WEEK 12
Confusion Matrix

STA130F24

Confusion Matrix

	Predicted "Negative"	**Predicted "Positive"**
Actually "Negative"	**True** *Negative* (TN)	**False** *Positive* (FP)
Actually "Positive"	**False** *Negative* (FN)	**True** *Positive* (TP)

In-Sample VS Out-of-Sample Performance

- **In-sample performance** refers to how well a model predicts data it was trained on.
  - High in-sample performance could indicate the model has learned the patterns in the training data.
  - However, excessively high performance might indicate overfitting.
- **Out-of-sample performance** refers to how well a model generalizes to unseen data, such as test sets.
  - This is a better indicator of the model's ability to make predictions in real-world scenarios.
  - Metrics like accuracy, precision, and recall are computed on a test set to measure out-of-sample performance.

Interpreting Confusion Matrix

Metric	Formula	Interpretation	When to Prioritize
Accuracy	$(TP + TN)/(TP + TN + FP + FN)$	Proportion of correct predictions out of all predictions.	Use when classes are balanced, and both false positives and false negatives are equally costly.
Specificity	$TN/(TN + FP)$	Out of all actual negatives, how many are correctly identified as negative.	Useful when minimizing false positives is critical, such as in large-scale disease screening.
Sensitivity (Recall)	$TP/(TP + FN)$	Out of all actual positives, how many are correctly predicted.	Critical when false negatives are costly, such as in medical diagnoses or safety systems.
False Positive Rate (FPR)	$FP/(FP + TN)$	Proportion of actual negatives incorrectly predicted as positives.	Important when avoiding unnecessary actions triggered by false positives is essential.
Precision	$TP/(TP + FP)$	Out of all predicted positives, how many are truly positive.	Important when false positives are more costly than false negatives, such as in fraud detection.