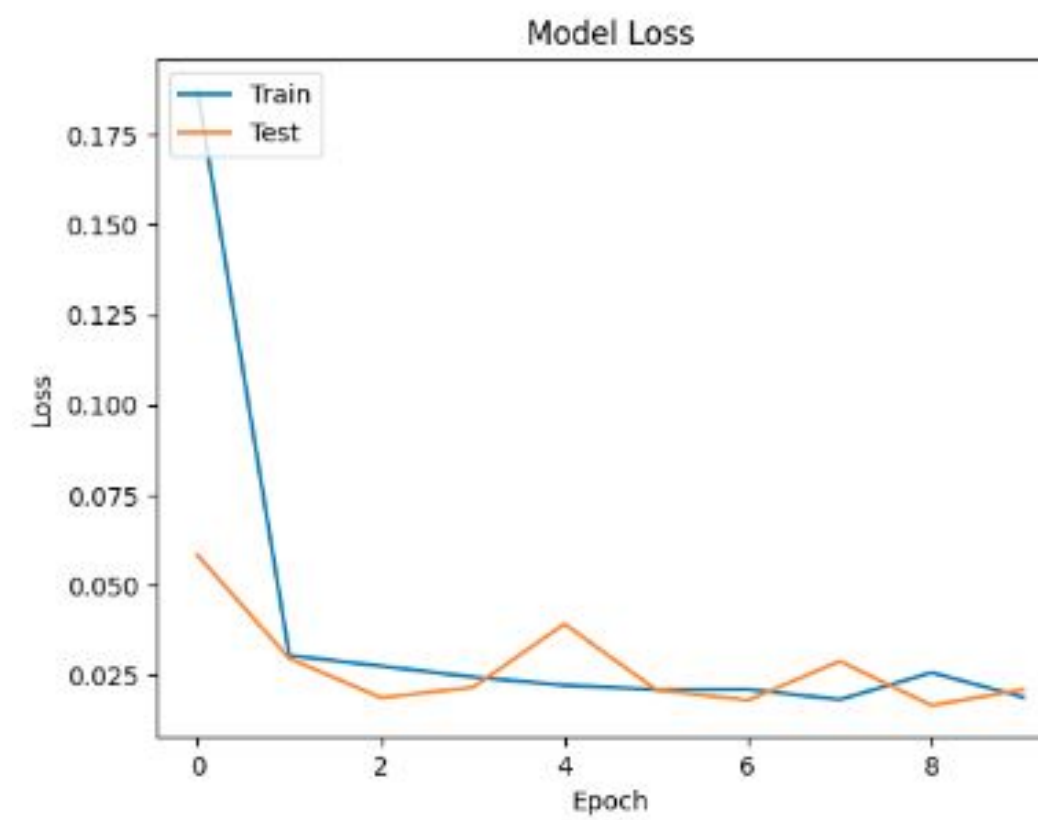
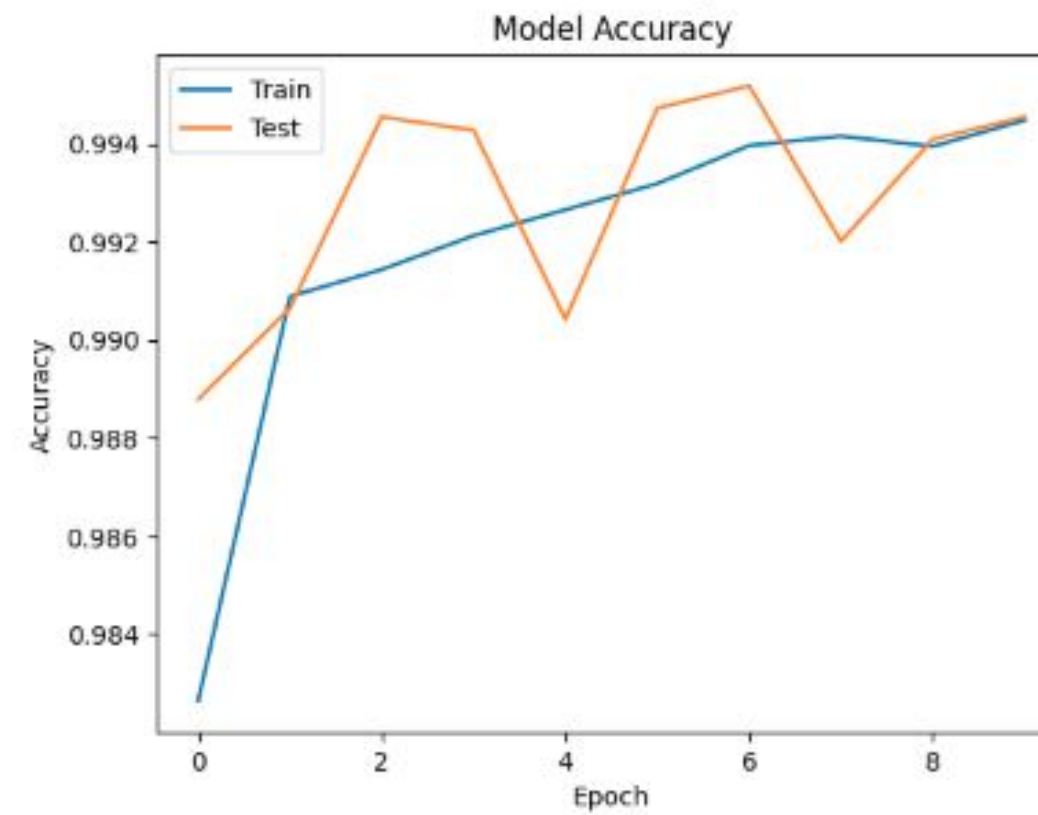
- Bagging, AdaBoost, Stacking, and Voting

03

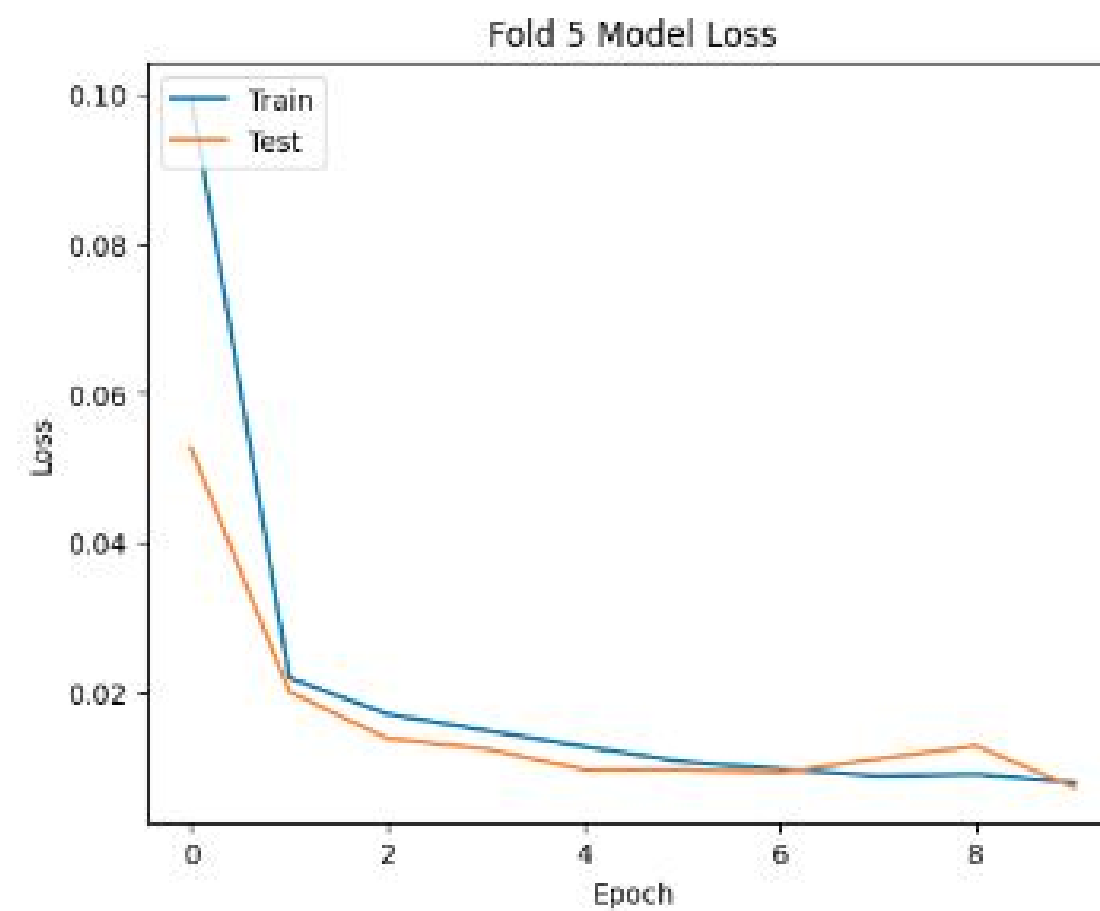
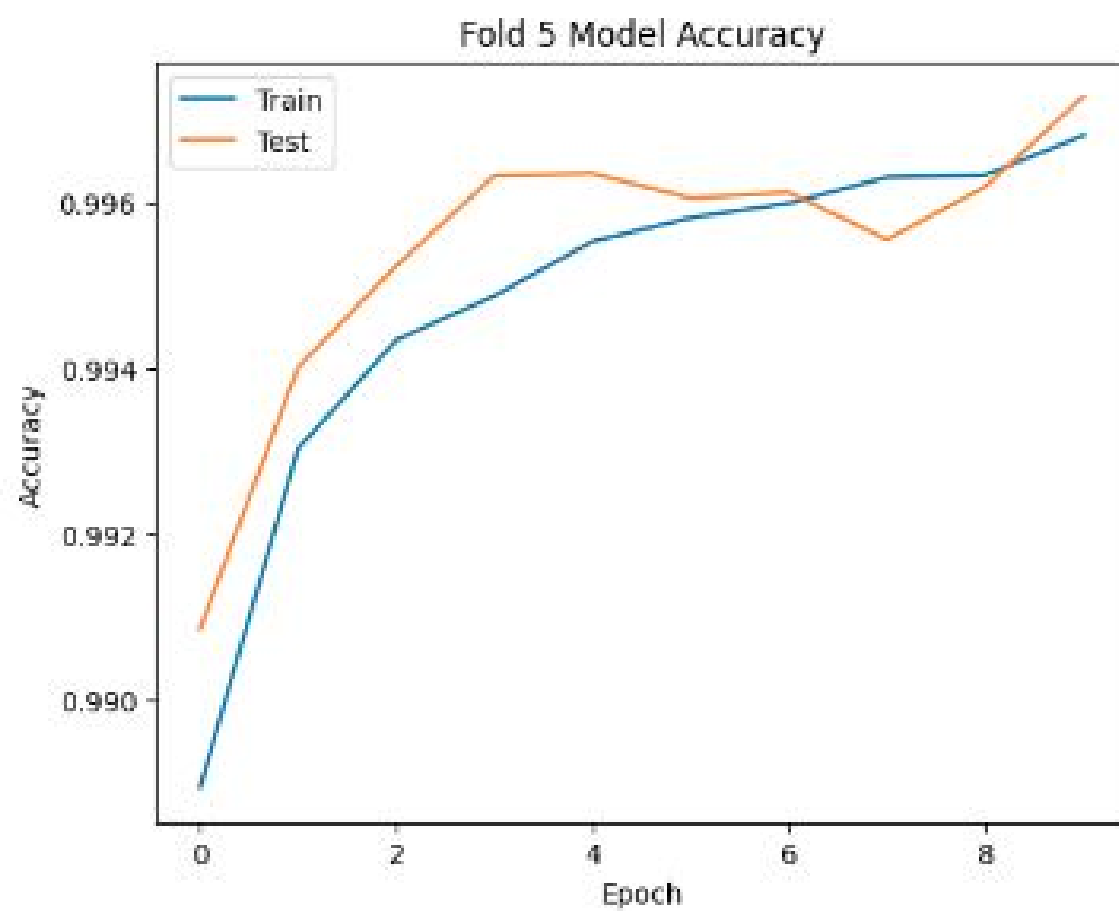
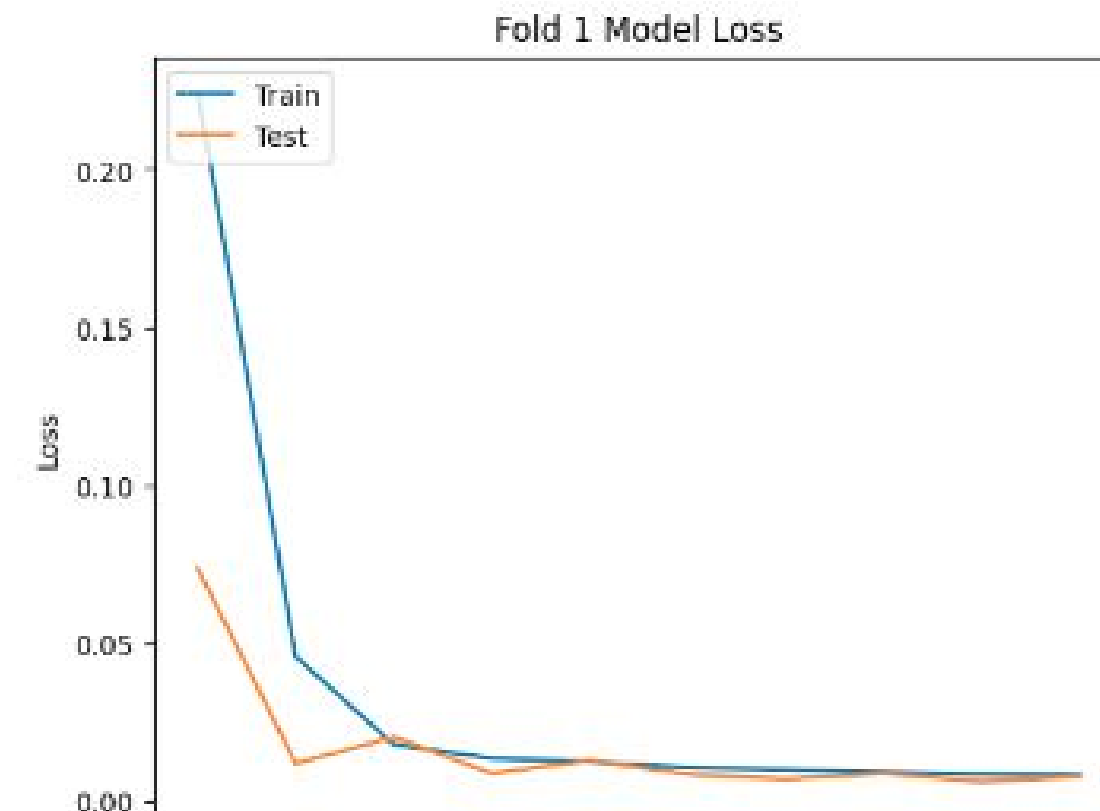
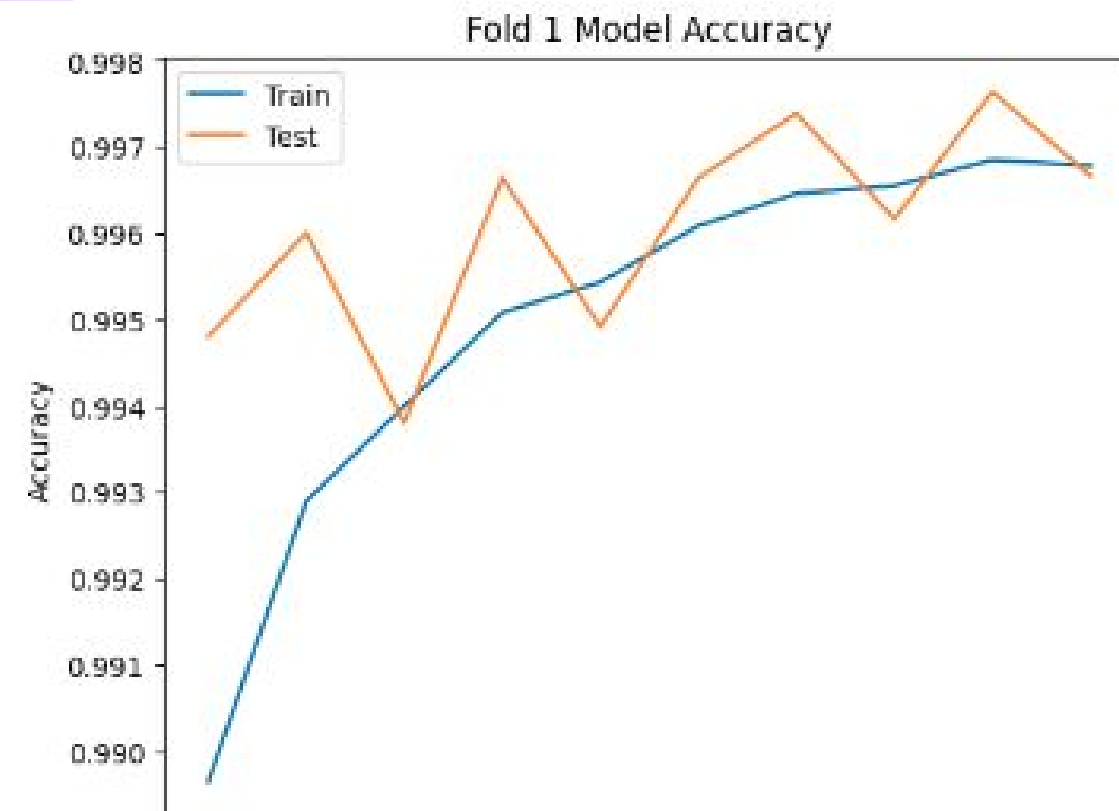
Tuning

- Implemented cross-validation for robust model evaluation
- Optimized models for high accuracy and generalization

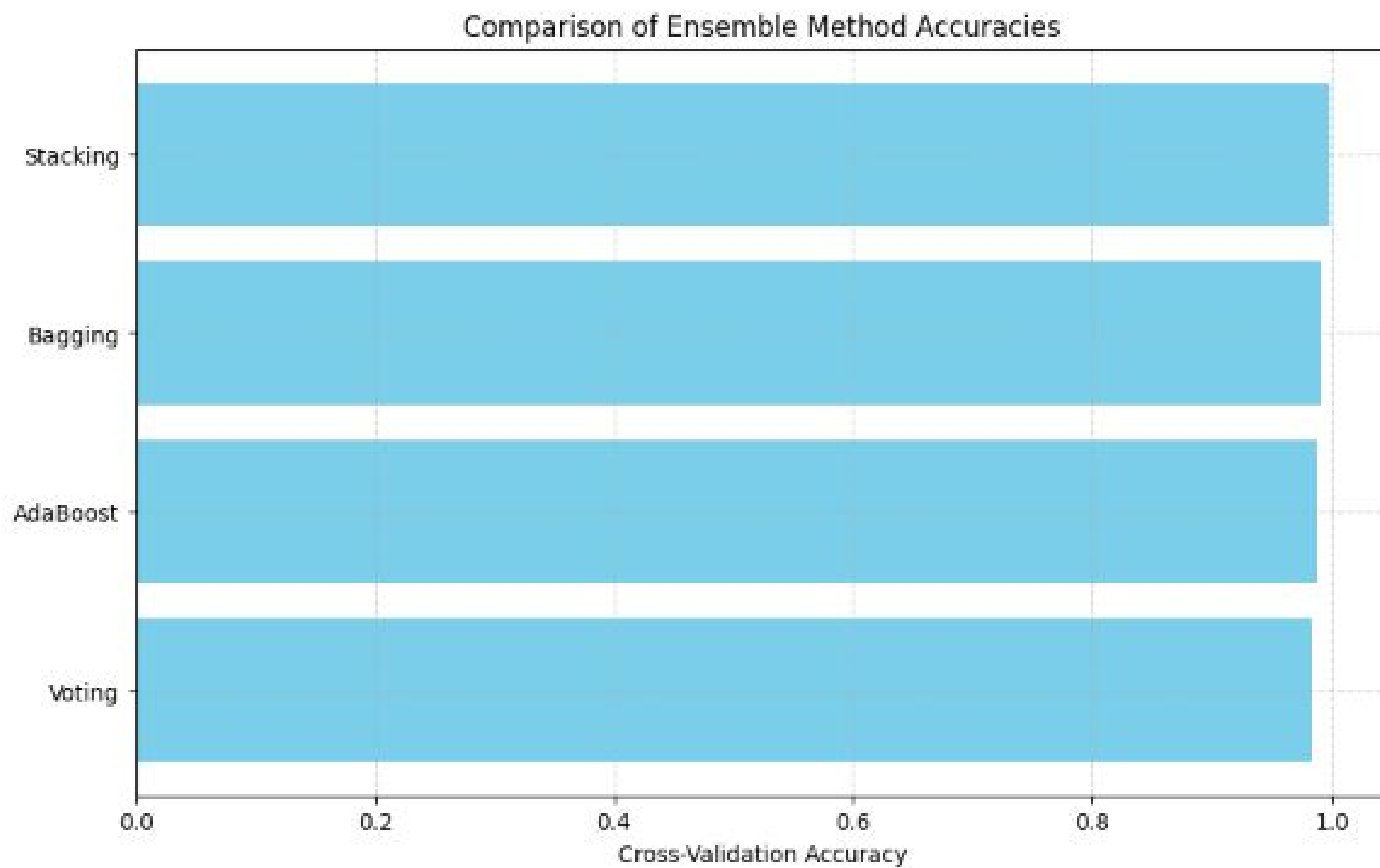
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Data



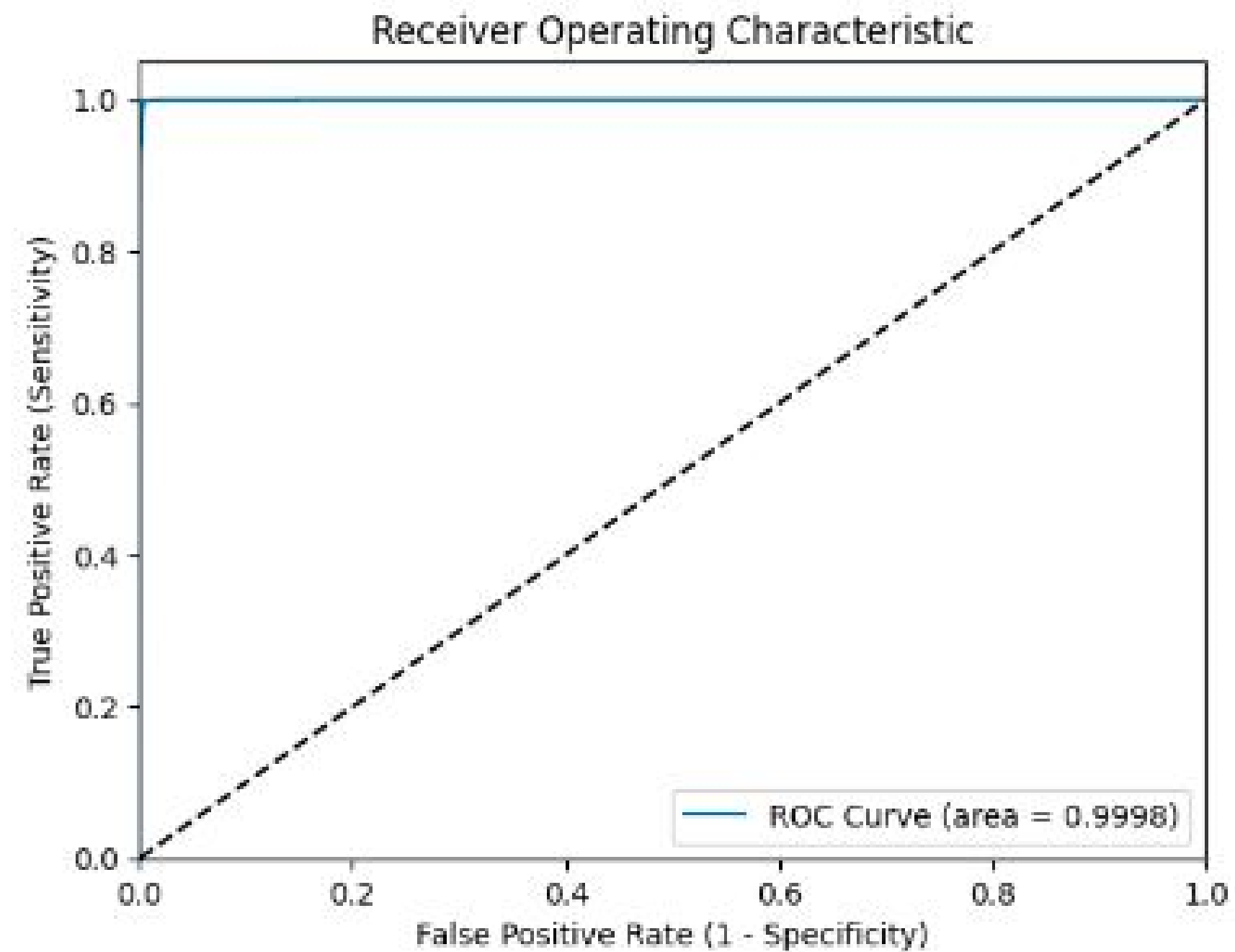
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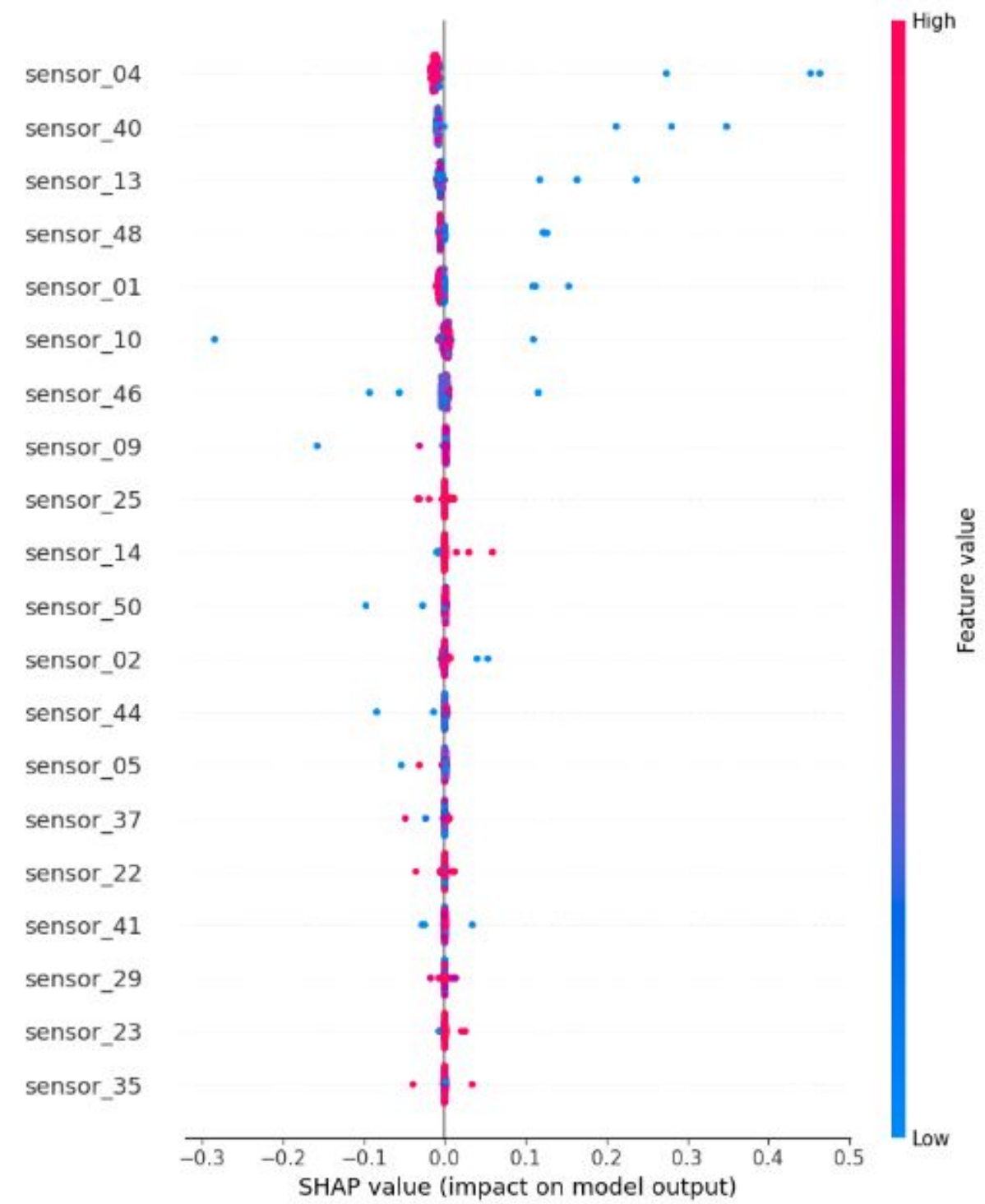
Data



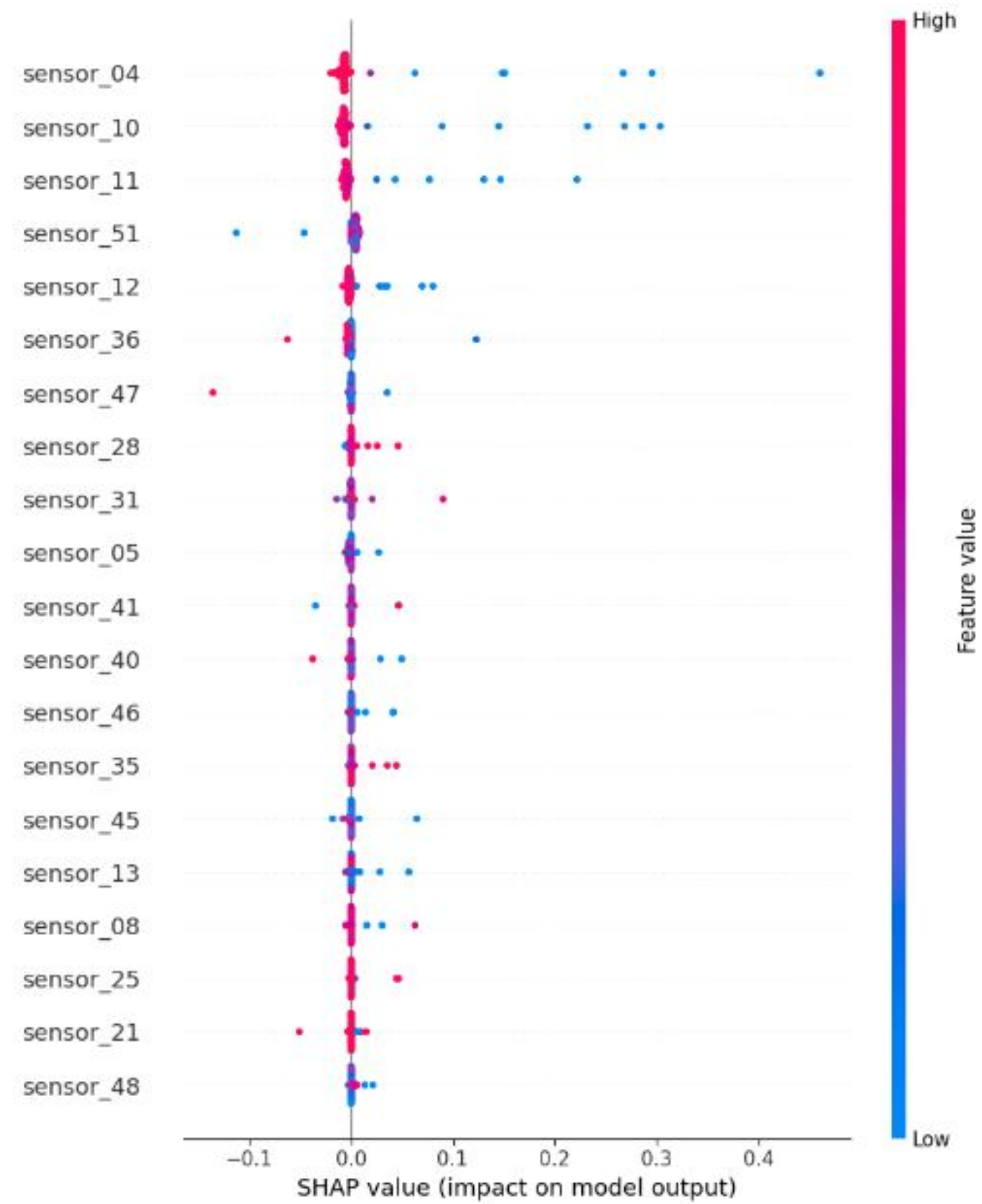
Precision: 0.9246
Recall: 0.9986
F1 Score: 0.9602
ROC AUC Score: 0.9998



Data



Data



Results

- Achieved high consistency and accuracy across cross-validation folds
- Near-perfect ROC AUC scores indicating excellent model performance
- SHAP analysis confirmed key sensors as strong predictors





Next Steps

01

Refine models

- Continuous monitoring of key sensors for real-time predictive maintenance

02

Deployment

- Implementation into production with a real-time analytics pipeline

03

More data insight

- Further investigation into high-impact sensors for targeted maintenance

04

Further experiment

- Regular retraining of models with new data to maintain performance

CONTACT

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Our Team



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**THANK
YOU**

