Performance Metrics in Logistic Regression

Rajdeep Banerjee, PhD

Confusion Matrix, Precision, Recall, etc.

Predicted vs Actual Classifications

- TP = True Positives
- FP = False Positives
- FN = False Negatives
- TN = True Negatives

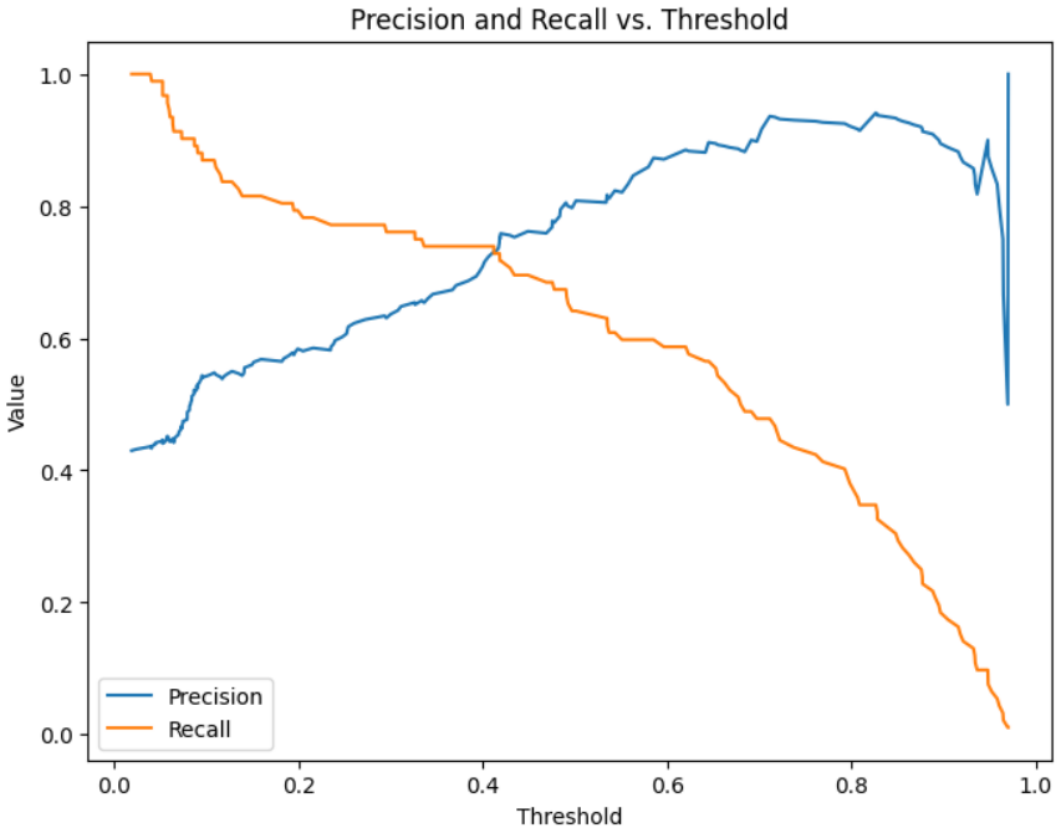
	Predicted Positive	**Predicted Negative**
Actual Positive	True Positive (TP)	False Negative (FN)
Actual Negative	False Positive (FP)	True Negative (TN)

Metric	Alternative Names	Formula
Accuracy	–	$\frac{TP+TN}{TP+TN+FP+FN}$
Precision	Positive Predictive Value (PPV)	$\frac{TP}{TP+FP}$
Recall	Sensitivity, True Positive Rate (TPR)	$\frac{TP}{TP+FN}$
Specificity*	True Negative Rate (TNR)	$\frac{TN}{TN+FP}$
F_β Score	–	$(1+\beta^2) \cdot \frac{Precision \cdot Recall}{\beta^2 \cdot Precision + Recall}$

*FPR = 1 - Specificity

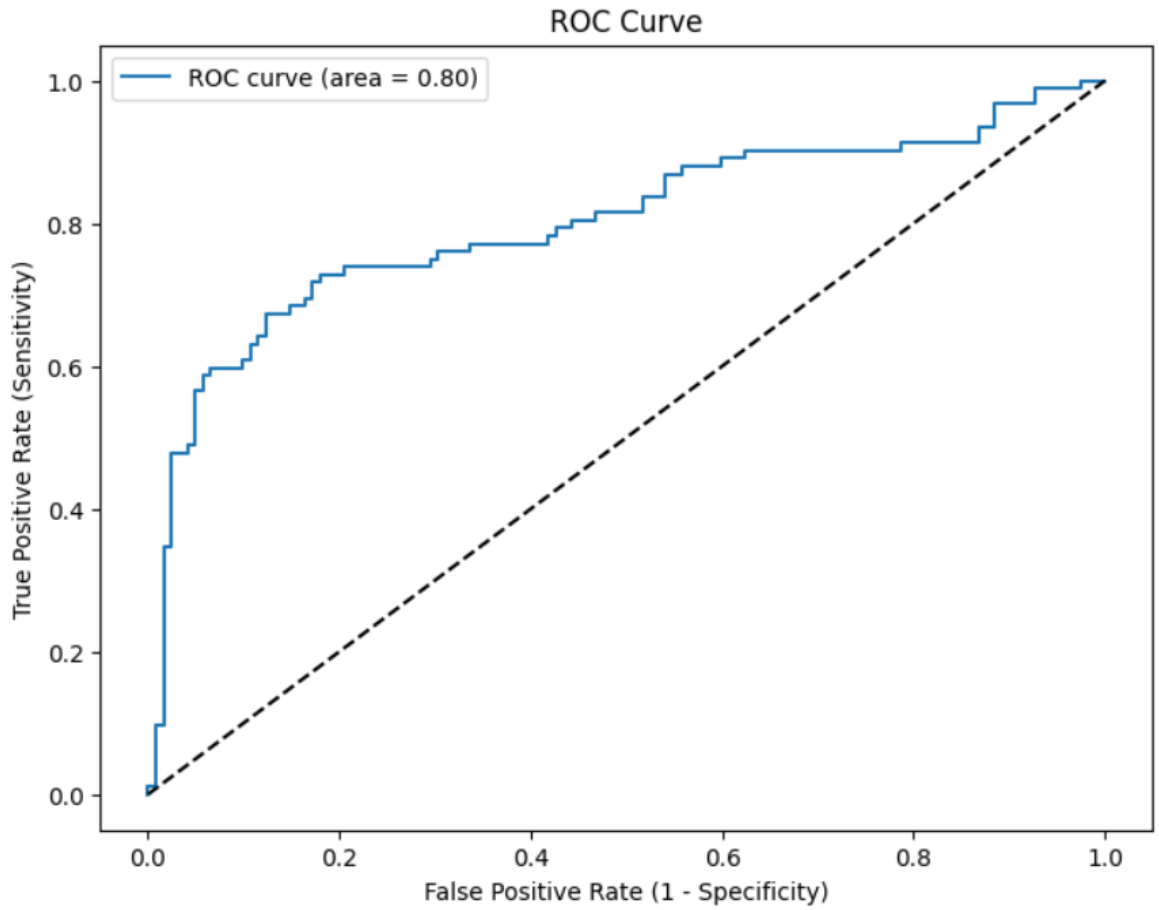
Effect of Threshold on Precision and Recall

- Lower threshold → Higher Recall, Lower Precision
- Higher threshold → Higher Precision, Lower Recall
- Finding a balance is key for performance optimization.



ROC Curve and AUC

ROC Curve: Plots Sensitivity or TPR vs. (1 - Specificity) or FPR
AUC: Measures classifier performance. Higher is better.



Kolmogorov-Smirnov (KS) Statistic

$$\mathrm{KS} = \max_t |\mathrm{CDF}_{\mathrm{pos}}(t) - \mathrm{CDF}_{\mathrm{neg}}(t)|$$

- KS measures the maximum separation between CDFs of positive & negative classes.
- A higher KS value(≥0.4) indicates better separation between classes.