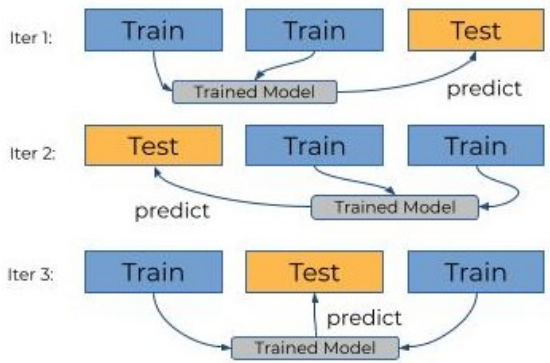
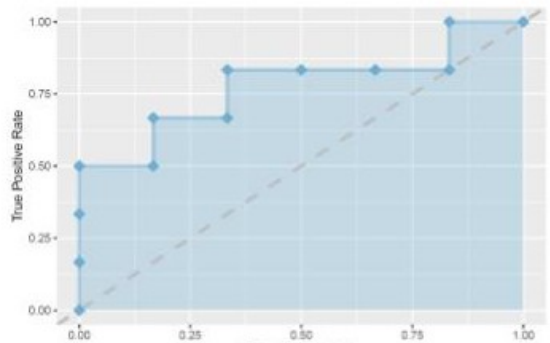
Introduction to Machine Learning

Evaluation: Partial AUC



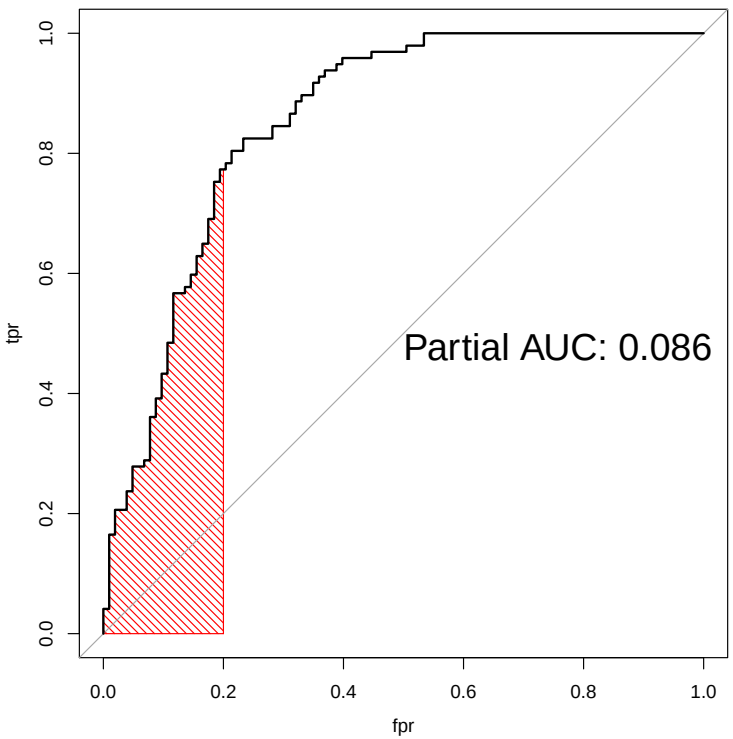


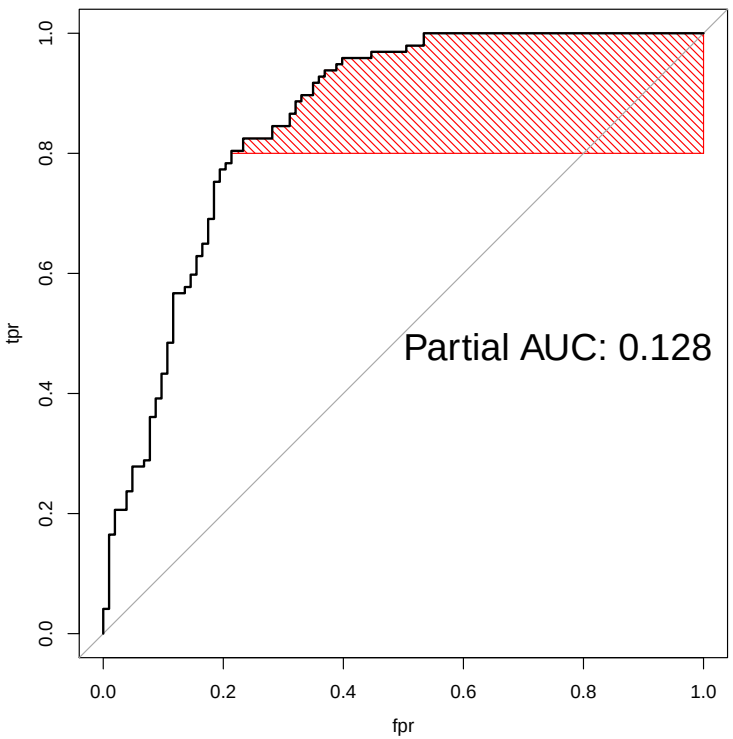
Learning goals

- Understand why pAUC is a reasonable metric in some contexts.
- Know how pAUC is computed and normalized.

PARTIAL AUC

- Sometimes it can be useful to look at a specific region under the ROC curve $\Rightarrow$ partial AUC (pAUC).
- For example, we might focus on a region with low FPR or a region with high TPR:





PARTIAL AUC – EXAMPLE

- Applications where sensitivity and specificity are treated asymetrically often occur in biomedical contexts.
- For example, Wild et al. (2010) used pAUC in their study of biomarkers for the detection of colorectal cancer.
- Sensitivity, i.e., being able to correctly detect present diseases, is crucial in this setting.
- At the same time, high sensitivity is only useful if the classifier also achieves high specificity.
  $\rightarrow$ Otherwise, healthy patients might receive costly and entirely unnecessary treatment.
- It is therefore reasonable to demand a certain level of specificity and evaluate/optimize learners on the resulting pAUC.

CORRECTED PARTIAL AUC

- The scale of the partial AUC depends on the FPR cut-off values used to determine the region of interest $\Rightarrow$ pAUC $\in [0, c_2 - c_1]$.
- For standard AUC, we have $c_1 = 0$ and $c_2 = 1$.
- We can scale pAUC to take on values in $[0, 1]$ again:

$$\text{pAUC}_{\text{corrected}} = \frac{1}{2}\left(1 + \frac{\text{pAUC} - \text{AUC}_{\text{min}}}{\text{AUC}_{\text{max}} - \text{AUC}_{\text{min}}}\right),$$

  where
  - AUC_{min} is the value of the non-discriminant AUC, and
  - AUC_{max} is the maximum possible AUC in the region.

- NB: using pAUC means casting aside parts of the information deliberately.