Precision-Recall Curve

Precision and Recall

- True Positive Rate (**Recall** or Sensitivity)

$$TP_{rate} = TP / (TP + FN)$$

- Positive Predictive Value (**Precision**)

$$PP_{value} = TP / (TP + FP)$$

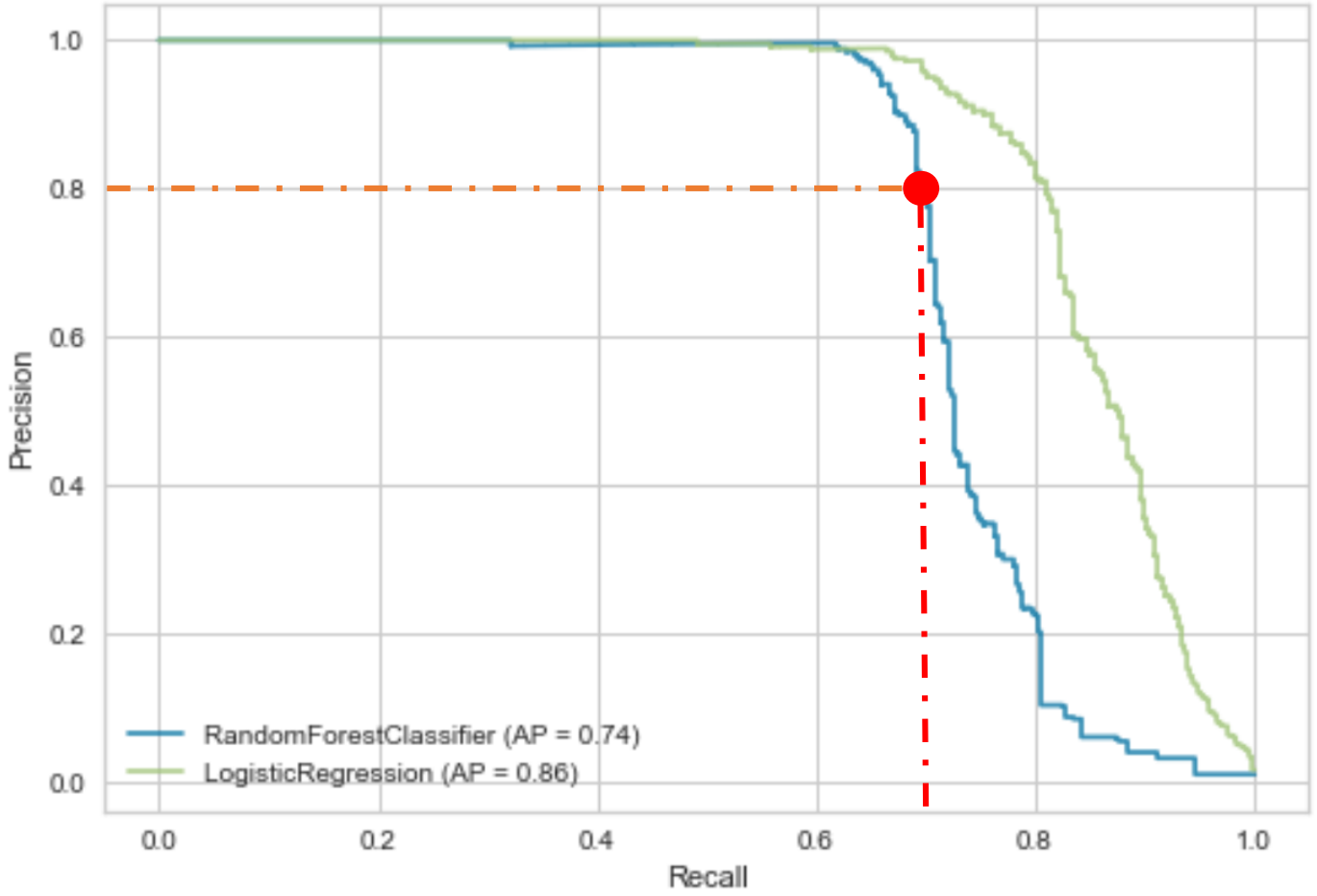
Precision-Recall Curve

- The Precision-Recall Curve shows the relationship between precision and recall for every cut-off / Discriminant Probability Threshold.

- The PRC is a graph with:
  - ✓ Recall in the x-axis
  - ✓ Precision in the y-axis

- Every point on the PRC represents a chosen cut-off. Every point provides the precision and the recall for a certain cut-off / threshold.

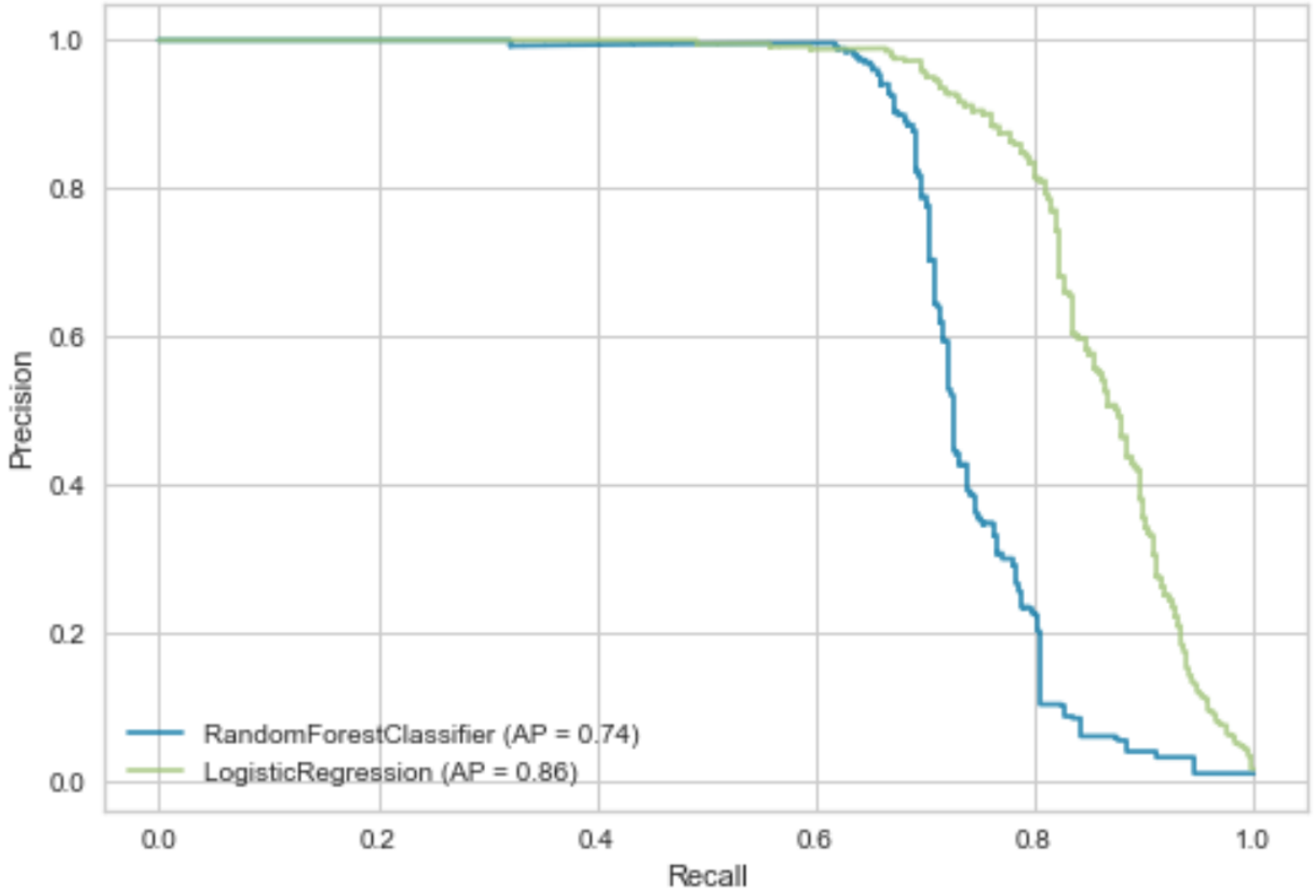
Precision-Recall Curve



For the threshold at ● :

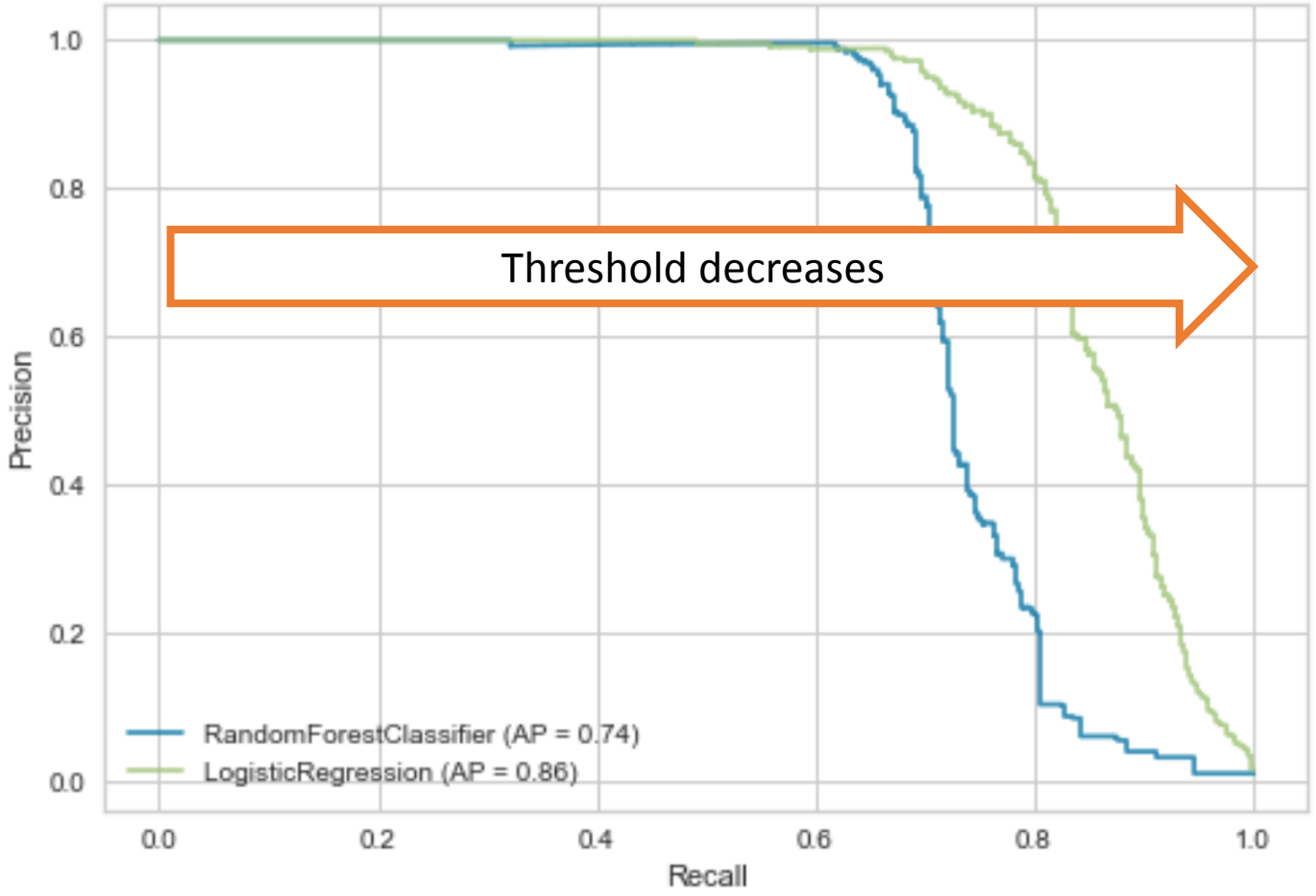
- Precision = 0.8
- Recall = 0.7

Precision-Recall Curve



- The area under the PRC provides an aggregate measure of performance across all possible classification thresholds.
- Higher area indicates better model performance

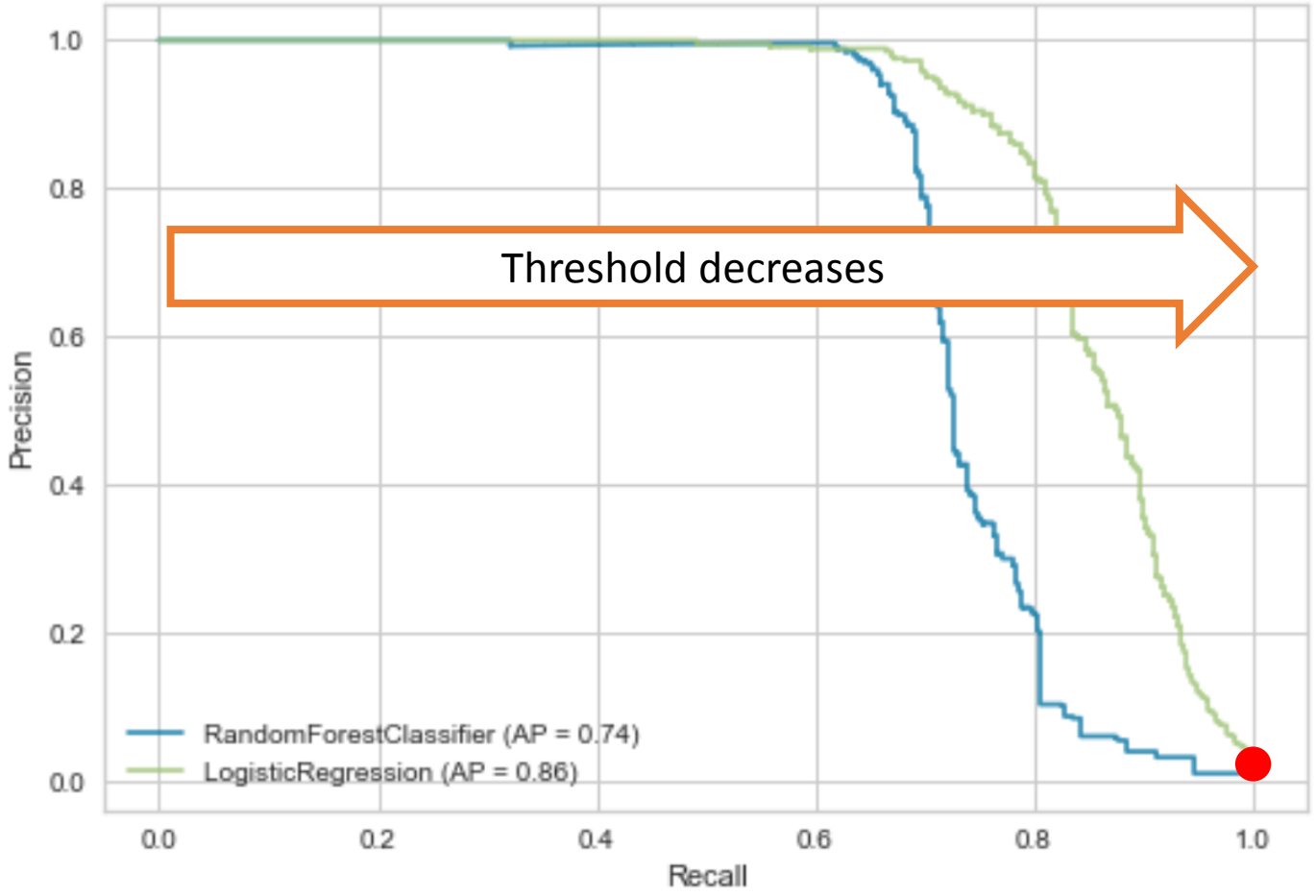
Precision-Recall Curve



As threshold decreases:

- Precision decreases
  - TP / (TP + FP)
- Recall increases
  - (TP / (TP + FN))

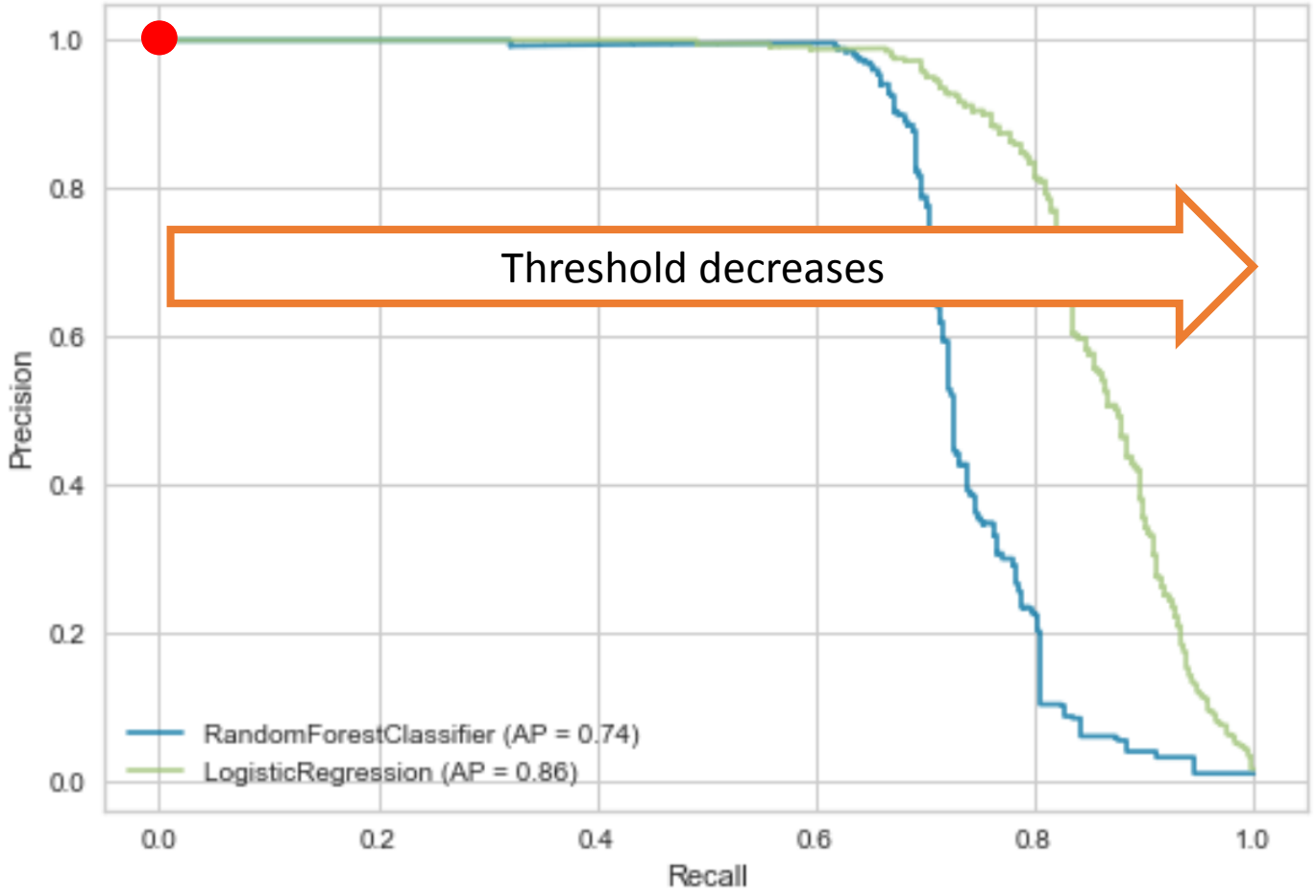
Precision-Recall Curve



As threshold decreases:

- Precision decreases
  - TP / (TP + FP)
- Recall increases
  - (TP / (TP + FN))
- Threshold = 0
  - Recall = 1
  - Precision ~ balance ratio

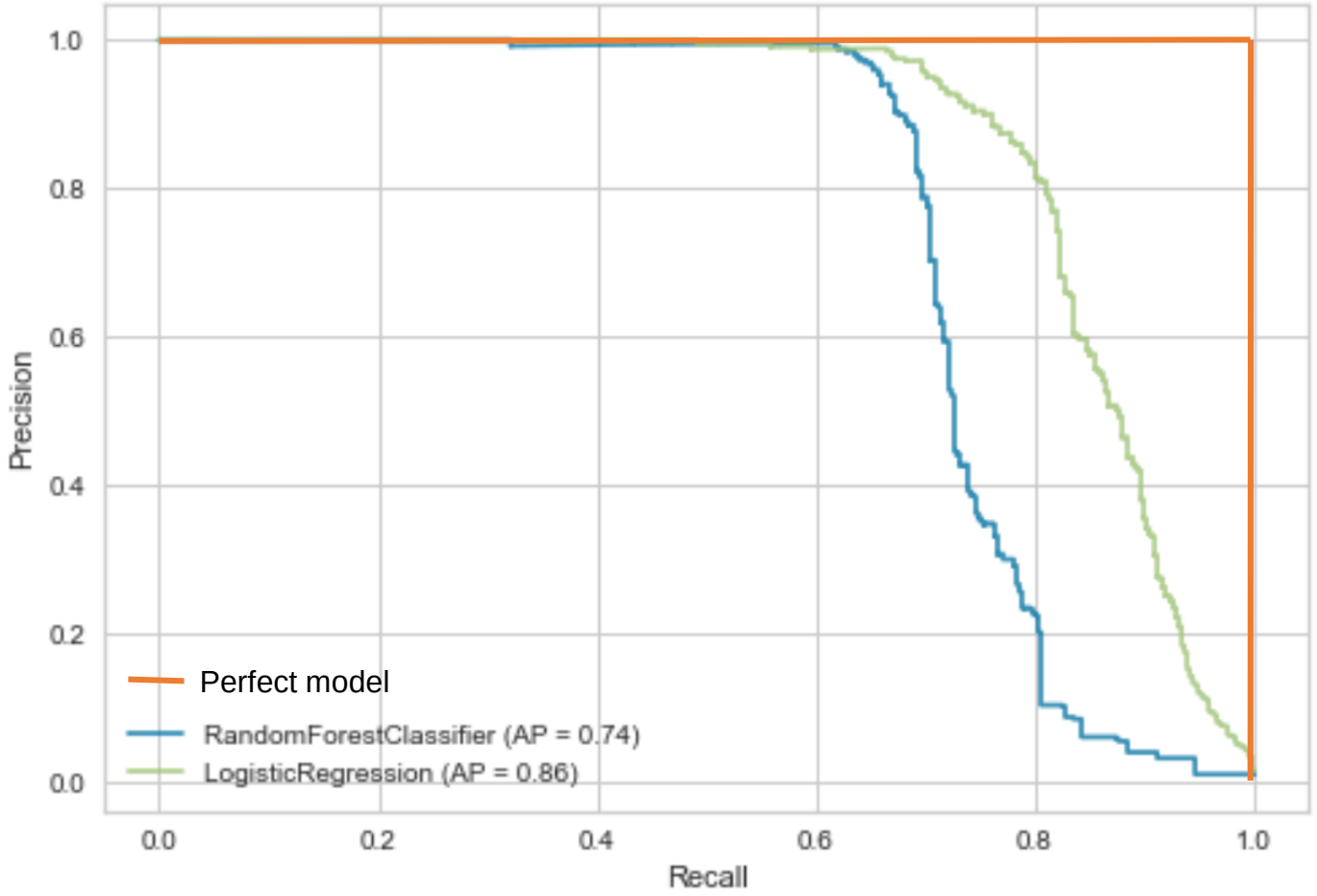
Precision-Recall Curve



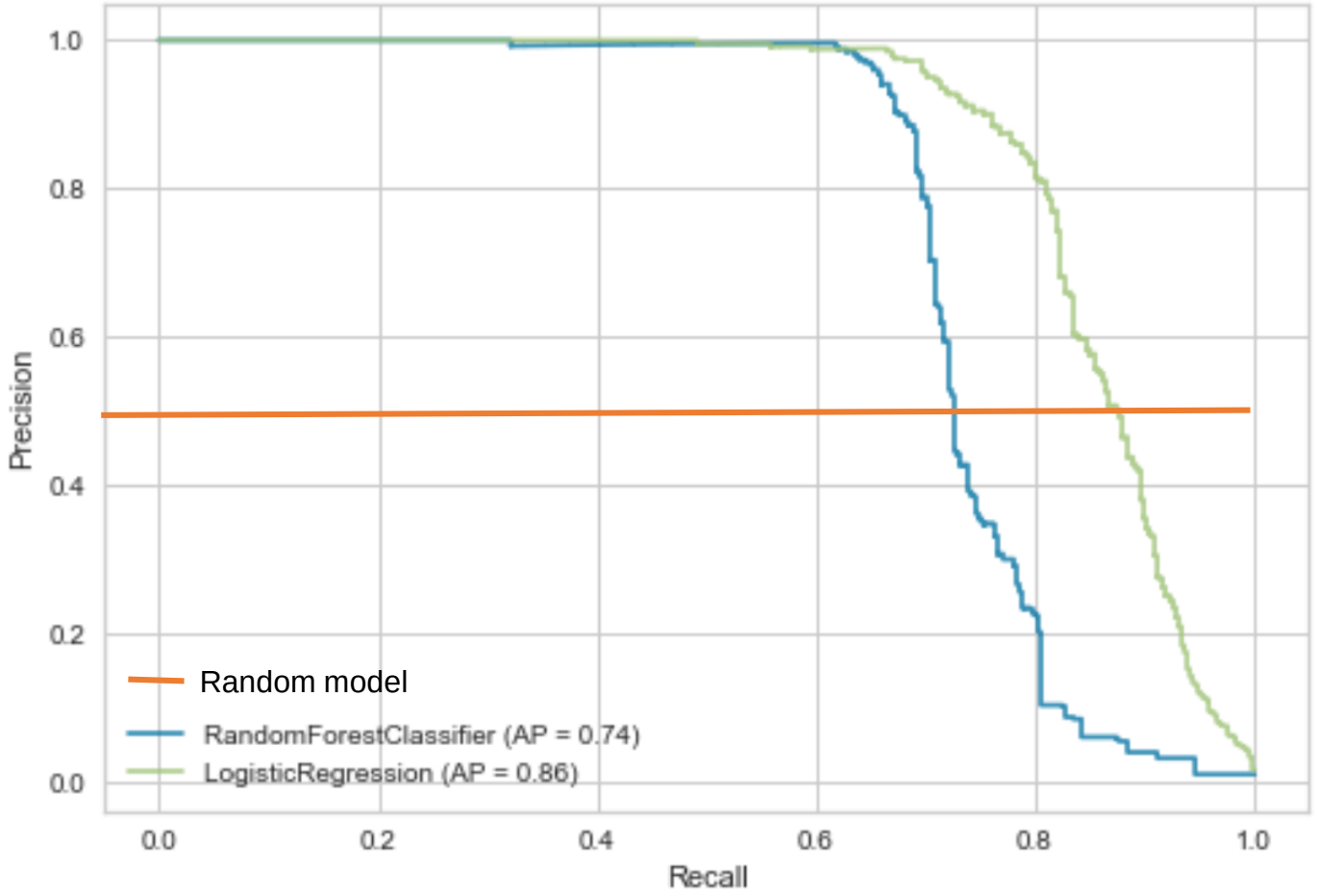
As threshold decreases:

- Precision decreases
  - TP / (TP + FP)
- Recall increases
  - (TP / (TP + FN))
- Threshold approx. 1
  - Recall approx. 0
  - Precision approx. 1

Precision-Recall Curve: Perfect model



Precision-Recall Curve: Random

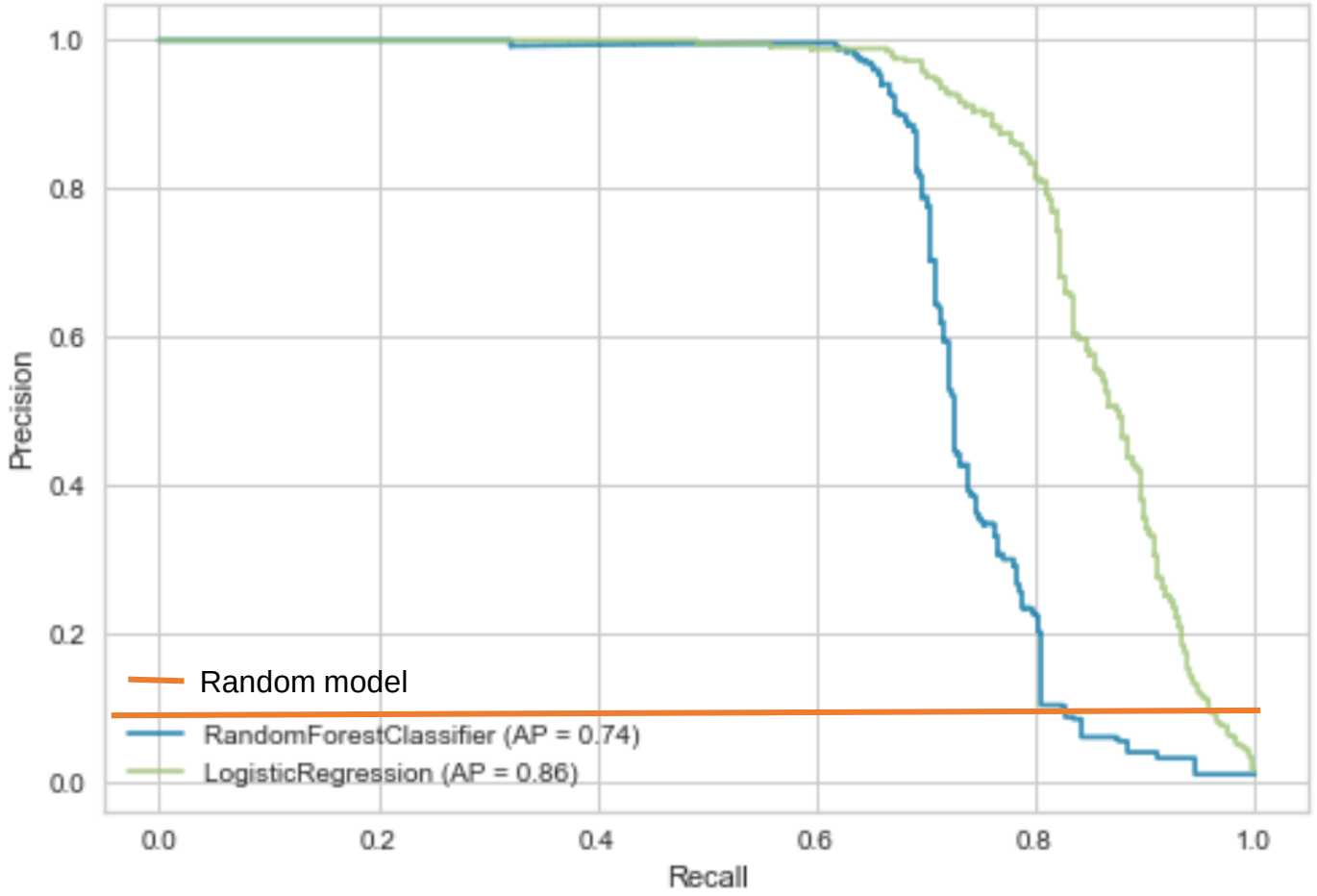


Random model on perfectly balanced data

For all thresholds:

- Precision = 0.5
  - Half of the positive predictions are wrong
- Recall varies

Precision-Recall Curve: Random



Random model on imbalanced data

Balancing ratio 1:10

For all thresholds:

- Precision = balancing ratio
- Recall varies

PRC vs ROC Curve

- It is harder to discriminate between ROC curves with large areas under the curve.

- PRC are robust to data imbalance
  - Better / more visual indicator to compare model performance

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THANK YOU

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