COMP 5630 Fall 2022 Assignment 3

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1. Linear Separators

   (a) AND truth table

x_1	x_2	AND
0	0	0
0	1	0
1	0	0
1	1	1

   (b) AND linear separator

$$y = \phi(1x_1 + 1x_2 - 1.5) \tag{1}$$

   (c) OR truth table

x_1	x_2	AND
0	0	0
0	1	1
1	0	1
1	1	1

   (d) OR linear separator

$$y = \phi(1x_1 + 1x_2 - 0.5) \tag{2}$$

   (e) XOR truth table

x_1	x_2	AND
0	0	0
0	1	1
1	0	1
1	1	1

(f) Impossible XOR linear separator

If you were to plot each pair of (x_1, x_2) in 2d space, drawing a single linear separator that cleanly divides the appropriate labels would be impossible.

(g) Custom function separator

This function cannot be learned by a Perceptron. Given the definition provided, there would be no way to devise a linear separator that differentiates between the cases of $(0, 2)$, $(2, 0)$ and $(1, 1)$.

2. Programming Assignment: Perceptrons (code at: github.com/wumphlett)

```
Accuracy: 0.7924
F1-Score: 0.8106530463334549
Precision: 0.8888
Recall: 0.7451374916163649
Time taken for perceptron to execute training and classification: 0.25786685943603516
Time taken for our model implementation is approximately 1.18
```