

Exercise 1:

Given are the dataset

| | | | | | |
|---|---|---|-----|----|----|
| x | 1 | 2 | 7.0 | 10 | 20 |
| y | 1 | 1 | 0.5 | 10 | 11 |

and the same dataset, but with the feature x log-transformed

| | | | | | |
|--------|---|-----|-----|------|----|
| log(x) | 0 | 0.7 | 1.9 | 2.3 | 3 |
| y | 1 | 1.0 | 0.5 | 10.0 | 11 |

Either manually compute the first split point that the CART algorithm would find for each dataset or implement your own CART split-point-finding algorithm with a few lines of code.

Exercise 2:

The fractions of the classes $k = 1, \dots, g$ in node \mathcal{N} of a decision tree are $\pi_1^{(\mathcal{N})}, \dots, \pi_g^{(\mathcal{N})}$. Assume we replace the classification rule in node \mathcal{N}

$$\hat{k}|\mathcal{N} = \arg \max_k \pi_k^{(\mathcal{N})}$$

with a randomizing rule, in which we draw the classes in one node from their estimated probabilities.

Compute the expectation of the misclassification rate in node \mathcal{N} , for data distributed like the training data, assuming independent observations. What do you notice? (*Hint*: The observations and the predictions using the randomizing rule follow the same distribution.)