

Homework #5 - STA414

Winter 2018

Instructions: Do not submit your work. This assignment is for your edification only – not for credit.

Question 1.

Consider a two-layer network function of the form

$$y_k(\mathbf{x}, \mathbf{w}) = \sigma \left(\sum_{j=1}^M w_{kj}^{(2)} h \left(\sum_{i=1}^D w_{ji}^{(1)} x_i + w_{j0}^{(1)} \right) + w_{k0}^{(2)} \right)$$

in which the hidden-unit nonlinear activation functions $h(\cdot)$ are given by logistic sigmoid functions of the form

$$\sigma(a) = \frac{1}{1 + \exp(-a)}$$

Show that there exists an equivalent network, which computes exactly the same function, but with hidden unit activation functions given by $\tanh(a)$. Hint: first find the relation between $\sigma(a)$ and $\tanh(a)$, and then show that the parameters of the two networks differ by linear transformations. [from Bishop p 284]

Question 2.

Design a neural network with one scalar input, x , a single layer of two ReLU units, and one linear output unit, y , that perfectly fits the data $(-5,1), (-4,1), (-3,1), (-2,1), (-1,2), (0,3), (1,4), (2,4), (3,4), (4,4), (5,4)$. Enter the values of the weights in the boxes in the diagram below.

