



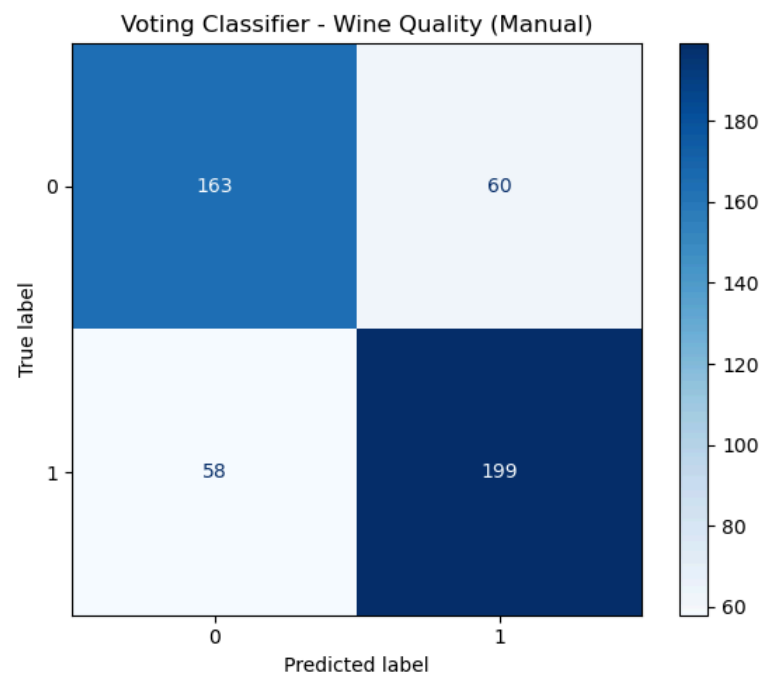
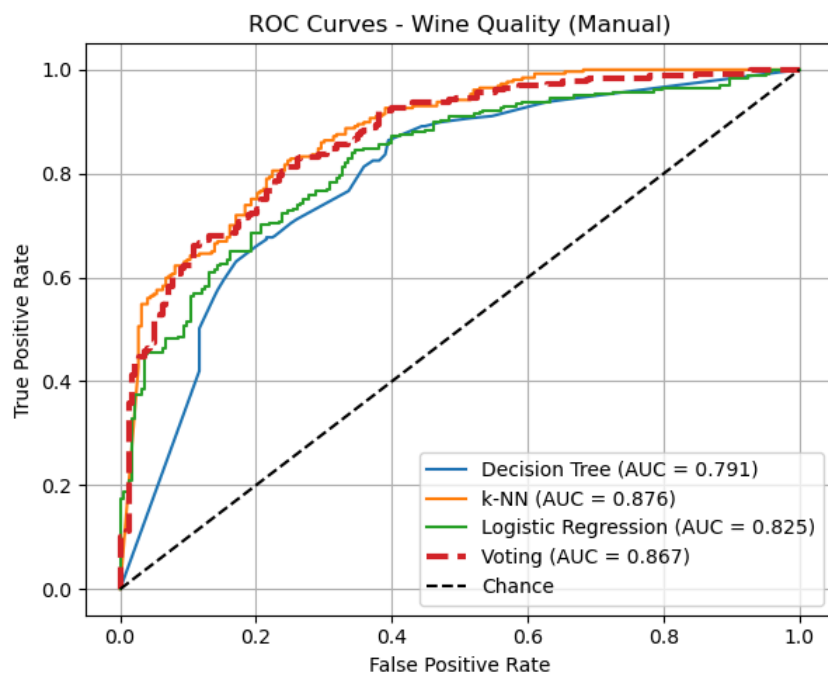
Output and Report for Lab-4

Name: Mohammed Aahil Parson

SRN: PES2UG23CS342

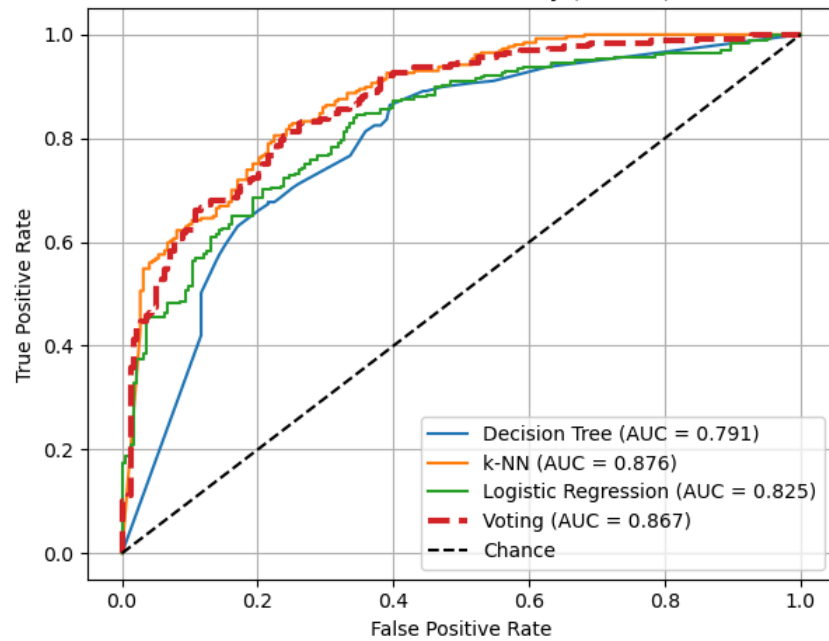
Output Screenshots:

Wine Quality (Manual):

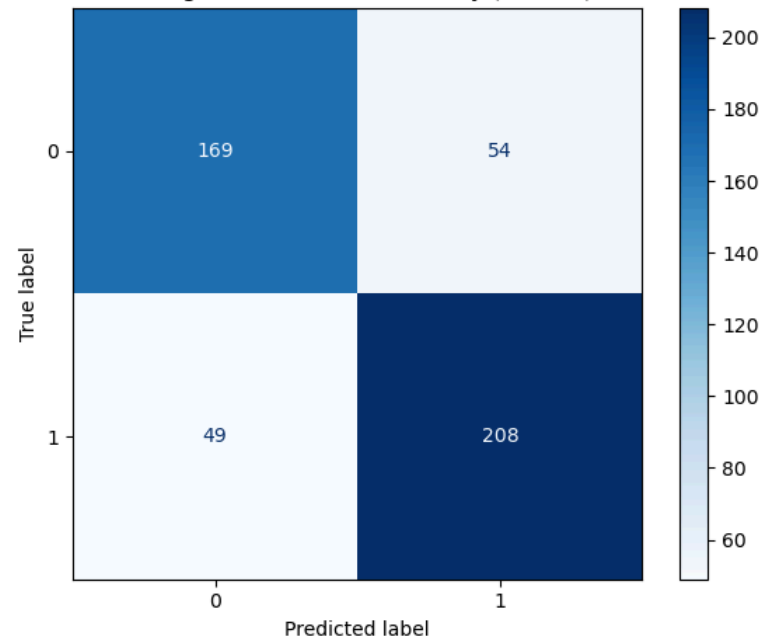


Wine Quality (Built-in):

ROC Curves - Wine Quality (Built-in)

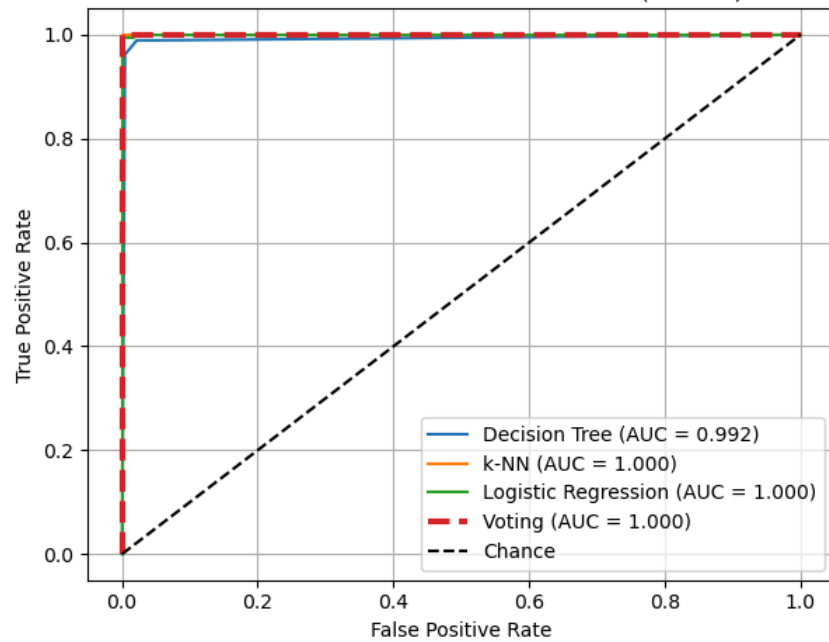


Voting Classifier - Wine Quality (Built-in)

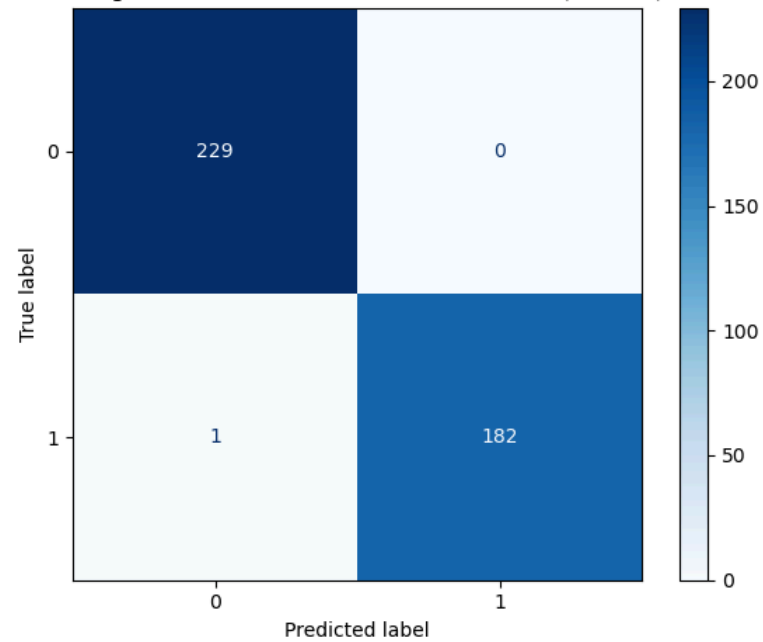


Banknote Authentication (Manual):

ROC Curves - Banknote Authentication (Manual)

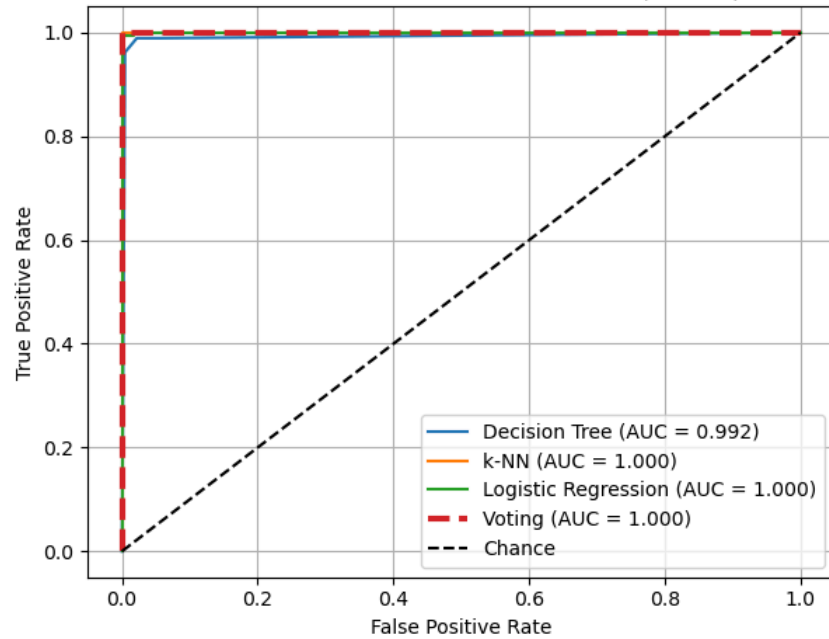


Voting Classifier - Banknote Authentication (Manual)

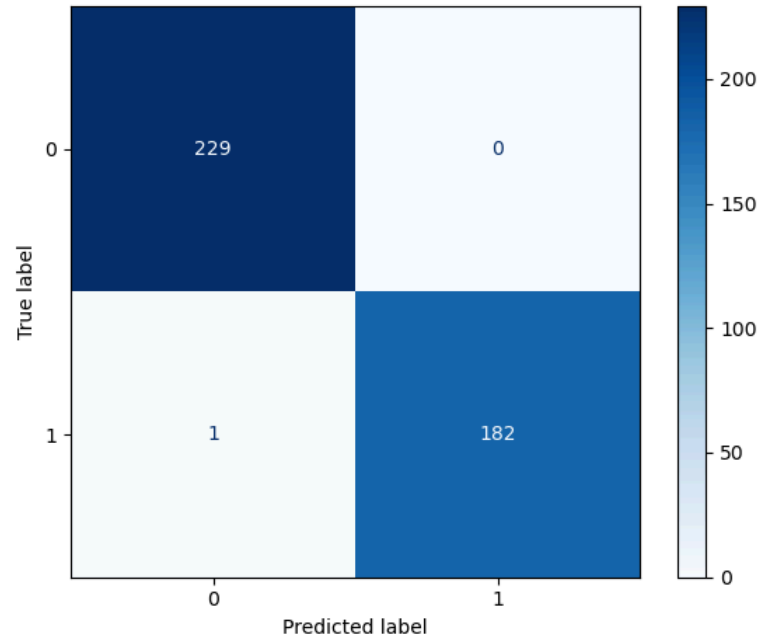


Banknote Authentication (Built-in):

ROC Curves - Banknote Authentication (Built-in)

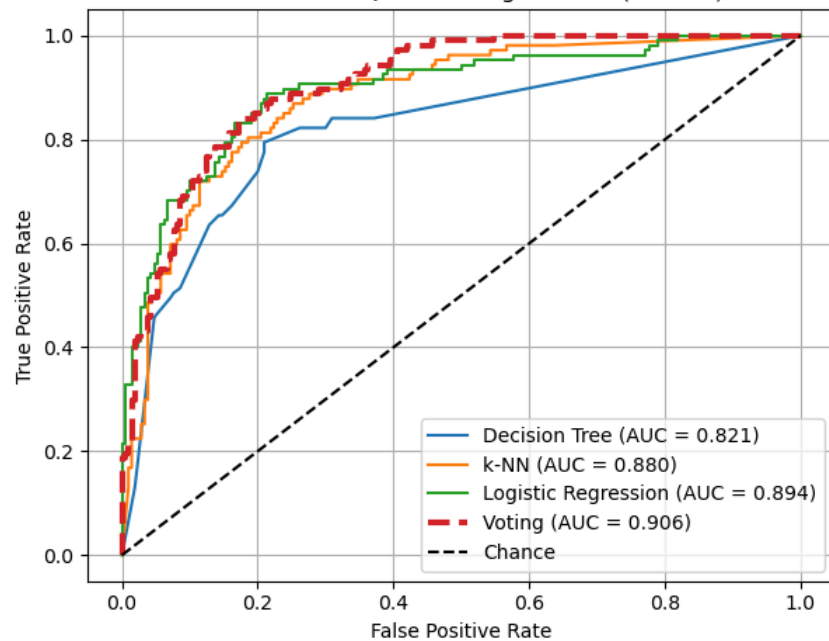


Voting Classifier - Banknote Authentication (Built-in)

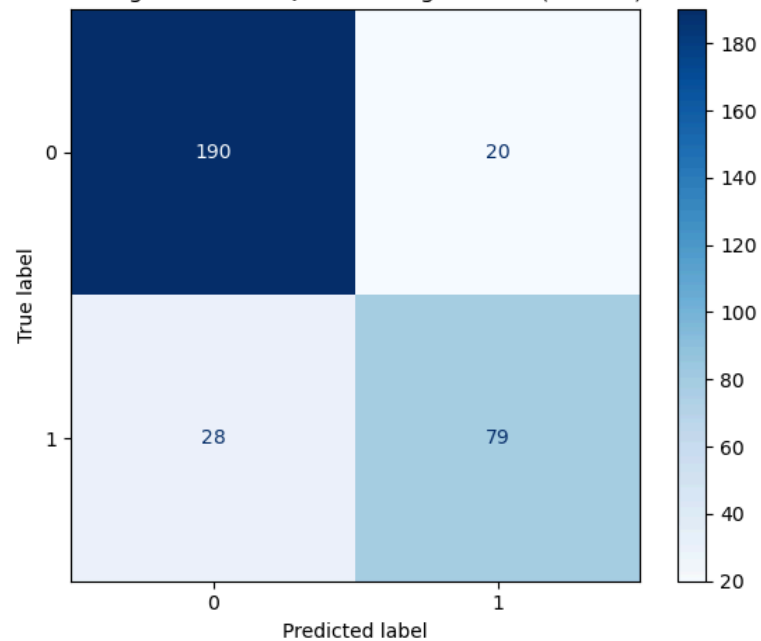


QSAR Biodegradation (Manual):

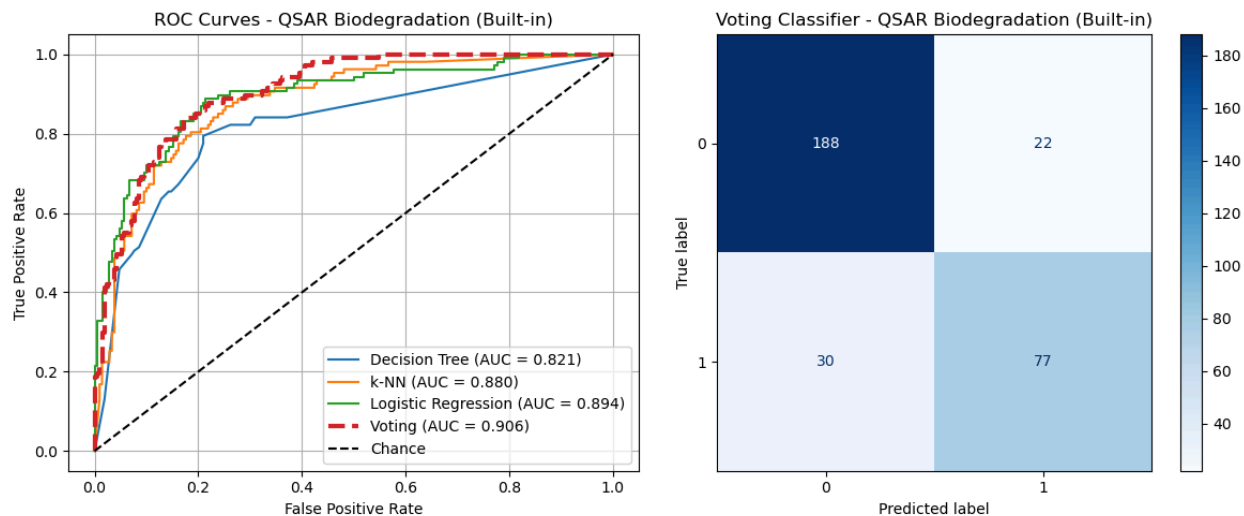
ROC Curves - QSAR Biodegradation (Manual)



Voting Classifier - QSAR Biodegradation (Manual)



QSAR Biodegradation (Built-in):



Detailed Report:

Individual Results:

Dataset	Voting AUC	Best Individual	Result
Wine Quality	0.8666	0.8765 (k-NN)	Very competitive
Banknote	1	1.0000 (k-NN)	Perfect classification!
QSAR	0.9055	0.8941 (LogReg)	Beat the best individual model

What I Discovered

- Building our own hyperparameter tuning system was a real eye-opener.
- Our manual implementation matched scikit-learn's optimal parameters across all datasets and models.
- This was super validating—it proved our code worked exactly as intended.
- The QSAR results were especially exciting—our ensemble outperformed any single classifier, just as ensemble learning theory predicts.

What Manual Implementation Taught Me

- Got to see how cross-validation truly works under the hood.
- Learned that different algorithms need different tuning strategies.
- Saw the importance of feature selection (4 features in Banknote vs. 20+ in QSAR).

Why Scikit-Learn is Better

- Speed → much faster both to build and to run.
- Reliability → fewer bugs than our manual code.
- Features → parallelization and advanced options I hadn't even imagined.

The Real Takeaway

- Matching results with scikit-learn proved that understanding fundamentals really matters.
- You can't just blindly use libraries—you need to know what's happening inside.
- Once you understand, libraries become tools that save time and reduce mistakes.
- Voting classifiers showed me that combining methods (decision trees, k-NN, logistic regression) is often better—like getting multiple expert opinions.

Final Insight

This lab perfectly showed me the balance between learning the basics and using professional tools—both are essential for being effective in machine learning.