ML Assignment 2020 - 2021

WINE QUALITY PREDICTION

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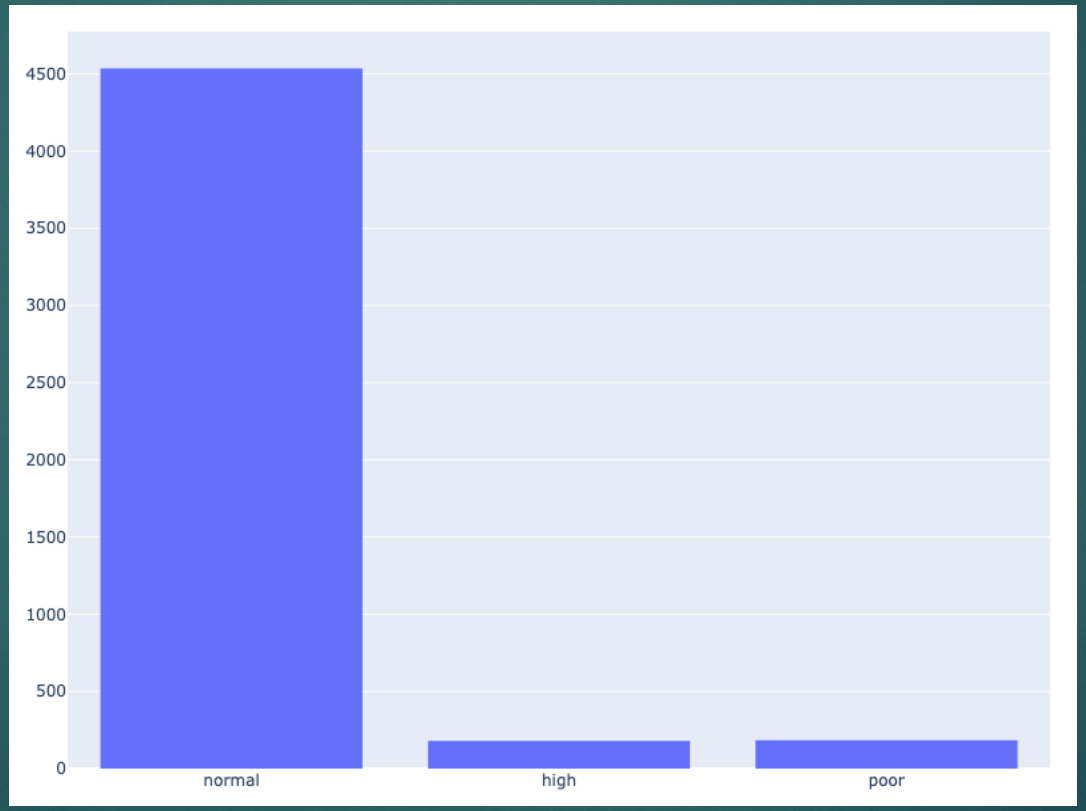
Problem Definition

- The Dataset (from UCI):
  - 4898 examples of white wines
  - 11 physicochemical variables e.g. (acids, pH, residual sugar)
  - Quality range -> [3,9]
  - Modeled as a classification task
    - [3,4] -> poor quality
    - [5,7] -> normal quality
    - [8,9] -> high quality

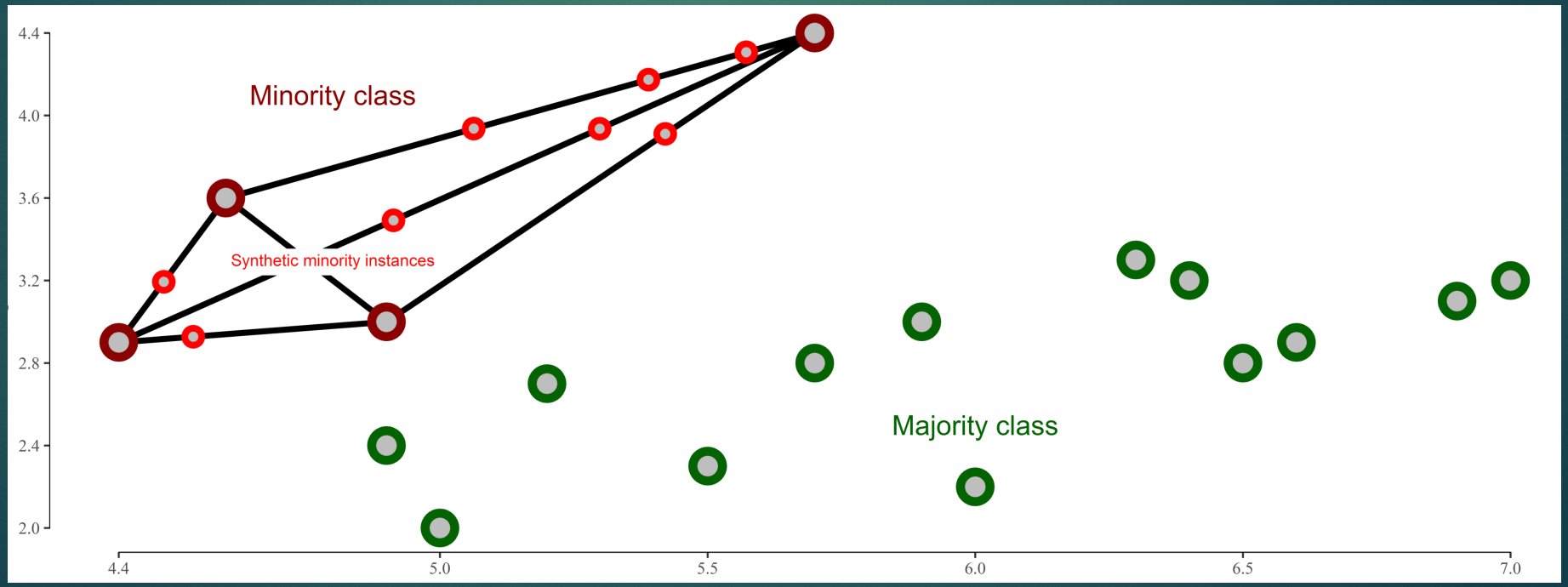
Class Imbalance

93% of the examples belong to the majority class



SMOTE

- The Synthetic Minority Oversampling Technique (SMOTE) is an over-sampling method to address the problem of imbalanced distribution of data.
- SMOTE works by selecting examples that are close in the feature space, drawing a line between the examples in the feature space and drawing a new sample at a point along that line.



Classifiers

- Logistic Regression
- Gaussian Naïve Bayes
- K Neighbors
- SVM
- Decision Tree
- Random Forest

- Grid Search CV for hyperparameter tuning.

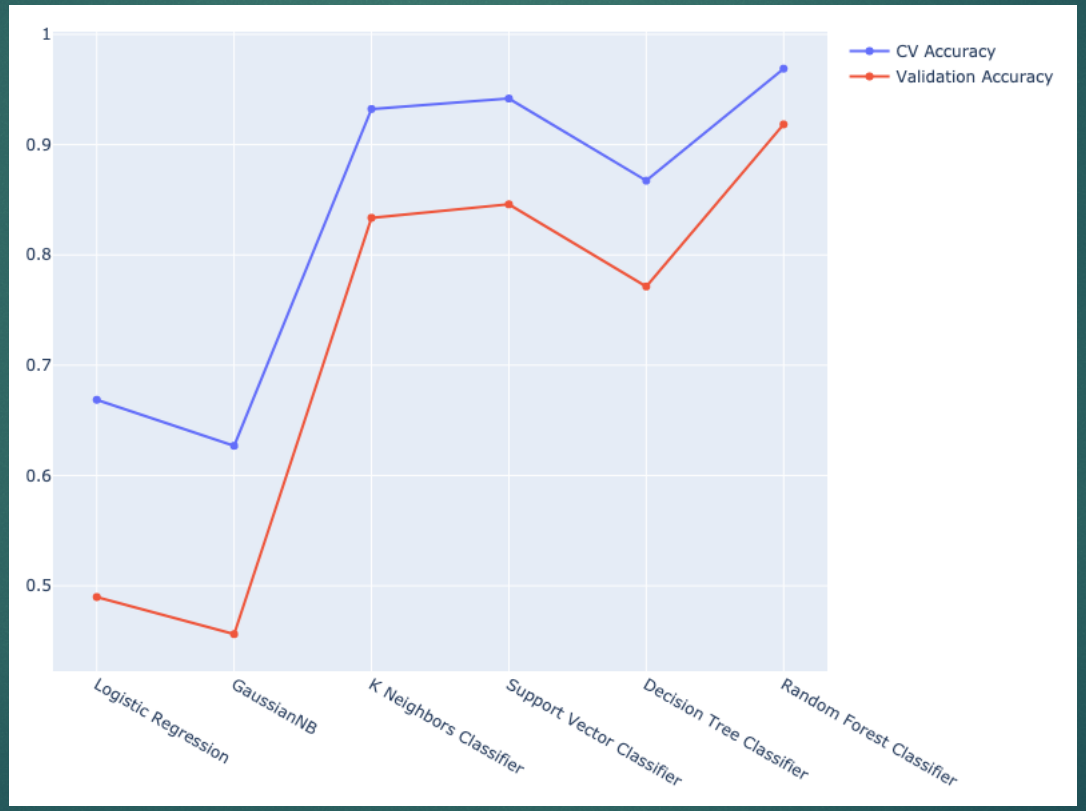
Model Evaluation

- CV, Validation Accuracy -> improve training.
- Test Accuracy and ROC Curves -> generalization capabilities.

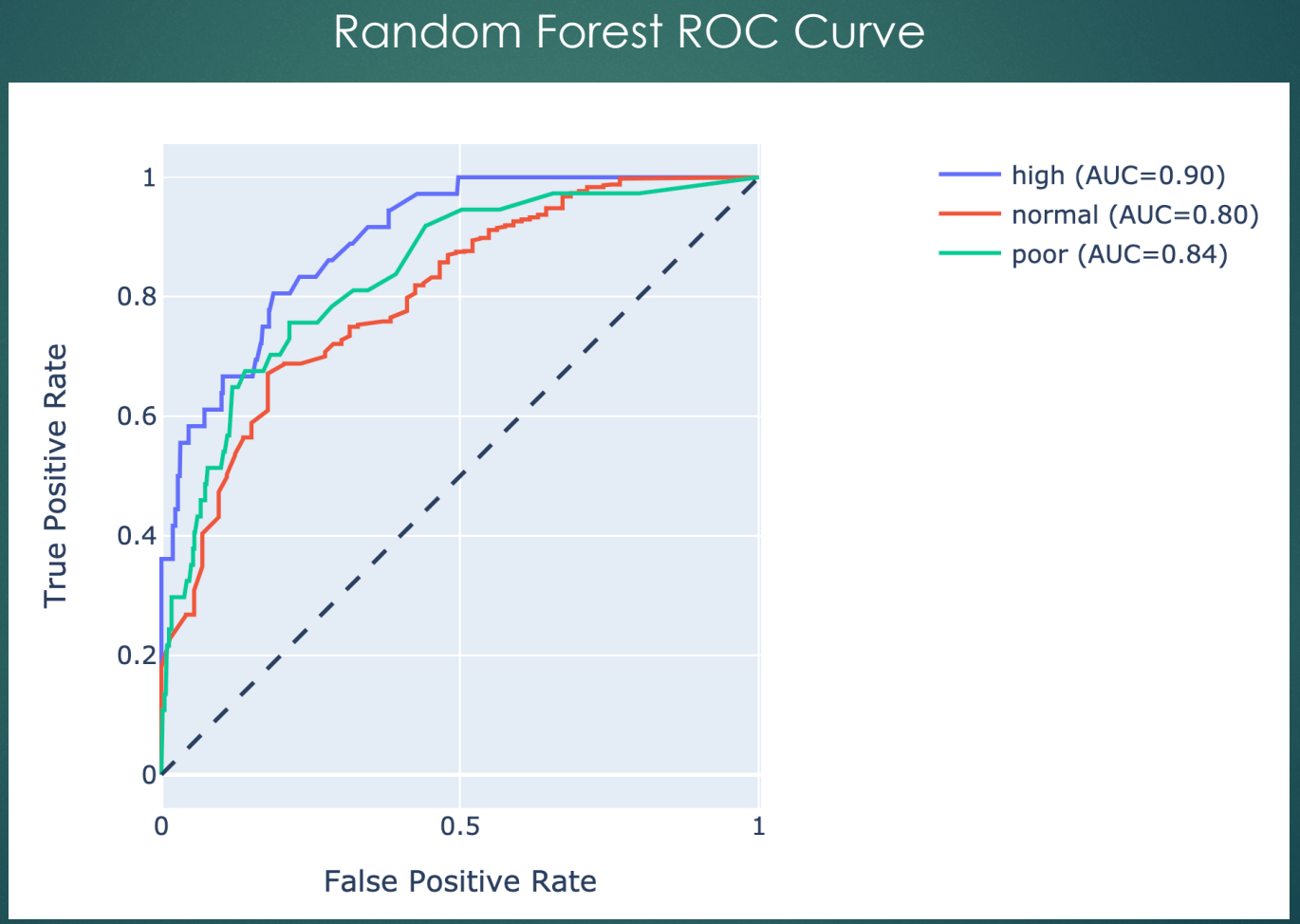
Model Comparison (1/2)

	Classifier	Tuned Hyperparameters	Mean CV Accuracy	Validation Accuracy	Test Accuracy
0	Logistic Regression	{'C': 0.1, 'penalty': 'l1'}	0.668653	0.489796	0.478571
1	GaussianNB	{}	0.626943	0.456122	0.457143
2	K Neighbors Classifier	{'algorithm': 'ball_tree', 'n_neighbors': 3, '...	0.932383	0.833673	0.845918
3	Support Vector Classifier	{'C': 10, 'kernel': 'rbf'}	0.941839	0.845918	0.857143
4	Decision Tree Classifier	{'criterion': 'entropy', 'max_depth': 10}	0.867358	0.771429	0.734694
5	Random Forest Classifier	{'max_depth': 21, 'n_estimators': 90}	0.968912	0.918367	0.907143

Model Comparison (2/2)



Best Model


Random Forest ROC Curve
True Positive Rate
False Positive Rate
0
0.2
0.4
0.6
0.8
1
0
0.5
1
high (AUC=0.90)
normal (AUC=0.80)
poor (AUC=0.84)

Questions?