**Project Insights**

1. **Alcohol Content Strongly Influences Quality**  
   During analysis, it was observed that wines with higher alcohol content generally received better quality scores. Among all features, alcohol showed the strongest positive correlation with wine quality.
2. **Volatile Acidity Impacts Taste Negatively**  
   Wines with higher levels of volatile acidity tended to have lower quality ratings. This feature negatively affects the taste and overall acceptability of the wine.
3. **Imbalanced Quality Scores Affected Model Performance**  
   The dataset had most of its samples rated with quality scores of 5 or 6. Very few samples were rated as 3, 4, or 8, which made it difficult for the models to predict these rare classes accurately. This class imbalance resulted in low precision and recall for underrepresented classes.
4. **Random Forest Gave the Best Results**  
   Among the three classification models used (Random Forest, SGD, and SVC), the Random Forest Classifier performed the best in terms of accuracy and overall metrics. It also helped in identifying the most important features influencing wine quality.
5. **Simplifying the Target Variable Can Improve Accuracy**  
   Instead of predicting exact wine quality scores, converting them into categories like *Low*, *Medium*, and *High* can simplify the problem and improve model performance. This approach also aligns better with practical use cases.

**Project Summary**

This project involved predicting wine quality using a dataset that included various chemical features of red wine. After exploring and visualizing the data, three machine learning classification models—Random Forest, SGD, and SVC—were trained and tested. Model performance was evaluated using accuracy, confusion matrix, and classification reports.

During the process, important insights were drawn regarding feature importance and class imbalance. The Random Forest model performed the best and identified key features such as alcohol, sulphates, and volatile acidity as strong predictors of wine quality.

**Final Takeaways**

This project offered hands-on experience with the full machine learning pipeline, including:

* Data preprocessing and visualization
* Feature selection and analysis
* Model training, evaluation, and comparison
* Handling real-world issues such as class imbalance and metric warnings

Overall, it served as a solid introduction to practical machine learning applications in the field of food and beverage quality assessment.