

Artificial Intelligence – Spring 2021

Homework 6

Issued: May 24th, 2021

Due: June 7th, 2021

Problem 1:

18.6 Consider the following data set comprised of three binary input attributes (A_1 , A_2 , and A_3) and one binary output:

Example	A_1	A_2	A_3	Output y
x_1	1	0	0	0
x_2	1	0	1	0
x_3	0	1	0	0
x_4	1	1	1	1
x_5	1	1	0	1

Use the algorithm in Figure 18.5 (page 702) to learn a decision tree for these data. Show the computations made to determine the attribute to split at each node.

Problem 2:

18.22 Suppose you had a neural network with linear activation functions. That is, for each unit the output is some constant c times the weighted sum of the inputs.

- Assume that the network has one hidden layer. For a given assignment to the weights w , write down equations for the value of the units in the output layer as a function of w and the input layer x , without any explicit mention of the output of the hidden layer. Show that there is a network with no hidden units that computes the same function.
- Repeat the calculation in part (a), but this time do it for a network with any number of hidden layers.
- Suppose a network with one hidden layer and linear activation functions has n input and output nodes and h hidden nodes. What effect does the transformation in part (a) to a network with no hidden layers have on the total number of weights? Discuss in particular the case $h \ll n$.