Introduction to neural networks

- Biological background
- Basic properties of artificial neural networks (ANNs)
- Single-layer networks and the delta rule

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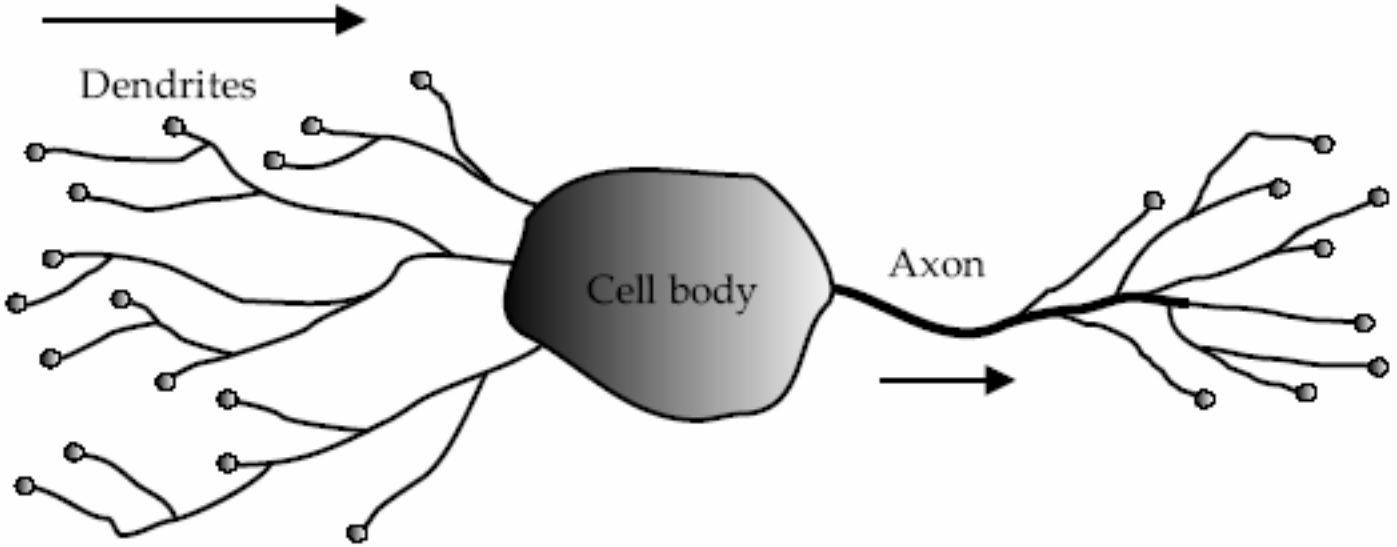

Figure 1.1: *A schematic illustration of a neuron.*

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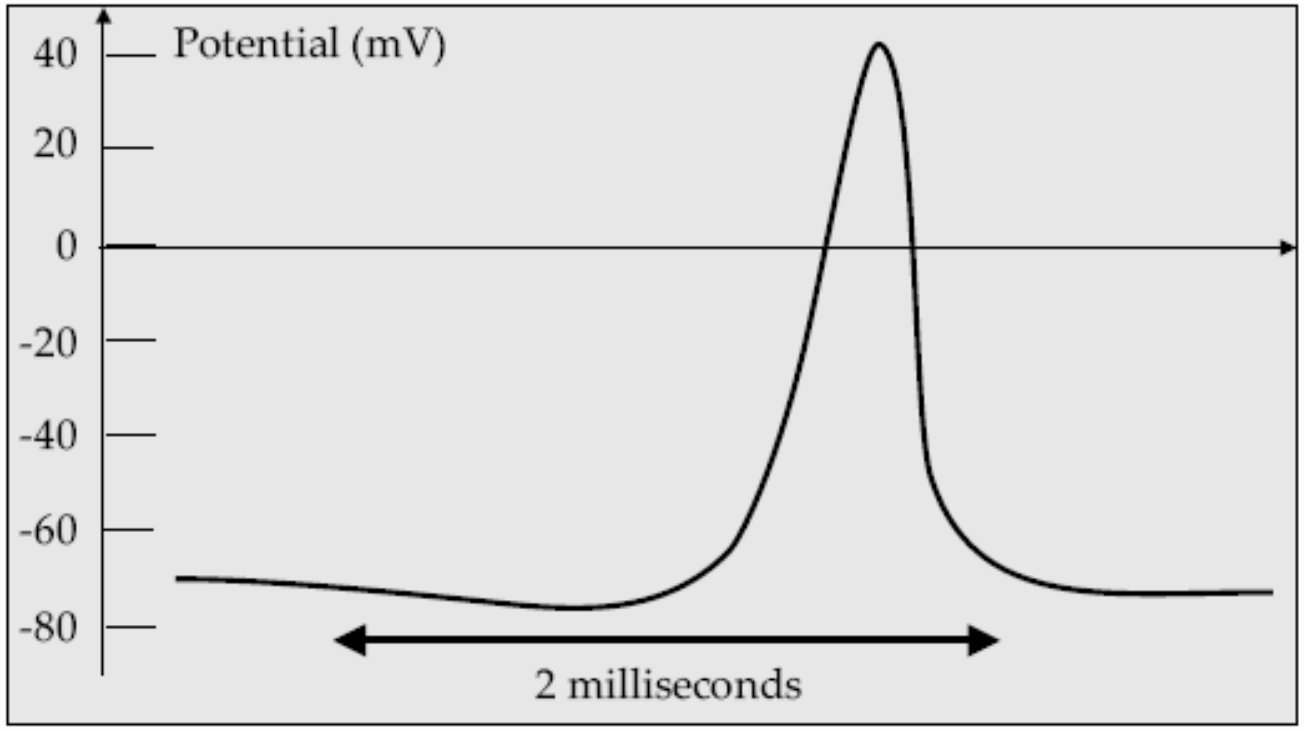

Figure 1.2: *A typical neural spike.*

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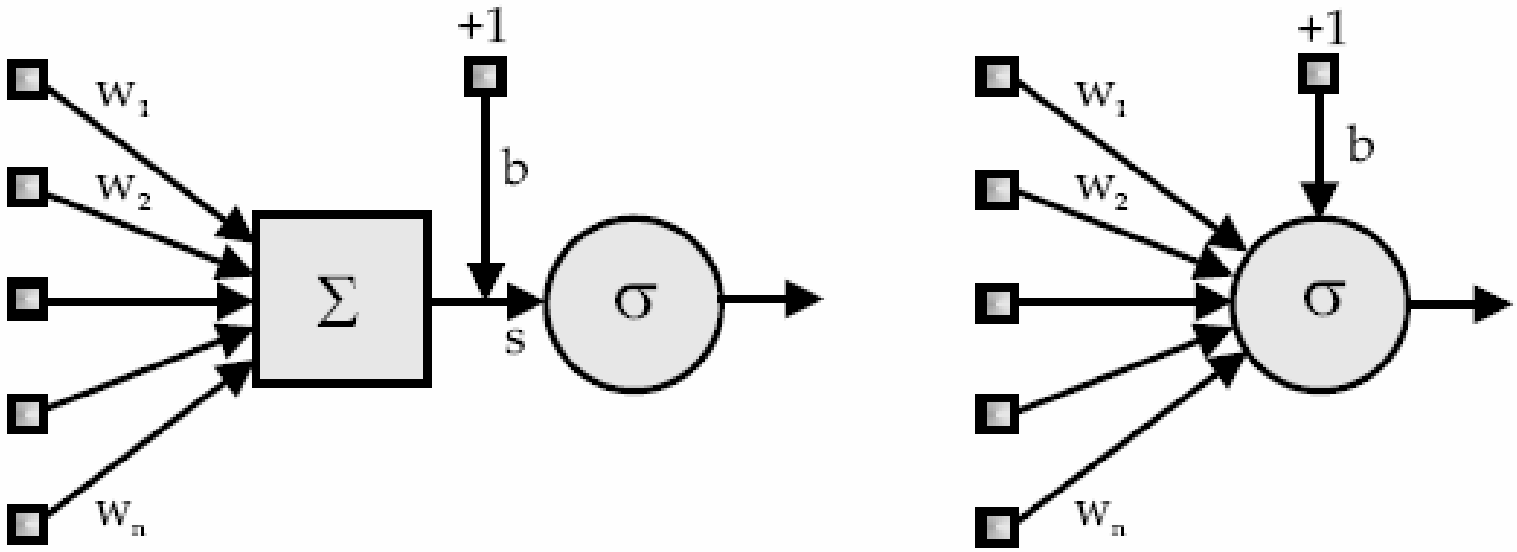

Figure 1.3: *The McCulloch–Pitts neuron is shown in the left panel. The signal flow is from left to right. The right panel shows the simplified notation which is normally used.*

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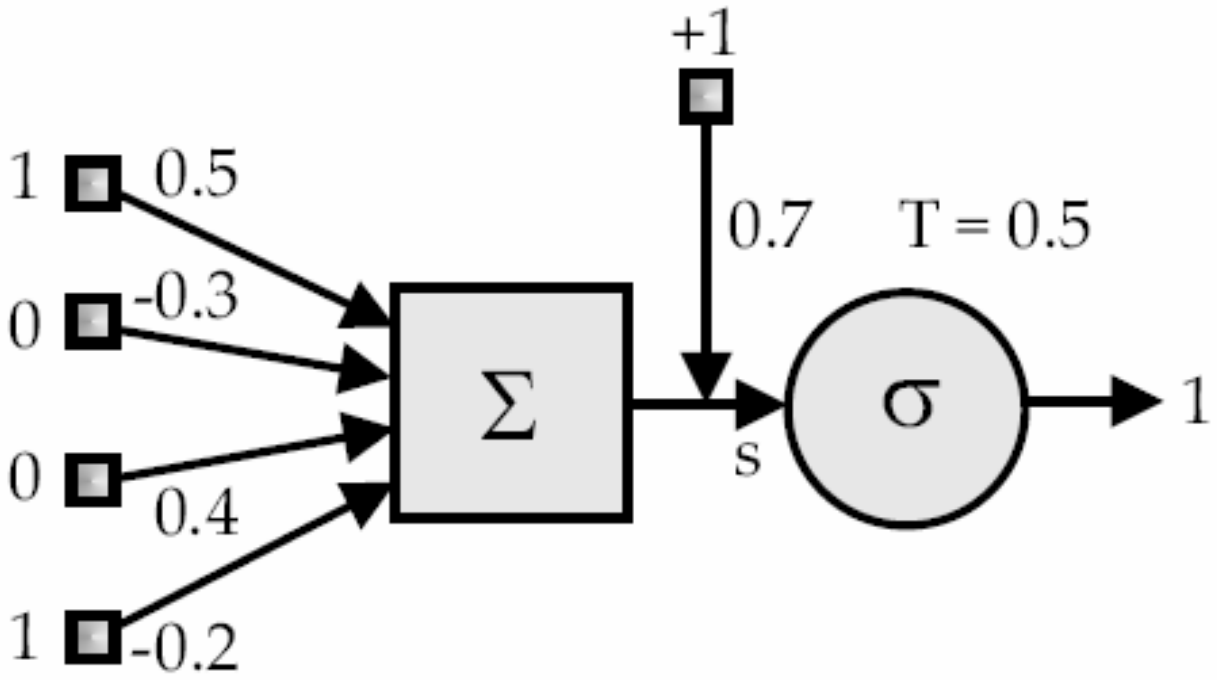

Figure 1.4: *An MCP neuron firing (see example 1.1).*

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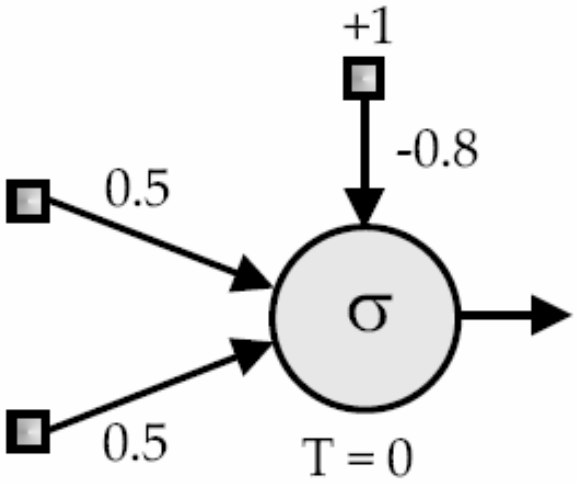

x_1	x_2	y
0	0	0
0	1	0
1	0	0
1	1	1

Figure 1.5: *An MCP neuron that implements the Boolean AND function.*

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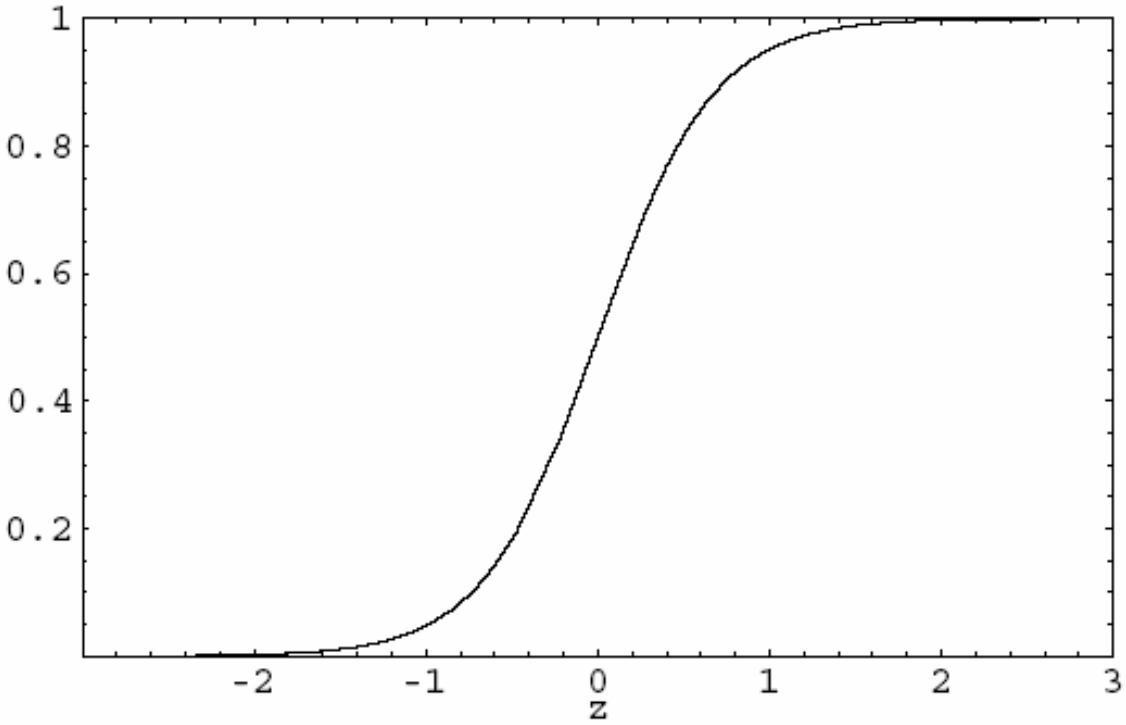

Figure 1.6: *A sigmoid with* $c = 3$.

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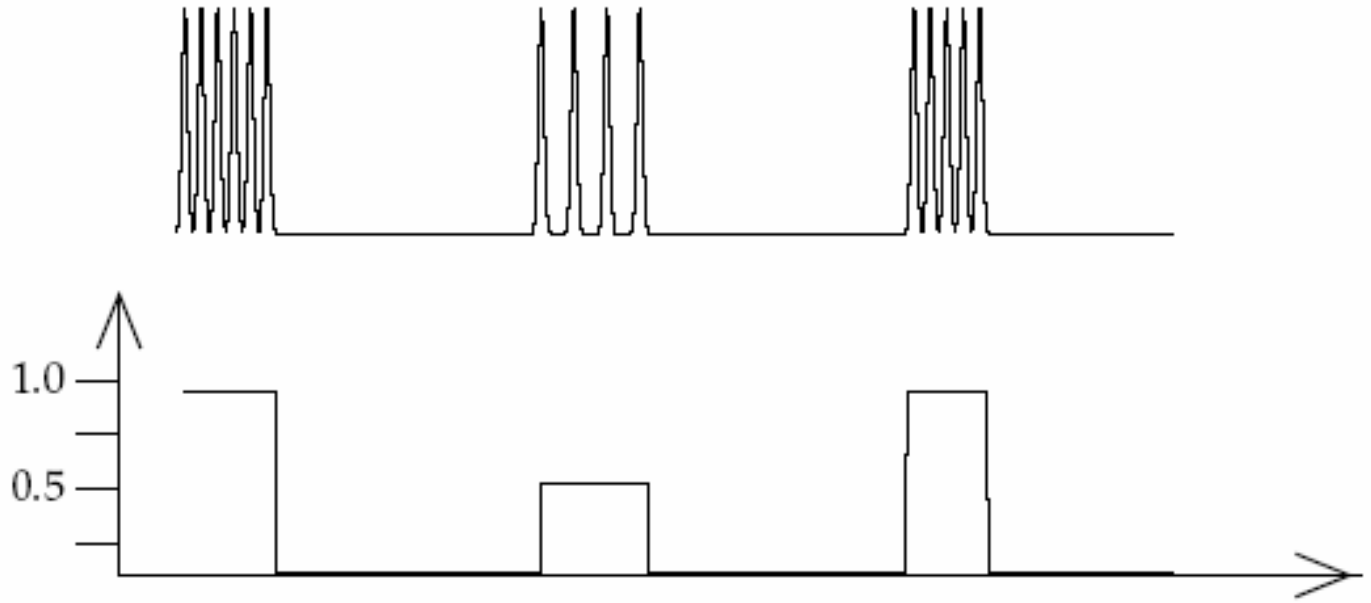

Figure 1.7: *A spike train from a neuron (upper graph) and the corresponding graded response.*

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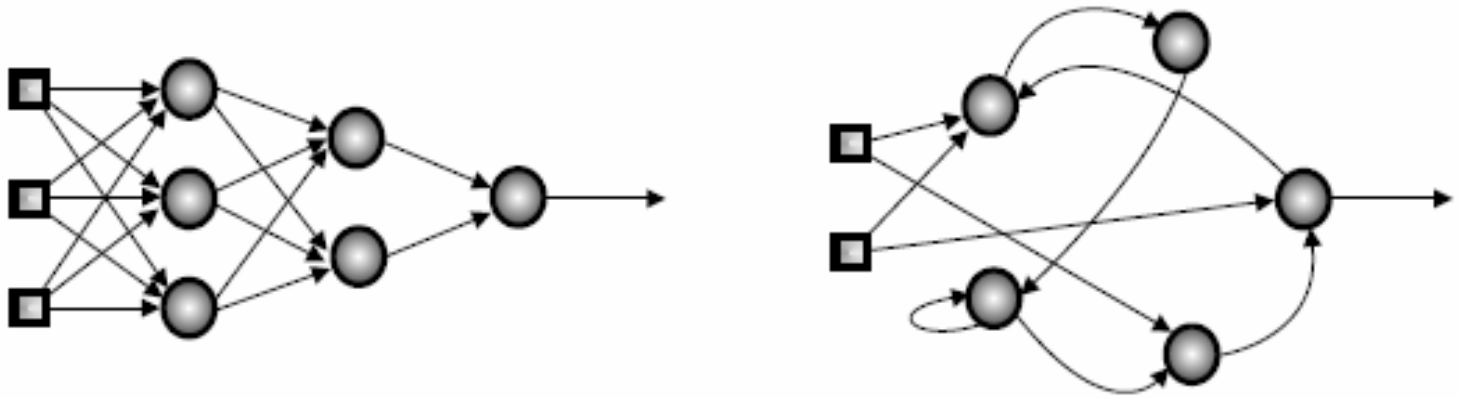

Figure 1.8: *A layered neural network (left) and a recurrent neural network. The signal flow is from left to right, except for the recurrent connections in the right panel.*

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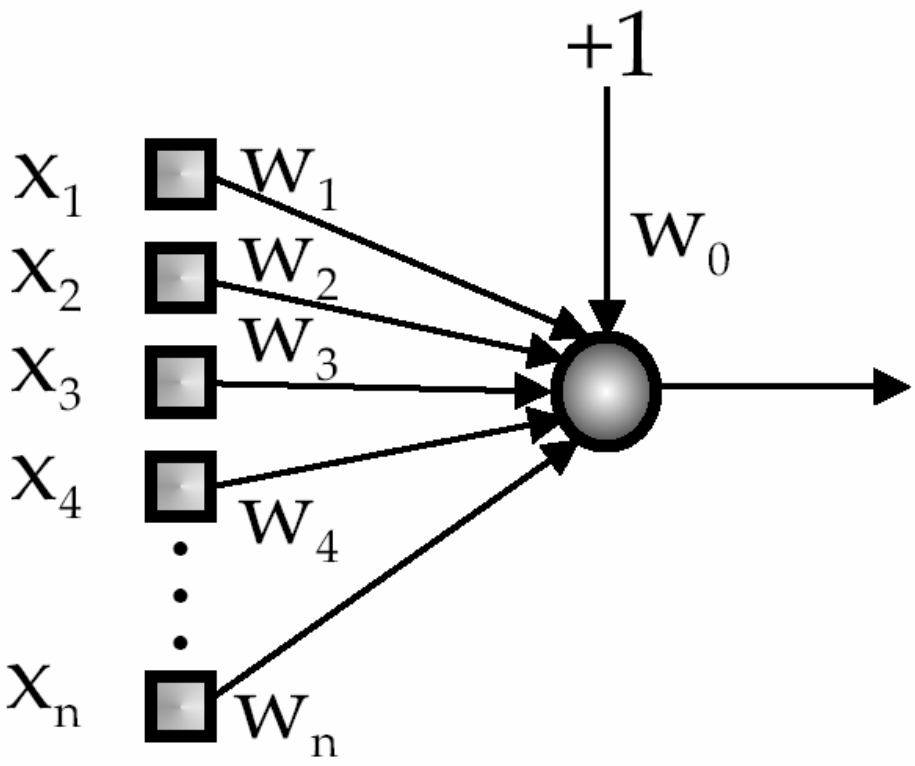

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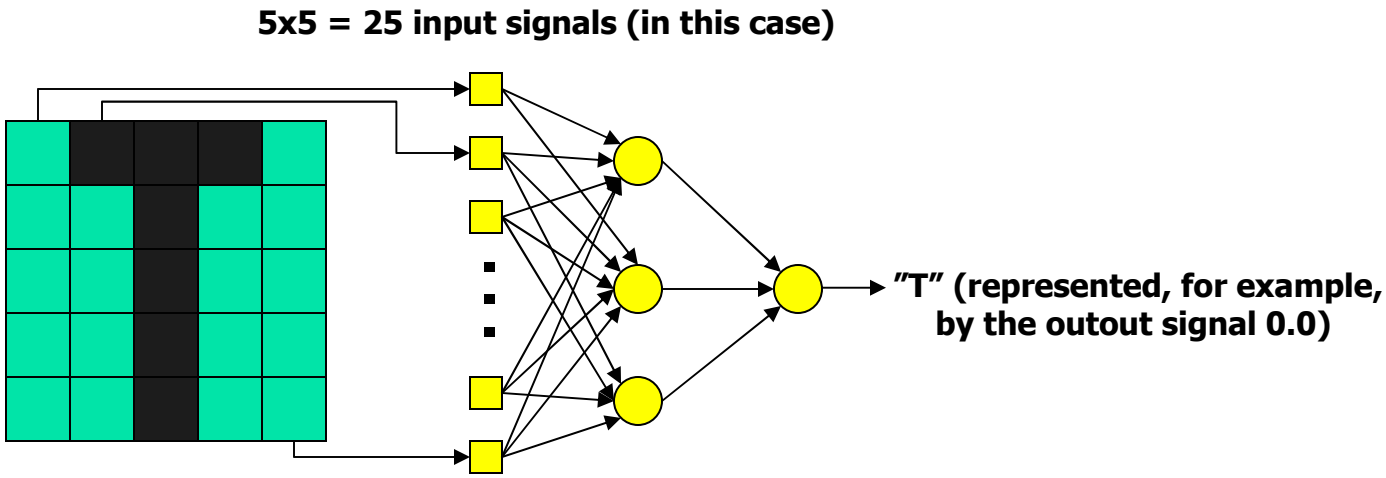
ANN example: character recognition



Desired outputs (examples): "T" -> 0.0, "A" -> 0.25, "B" -> 0.50, "H" -> 0.75, "O" -> 1.0

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Training data set, n input signals, 1 output signal

m	x_1	x_2	...	x_n	o_1
1	⋮	⋮	⋮	⋮	⋮
2	⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮	⋮
M	⋮	⋮	⋮	⋮	⋮

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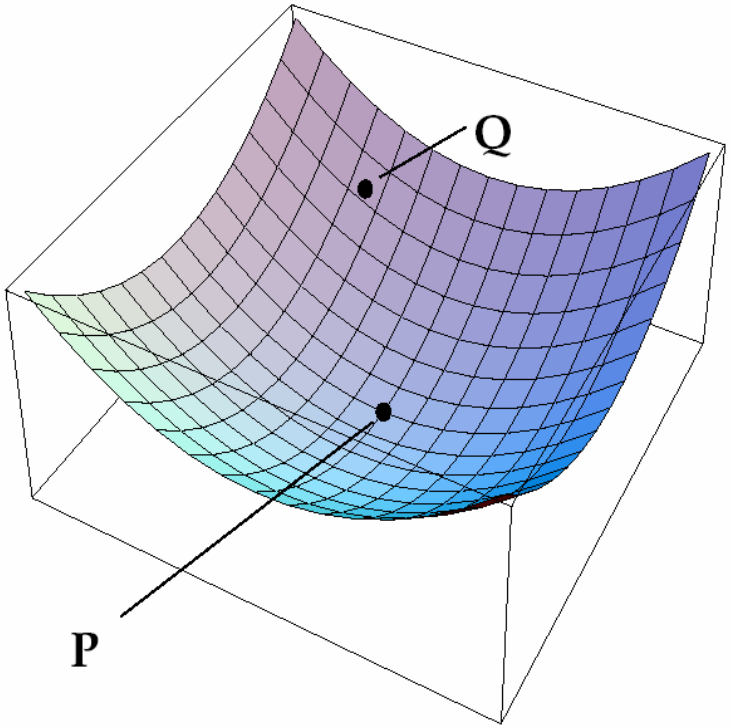

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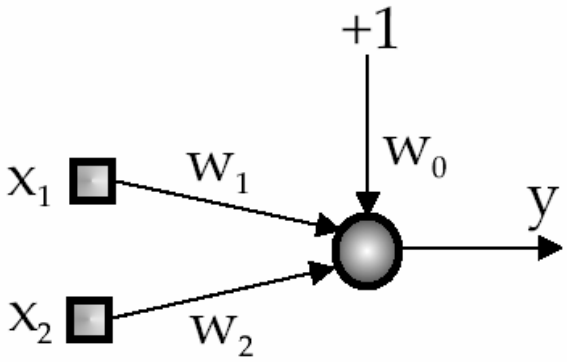

x_1	x_2	o
0	0	low
1	0	high
0	1	high
1	1	low

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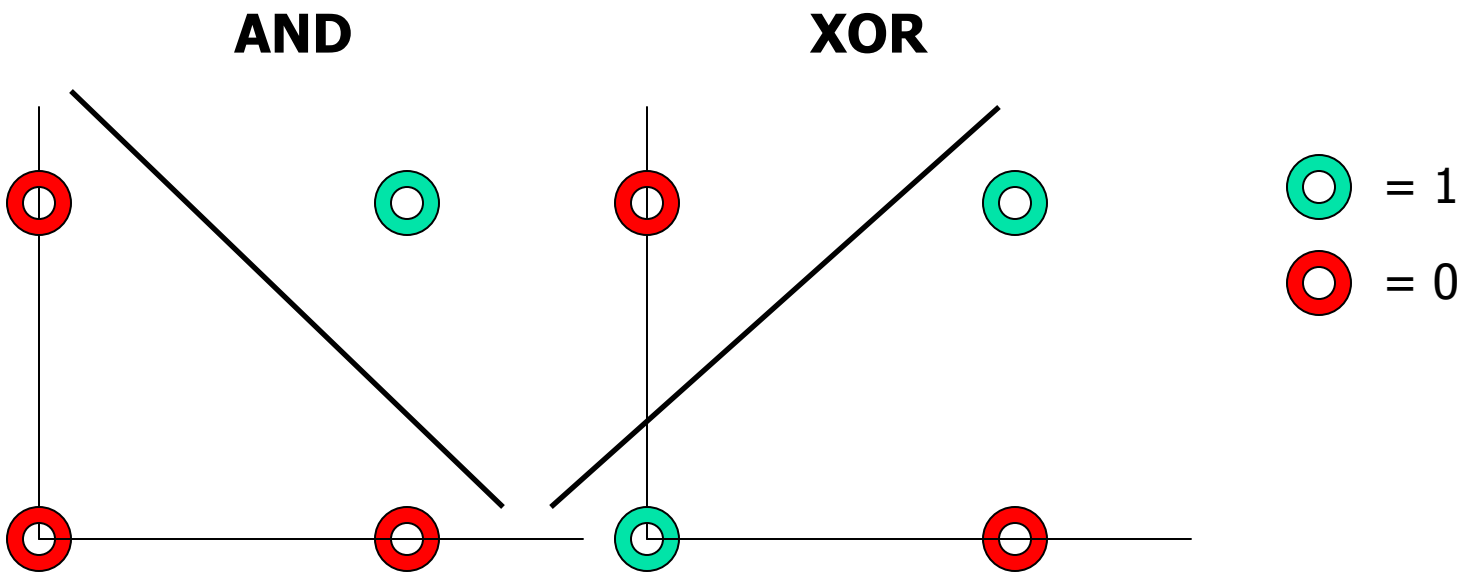

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