**Glass Identification Assignment**

**Background Story:** You are working as a forensic analyst for a criminal investigation department. When glass is recovered at a crime scene, it's crucial to determine its type to link suspects or events to specific locations. The lab has provided you with a dataset containing the chemical composition of different types of glass. Your goal is to classify the type of glass found at a crime scene.

**Dataset:** Glass Identification Dataset

* 214 samples
* 9 features (e.g., refractive index, elemental content)
* Target: 6 glass types (classes 1, 2, 3, 5, 6, 7) [Note: Class 4 is absent]

**Instructions:**

* Perform Exploratory Data Analysis (EDA) to understand class distribution and feature correlations.
* Train and evaluate the following classification models:
  + K-Nearest Neighbors (KNN)
  + Decision Tree
  + Random Forest
  + Gradient Boosting
  + XGBoost
* Use Cross-Validation to ensure robust model evaluation.
* Apply Recursive Feature Elimination (RFE) to identify important features.
* Apply PCA for dimensionality reduction and visualization.
* Tune hyperparameters for Gradient Boosting and XGBoost models.
* Present results using confusion matrices and classification reports.

**Objectives:**

* Identify which features most strongly differentiate glass types.
* Recommend the most accurate and cost-effective model.
* Provide a 2D visualization (PCA-based) for class separation.

**Deliverables:**

* Jupyter Notebook with complete code and documentation