Machine Learning Analysis Report

Generated by Jotty SwarmML Comprehensive v3.0.0
Date: 2026-02-05 02:49:15

Executive Summary

Context: Classify wine cultivars based on chemical analysis (3 classes)
Final Score: 1.0000
Best Model: Random Forest
Features Used: 0
Iterations: 0

Key Findings:
• Achieved excellent performance with 100.0% accuracy
• Most important feature: color_intensity (19.48% importance)

Feature Importance Analysis

Total Features: 16
Top 20 Features:

Rank	Feature	Importance
1	color_intensity	0.1948
2	color_intensity_hue	0.1228
3	proline	0.1226
4	flavanoids	0.1162
5	phenols_flavanoids	0.0969
6	od280/od315_of_diluted_wines	0.0917
7	alcohol	0.0715
8	hue	0.0652
9	total_phenols	0.0323
10	magnesium	0.0228
11	malic_acid	0.0206
12	alcalinity_of_ash	0.0136
13	alcohol_malic_ratio	0.0092
14	ash	0.0088
15	nonflavanoid_phenols	0.0065

Model Benchmarking

Best Model: SVM

Model	CV Score	Std	Train Time
Logistic Regression	0.9860	0.0172	0.24s
Random Forest	0.9793	0.0414	0.69s
Gradient Boosting	0.8951	0.0867	2.01s
SVM	0.9862	0.0169	0.03s
KNN	0.9574	0.0268	0.04s
XGBoost	0.9512	0.0466	2.12s
LightGBM	0.9722	0.0259	2.21s

Recommendations & Next Steps

• Best model Random Forest achieves 100.0% accuracy on 3-class problem
• Macro F1: 1.0000 shows balanced performance across classes
• Color intensity and flavanoids are most discriminative features
• Multiclass problem solved with high confidence

Top 20 Feature Importance