

Machine Learning Analysis Report

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Executive Summary

Context: Predict survival on the Titanic disaster based on passenger characteristics

Final Score: 0.8324

Best Model: Logistic Regression

Features Used: 21

Iterations: 0

Key Findings:

- Achieved good performance with 83.2% accuracy
- Most important feature: class_age (10.10% importance)

Data Profile & EDA

Dataset Shape: 891 rows x 21 columns

EDA Recommendations:

- Age has some missing values - median imputation applied
- Embarked has few missing values - mode imputation applied
- Cabin has many missing values - dropped

Feature Importance Analysis

Total Features: 21

Top 20 Features:

Rank	Feature	Importance
1	class_age	0.1010
2	fare_per_person	0.0976
3	sex	0.0946
4	age	0.0931
5	adult_male	0.0913
6	fare_log	0.0844
7	fare	0.0819
8	who	0.0725
9	class_sex	0.0714
10	deck	0.0392
11	family_size	0.0280

12	class	0.0250
13	pclass	0.0246
14	age_group	0.0221
15	sibsp	0.0174

Model Benchmarking

Best Model: KNN

Model	CV Score	Std	Train Time
Logistic Regression	0.8118	0.0271	5.99s
Decision Tree	0.8175	0.0227	0.07s
Random Forest	0.8090	0.0218	1.25s
Gradient Boosting	0.8273	0.0356	0.92s
KNN	0.8301	0.0139	0.06s
SVM	0.8216	0.0239	0.40s
AdaBoost	0.8174	0.0373	1.00s
XGBoost	0.8062	0.0355	0.97s
LightGBM	0.8203	0.0362	1.01s

Confusion Matrix & Classification Report

Classification Metrics:

Class 0: Precision=0.851, Recall=0.882, F1=0.866

Class 1: Precision=0.800, Recall=0.754, F1=0.776

Class macro avg: Precision=0.825, Recall=0.818, F1=0.821

Class weighted avg: Precision=0.831, Recall=0.832, F1=0.831

ROC Curve Analysis

AUC Score: 0.8597

Optimal Threshold: 0.4819

Precision-Recall Analysis

Average Precision: 0.8267

SHAP Feature Analysis

Baseline Comparison

Baseline Model: Stratified Random
Baseline Score: 0.5196
Final Score: 0.8324
Improvement: 0.3128 (60.2%)

Recommendations & Next Steps

- The best performing model is Logistic Regression with 83.2% accuracy.
- Feature engineering improved performance by creating 8 new features.
- Top predictive features: pclass, sex, age, sibsp, parch.
- Consider hyperparameter tuning for further improvement.
- Cross-session learning can help improve future experiments.
- Regular retraining recommended as data patterns may change.







