

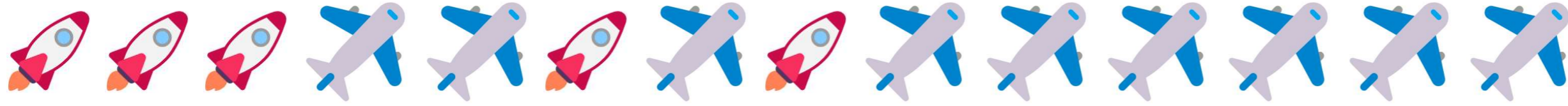
Utility in ROC Space:

Using economic utility to set a threshold for a machine learning classifier

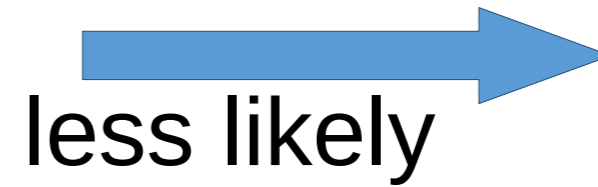
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Missile or Airliner?



Is it a missile?



Should I shoot it down?

Two kinds of mistakes

False negative: let a missile through

False positive: shoot down an airliner

Two levels of decisions

Tactical decision: There is a blip on my radar. Should I shoot it down?

Strategic decision: Should I invest in a better radar system?

Binary Classifiers

Would this customer appreciate our ad?



Will this voter choose our candidate?



Is this a regular package or a bomb?



Does this patient have cancer or not?

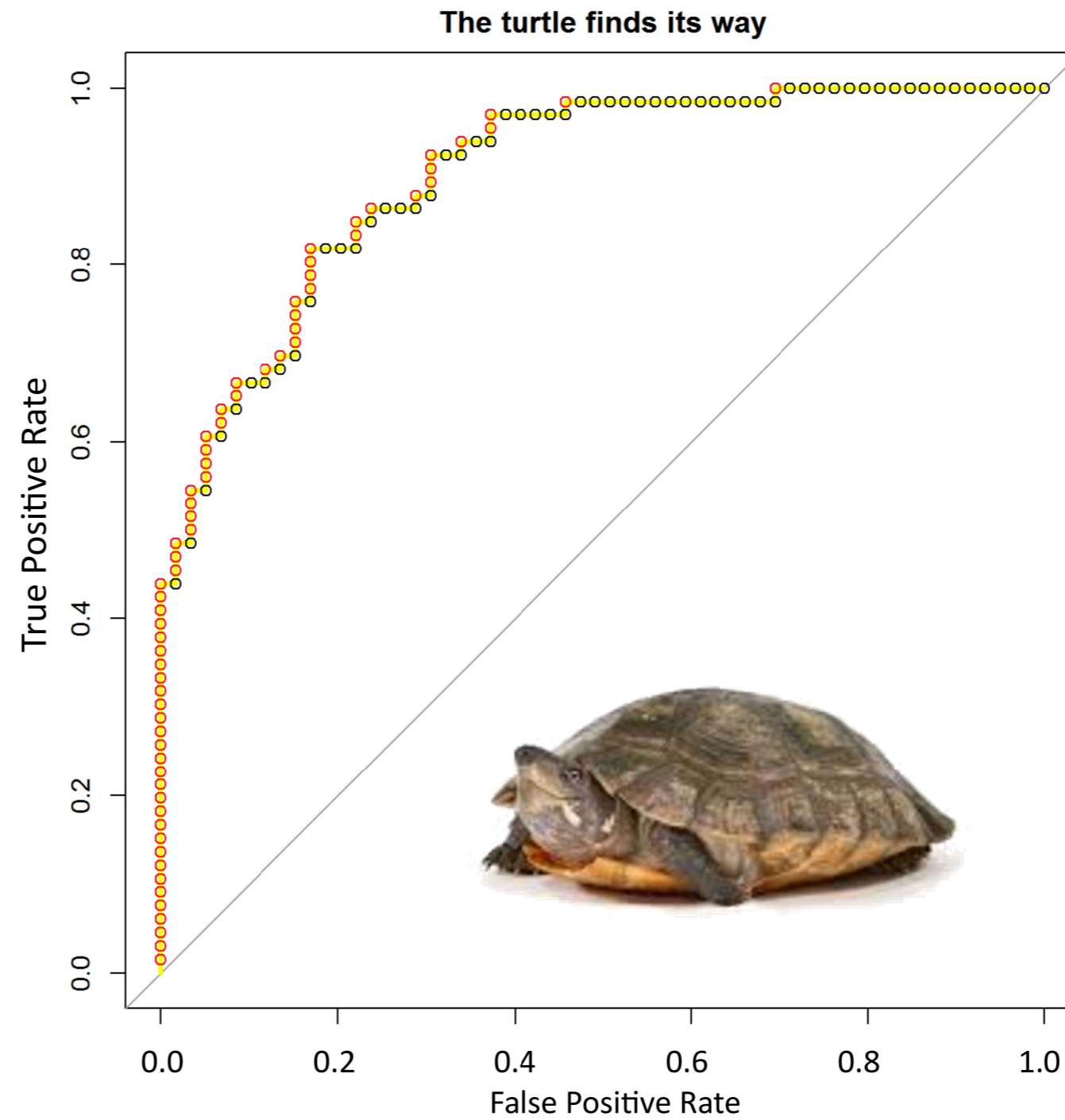


Will it rain here today?



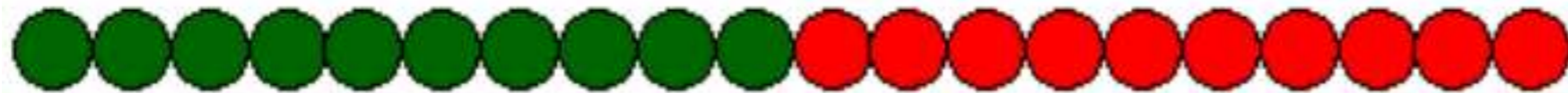
Simple ROC curves: Think like a turtle

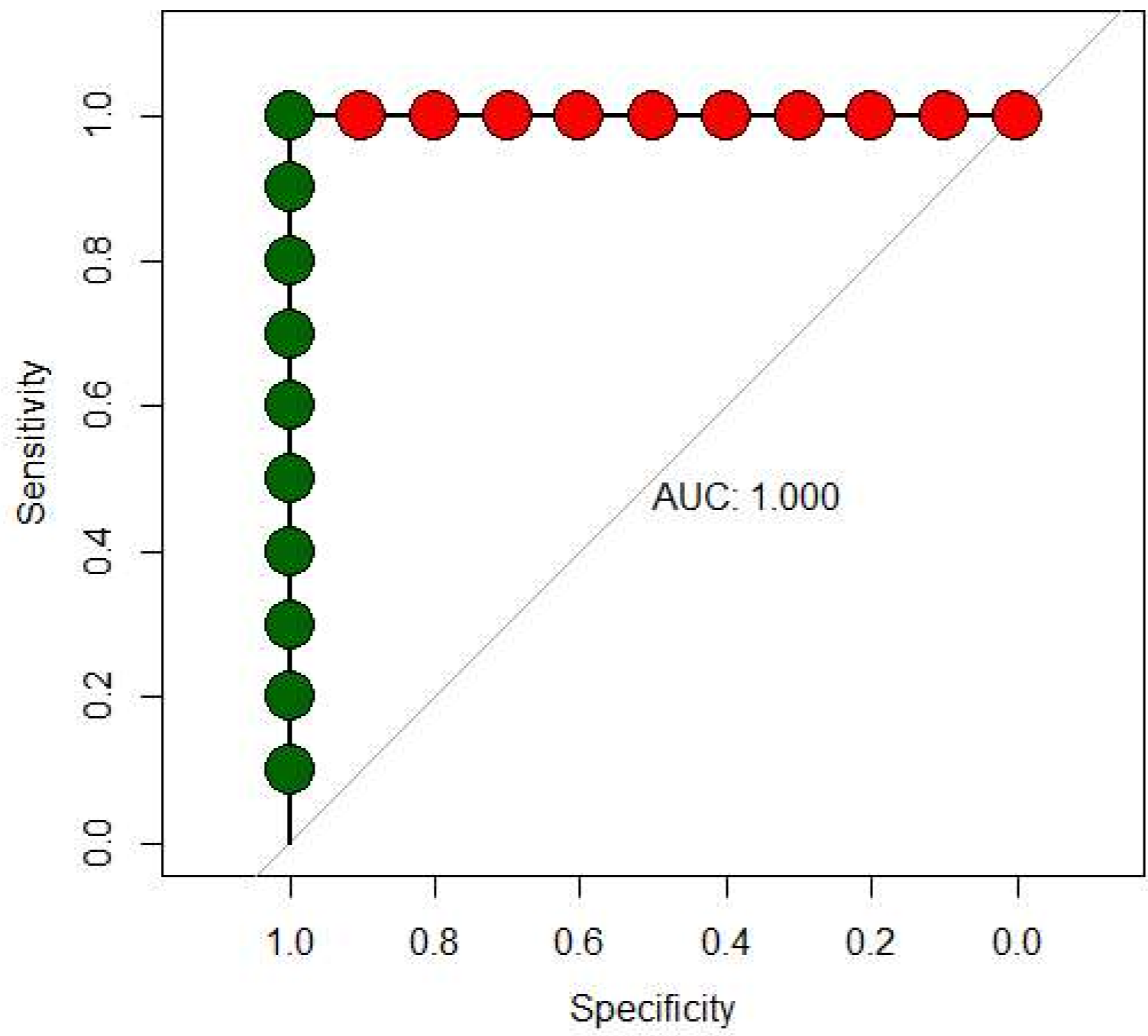
- Sort the observed outcomes by their predicted scores with the highest scores first.
- Calculate cumulative True Positive Rate (TPR) and False Positive Rate (FPR) for the ordered observed outcomes.
- Plot TPR (Sensitivity) against FPR (1 – Specificity)



Turtle Quiz!

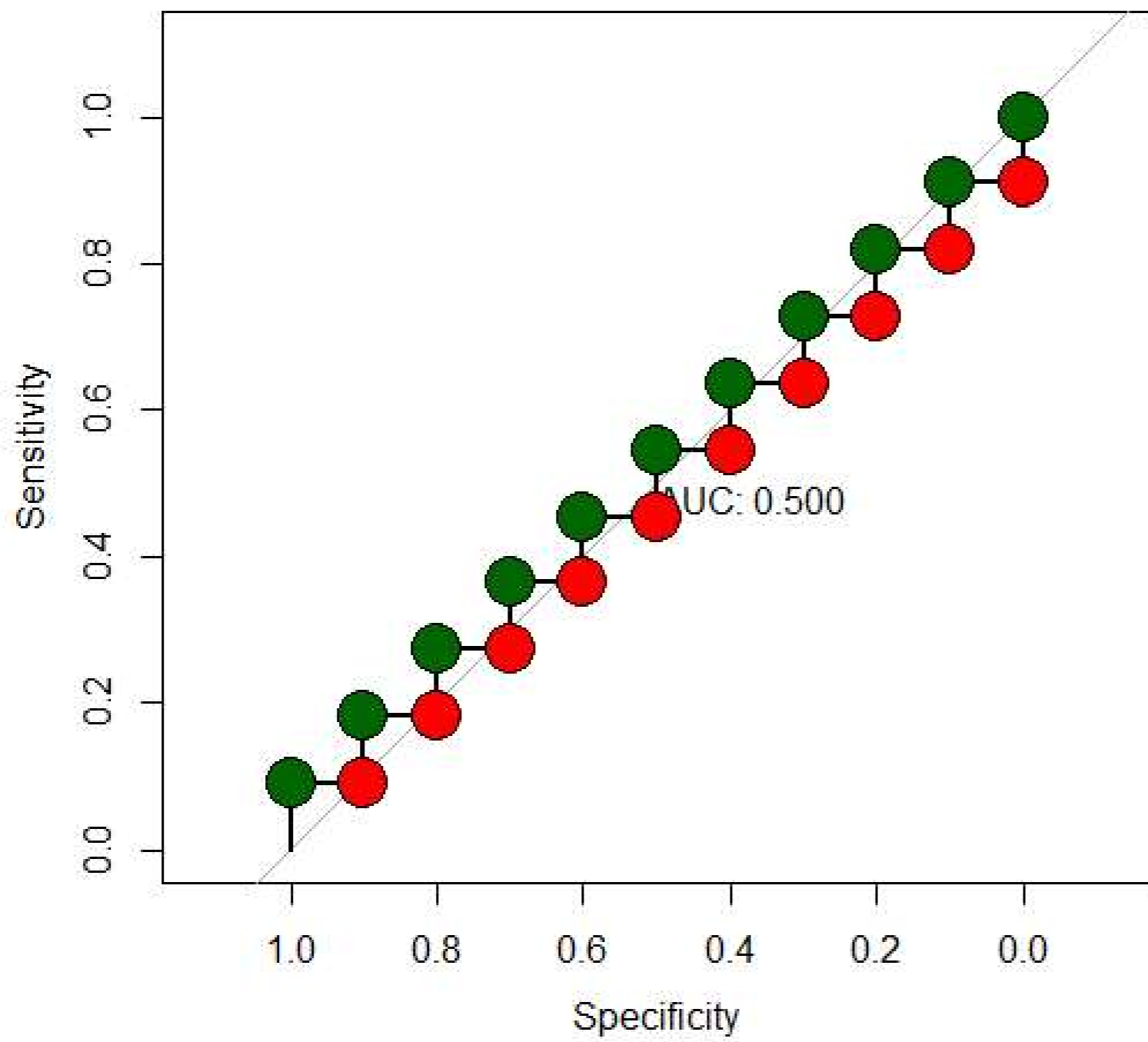
What would the ROC curve look like for these points?

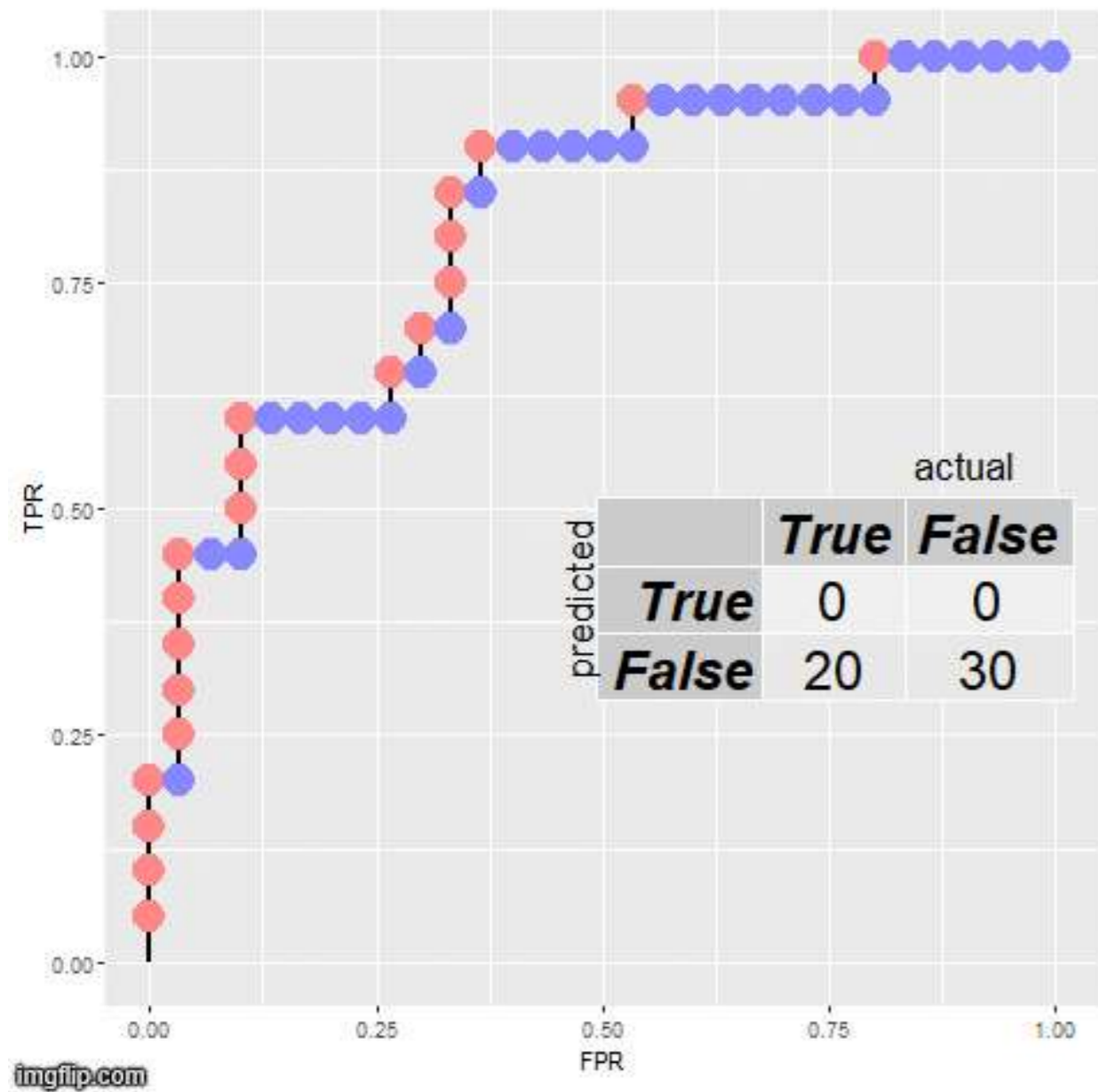




What would the ROC curve look like for these points?







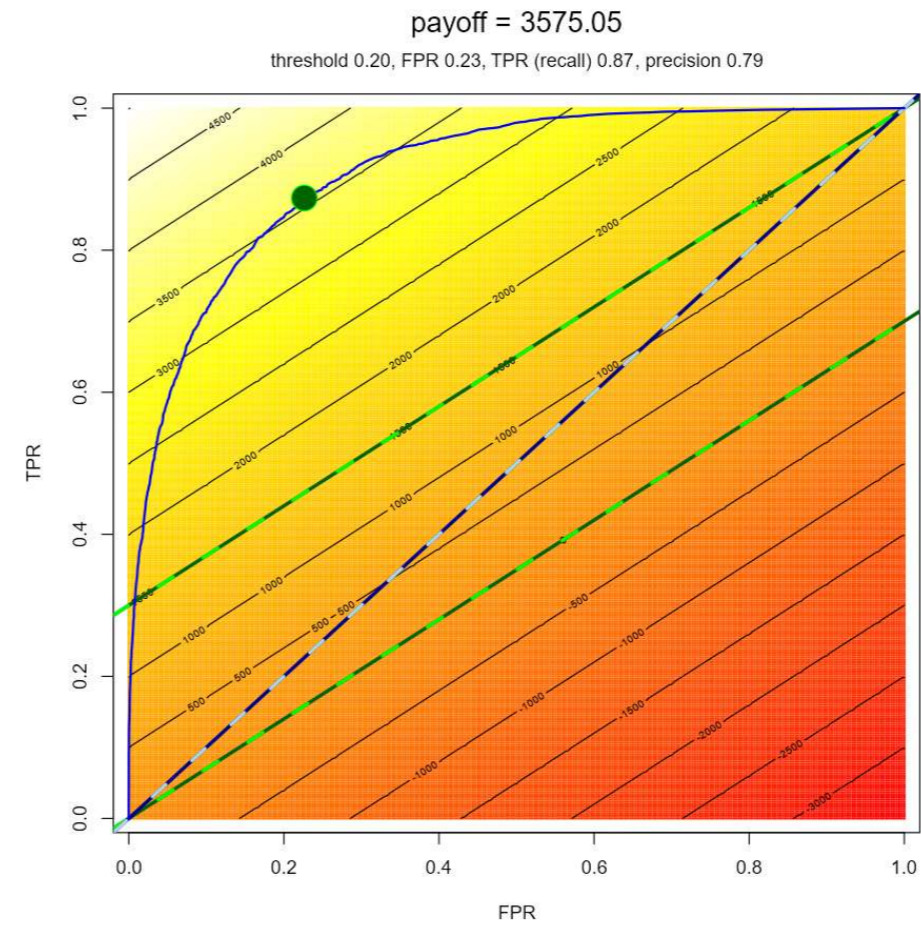
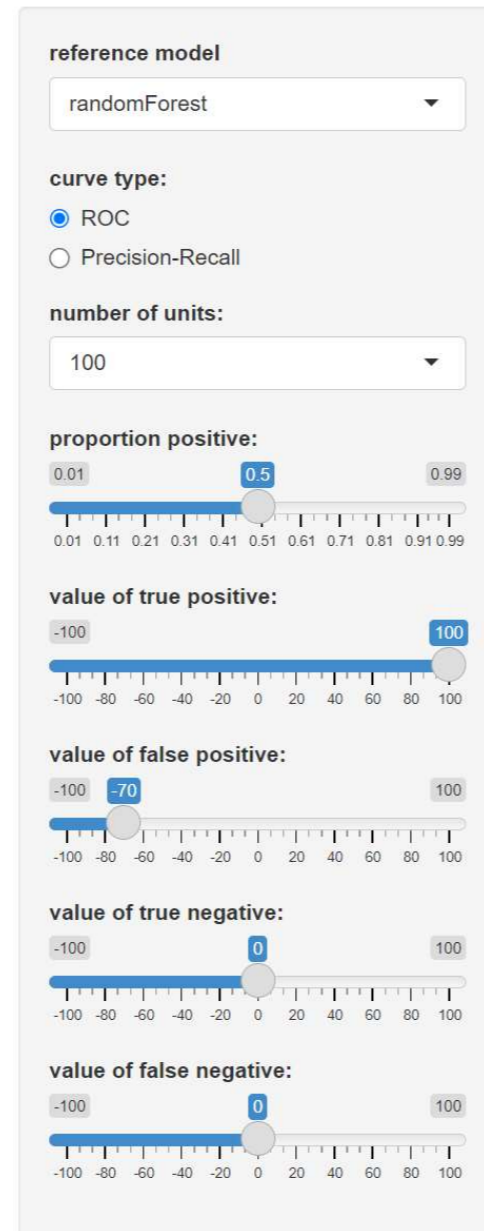
A confusion matrix represents a particular point on an ROC curve.

As the threshold scans past a case, it will move from the predicted False row to the predicted True row. Which column that case is in depends on whether it is actually True or actually False.

Useful model

Economic Utility of a Binary Classifier

Costs and Benefits

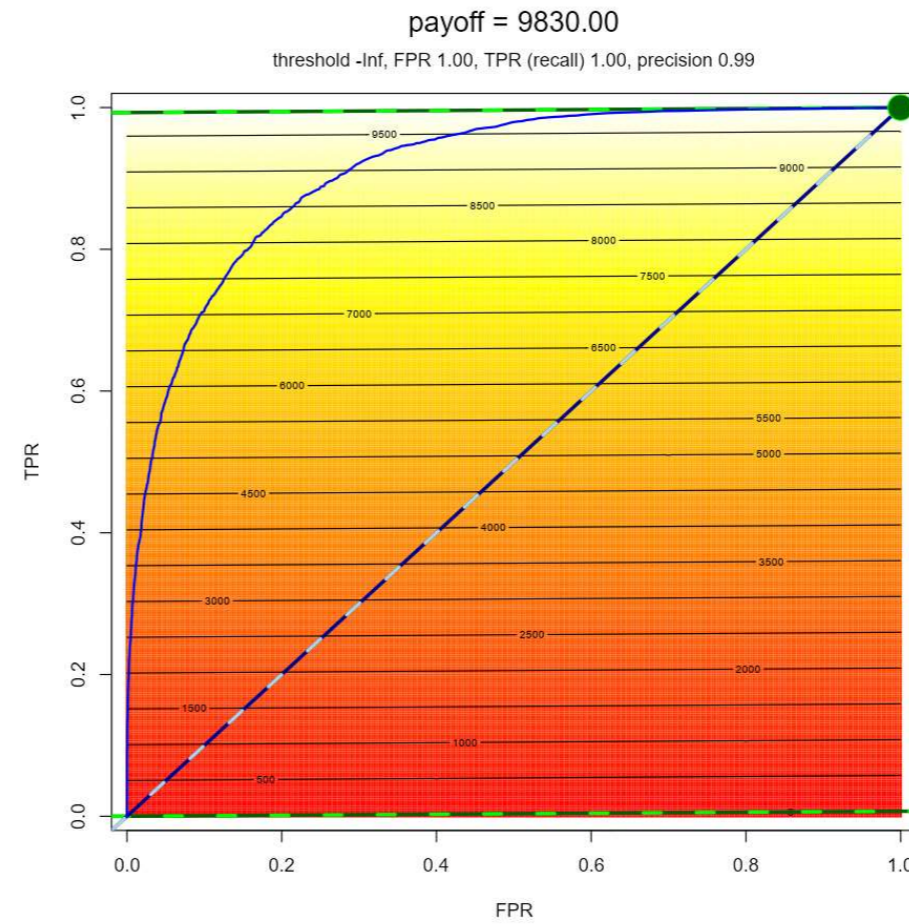
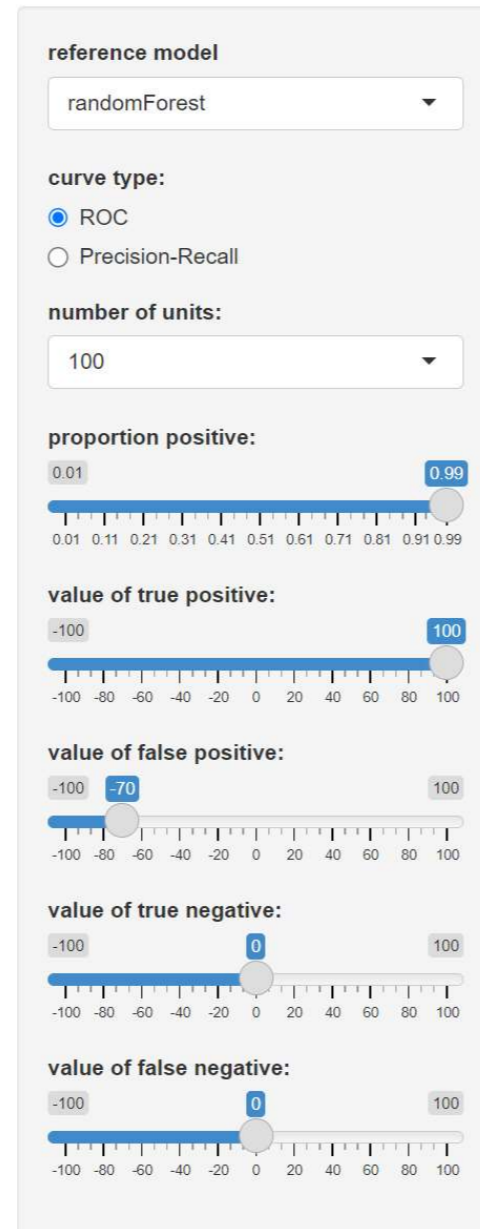


https://ml4managers.shinyapps.io/ML_utility/

Useless model

Economic Utility of a Binary Classifier

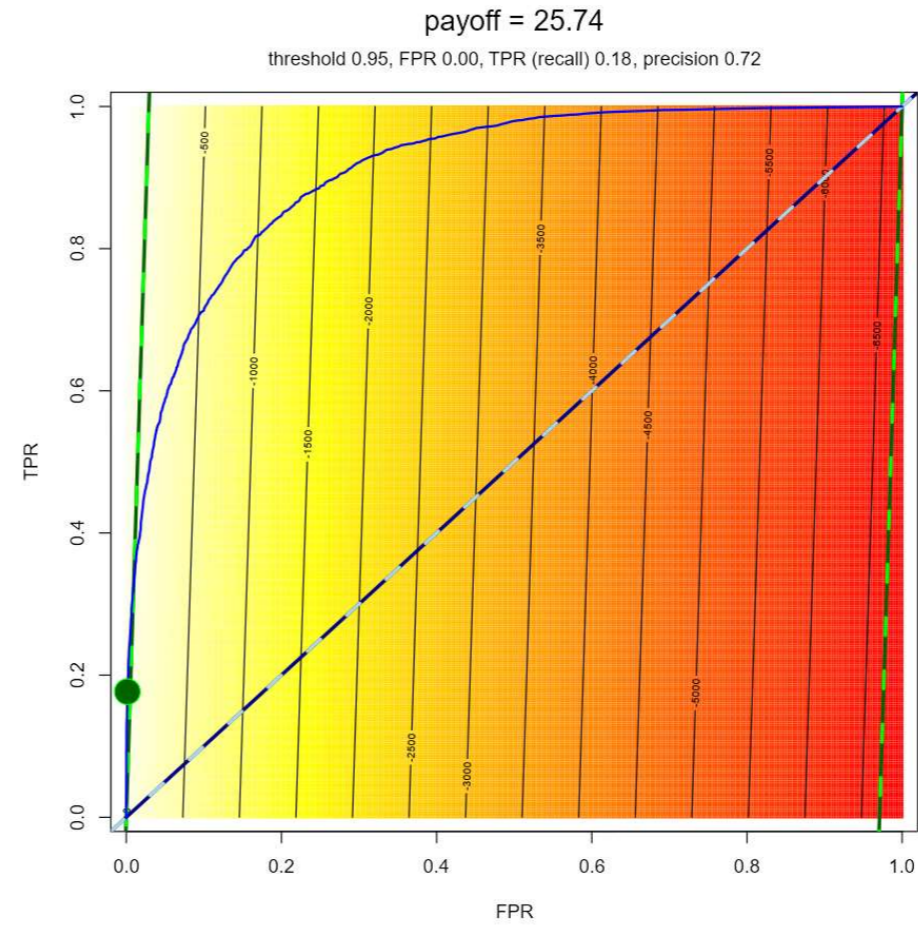
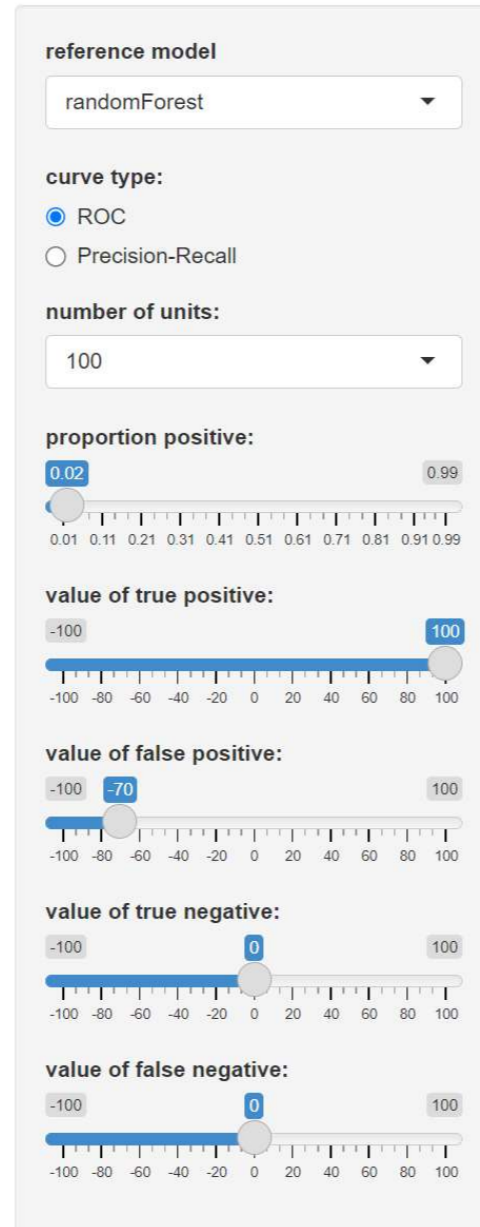
Costs and Benefits



Only the
left edge
matters

Economic Utility of a Binary Classifier

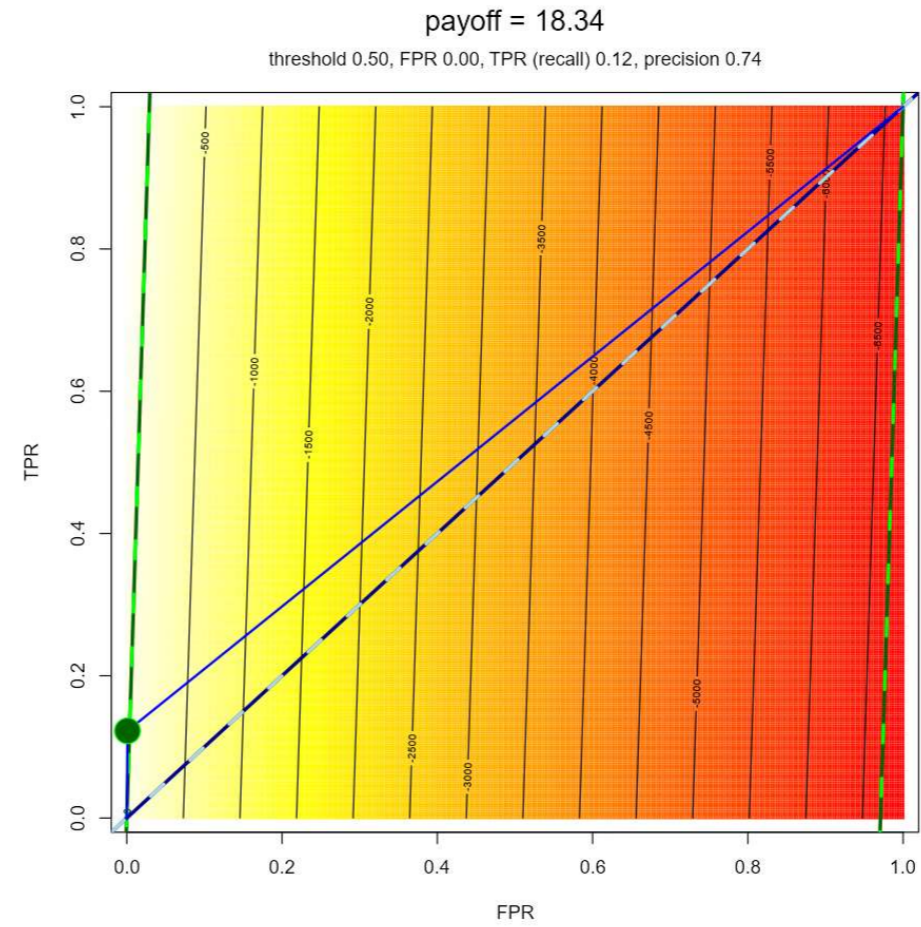
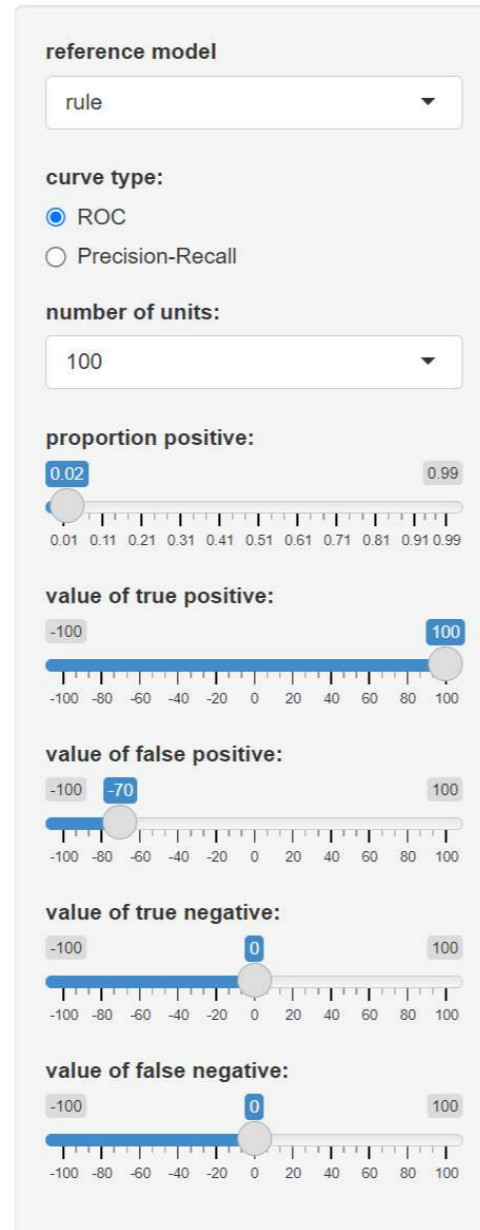
Costs and Benefits



Simple model captures most of the value

Economic Utility of a Binary Classifier

Costs and Benefits



Strategic Decision: Investing in an ML system

<i>Alternative</i>	<i>Cost</i>	<i>Benefit</i>
Fancy model	Compute, data collection & management, HR, ...	Great!
Simple model	Minimal (?)	Moderate
Status Quo	No new cost	Baseline

Nonlinear utility function

