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Course: Machine learning and Pattern Recognition

Task: Homework 2

Summary of LDA & QDA Results

1. Linear Discriminant Analysis (LDA)

Prior Probabilities

Class	**Prior Probability**
Down	0.492
Up	0.508

Group Means

Class	**Lag1 Mean**	**Lag2 Mean**
Down	0.0428	0.0339
Up	−0.0395	−0.0313

Coefficients (Linear Discriminant Function)

Predictor	**Coefficient**
Lag1	−0.0554
Lag2	−0.0443

Confusion Matrix

	Predicted Down	**Predicted Up**
Actual Down	35	76

	Predicted Down	Predicted Up
Actual Up	35	106

Performance Metrics

- Accuracy**:** 0.56
- LDA performs better at predicting Up days (Recall for Up = 0.75)
- It struggles with Down days (Recall for Down = 0.32)

Interpretation

The LDA model is moderately accurate, performing slightly above random guessing.
It leans towards predicting "Up", which can be seen from both the confusion matrix and the higher recall for Up.
This behavior matches the ISLR findings for the Smarket dataset using only Lag1 and Lag2.

2. Quadratic Discriminant Analysis (QDA)

Prior Probabilities

Class	Prior Probability
Down	0.492
Up	0.508

Group Means

Class	Lag1 Mean	Lag2 Mean
Down	0.0428	0.0339
Up	−0.0395	−0.0313

Confusion Matrix

	Predicted Down	**Predicted Up**
Actual Down	30	81
Actual Up	20	121

Performance Metrics

- **Accuracy:** 0.60
- QDA performs better than LDA in this dataset
- Strong performance predicting Up days
    - Recall for Up = 0.86
- Very weak at predicting Down days
    - Recall for Down = 0.27

Interpretation

QDA outperforms LDA with an accuracy of **60%**.
However, just like LDA, QDA is biased toward predicting "Up", likely because the dataset structure does not have strong separation between classes based on Lag1 and Lag2.

Overall Conclusions

- **QDA > LDA** in terms of accuracy (0.60 vs 0.56)
- Both models rely heavily on Lag1 and Lag2, which provide weak predictive power
- Both models tend to overpredict Up, capturing the market's tendency
- Results match the well-known outcome in ISLR Chapter 4