Perceptron for basic formulas

Machine Learning Course A.A. 22/23

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1 Exercise

Give Perceptron-based multi-layer networks with hard thresholds and relative weights (without using learning) that implement simple Boolean functions such as: A and (not B), A xor B, ...

1.1 $A \wedge \neg B$

The formula I want to implement is $\phi = A \wedge \neg B$.

A	B	$\neg B$	$A \wedge \neg B$
0	0	1	0
0	1	0	0
1	0	1	1
1	1	0	0

Table 1: $A \wedge \neg B$ truth table

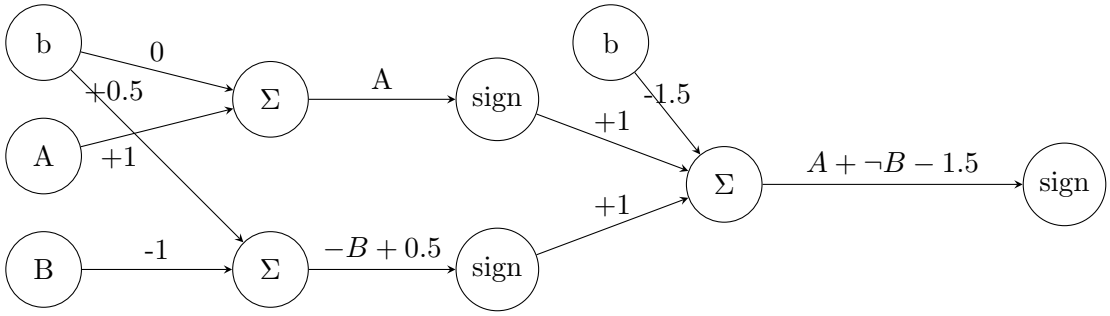

Figure 1: Perceptron for $A \wedge \neg B$ formula

1.2 $A \oplus B$

The formula I want to implement is $\phi = A \oplus B$.

A	B	$A \oplus B$
0	0	0
0	1	1
1	0	1
1	1	0

Table 2: XOR truth table

The xor operator can be seen as

$$\phi = DNF(A \oplus B) = (\neg A \wedge B) \vee (A \wedge \neg B)$$

in Disjunctive Normal Form, which is easier to implement.

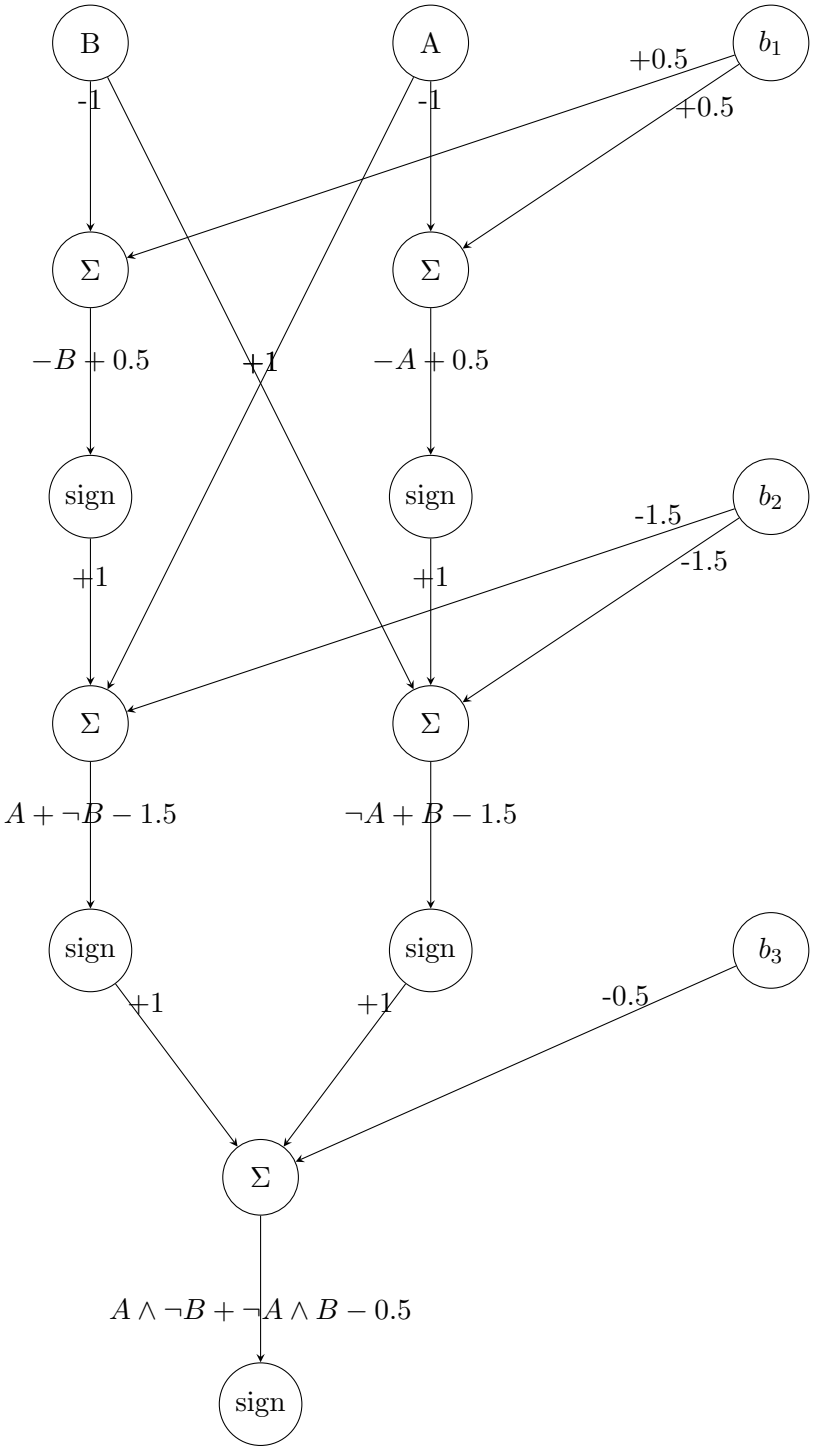

Figure 2: Perceptron for XOR operator