SMAI-2020-Homework

September 2020

1 Objective Question [1 mark]

Consider two perceptrons defined by the threshold expression $w_0 + w_1x_1 + w_2x_2 > 0$.
Perceptron A has weight values

$$w_0 = 1, \quad w_1 = 2, \quad w_2 = 1$$

and Perceptron B has weight values

$$w_0 = 0, w_1 = 2, w_2 = 1$$

True or False? Perceptron A is *more general than* Perceptron B.

Definition: Let h_j and h_k be boolean valued function defined over X. Then h_j is *more general than or equal to* h_k (written $h_j \geq_g h_k$) if and only if

$$(\forall x \in X)[h_k(x) = 1 \rightarrow h_j(x) = 1]$$

That is, any instance of h_k also satisfies h_j.

2 Subjective Question [2 marks]

Design a two-input perceptron that implements the boolean function $A \wedge \neg B$.

3 Programming Question [3 marks]

Using the linear perceptron algorithm, solve the multi-class classification problem of predicting hand-written digit data. Report the accuracy achieved. A starter code has been provided in the 'Linear Perceptron Excercise.ipynb' notebook [Hint: You can use a one-vs-one, one-vs-all scheme or use a multi-class signum function]