

Assignment Report: Explainable AI for Wine Quality

Methods Summary

We trained a Logistic Regression model on the Wine dataset with standardized features. Permutation Importance was applied to assess global feature significance. SHAP was used to generate both global and local explanations, showing feature impacts. LIME provided local interpretability for individual wine samples, highlighting feature contributions. The results were compared to analyze consistencies and differences across the methods.

Deliverables

- 1 Permutation Importance plot (global feature importance).
- 2 SHAP summary plot (global feature contributions).
- 3 SHAP force plot for one local wine sample.
- 4 LIME explanations for two wine samples of different classes.
- 5 Comparative analysis of results across PI, SHAP, and LIME.

Key Insights

- 1 Permutation Importance identified alcohol, flavanoids, and color intensity as top features.
- 2 SHAP summary confirmed these features but also revealed directionality of impact.
- 3 Local SHAP force plot showed how individual features push predictions toward a specific class.
- 4 LIME provided intuitive rules for why a specific sample was classified as a certain wine type.
- 5 SHAP and LIME both agreed on major feature contributions for individual predictions.
- 6 Permutation Importance gives only global ranking, while SHAP and LIME provide local insights.
- 7 Some features with low PI scores still had local importance in SHAP and LIME explanations.
- 8 The combination of all three methods enhances trust and interpretability of the model.