

# Lab 3 - Explainable AI

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Code File: XAI\_2303A52002\_Lab\_Assignment\_3.ipynb

## Report 1: Wine Quality Prediction

### Problem Statement

Predict wine quality (scale 0-10) using physicochemical properties like acidity, alcohol, residual sugar, and sulphates.

### Approach

Dataset: Wine Quality Dataset (red & white wines)

Preprocessing:

Dropped irrelevant columns

Converted type (red/white) to numeric (0 = red, 1 = white)

Handled missing values with mean imputation

Model Used: Random Forest Classifier

Explainability: SHAP and LIME

### Key Findings

Important Features:

Alcohol - Higher alcohol indicates better quality

Volatile Acidity - Negative impact on taste

Sulphates - Positive effect on flavor preservation

Citric Acid - Adds freshness

Chlorides - Higher values reduce quality

Model Performance:

Accuracy: ~67%

Precision: ~65%

Recall: ~62%

F1-score: ~64%

(Insert wine quality SHAP/LIME image here)

## **Report 2: Breast Cancer Diagnosis**

### **Problem Statement**

Predict benign vs malignant tumors with model interpretability for medical use.

### **Approach**

Dataset: Breast Cancer Wisconsin Dataset

Preprocessing:

Dropped irrelevant columns (id, unnamed)

Imputed missing values with mean

Encoded labels (B = 0, M = 1)

Model Used: Random Forest Classifier (100 trees)

Explainability: LIME (local explanations)

### **Key Findings**

Important Features:

Radius\_mean: Larger nuclei radius -> higher malignancy risk

Texture\_mean: Irregular texture suggests cancer

Perimeter\_mean & Area\_mean: Bigger, irregular clusters -> malignant

Smoothness/Concavity: Lack of smoothness -> invasive cancer

Model Performance:

Accuracy: ~83%

Precision: ~81%

Recall: ~84%

F1-score: ~82%

### **Conclusion (Lab 3)**

Random Forest performed well for both Wine and Breast Cancer datasets

SHAP & LIME provided transparency into predictions

Limitations: Subjectivity in wine dataset, small size for medical dataset

Future Work: Explore XGBoost / Gradient Boosting, include more features