



Neural Networks & Deep Learning

Objectives



Objective

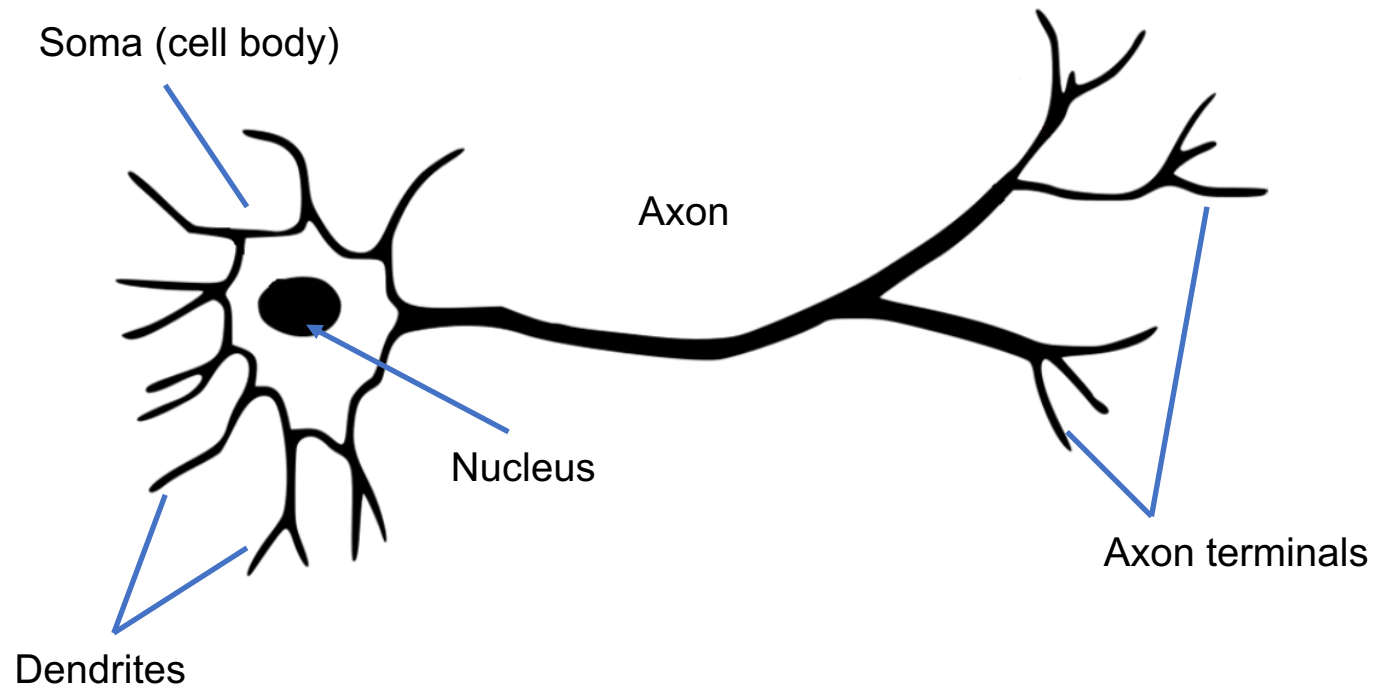
Describe the big-picture view of how neural networks work



Objective

Identify the basic building blocks and notations of deep neural networks

Illustrating A Biological Neuron



Neural Network

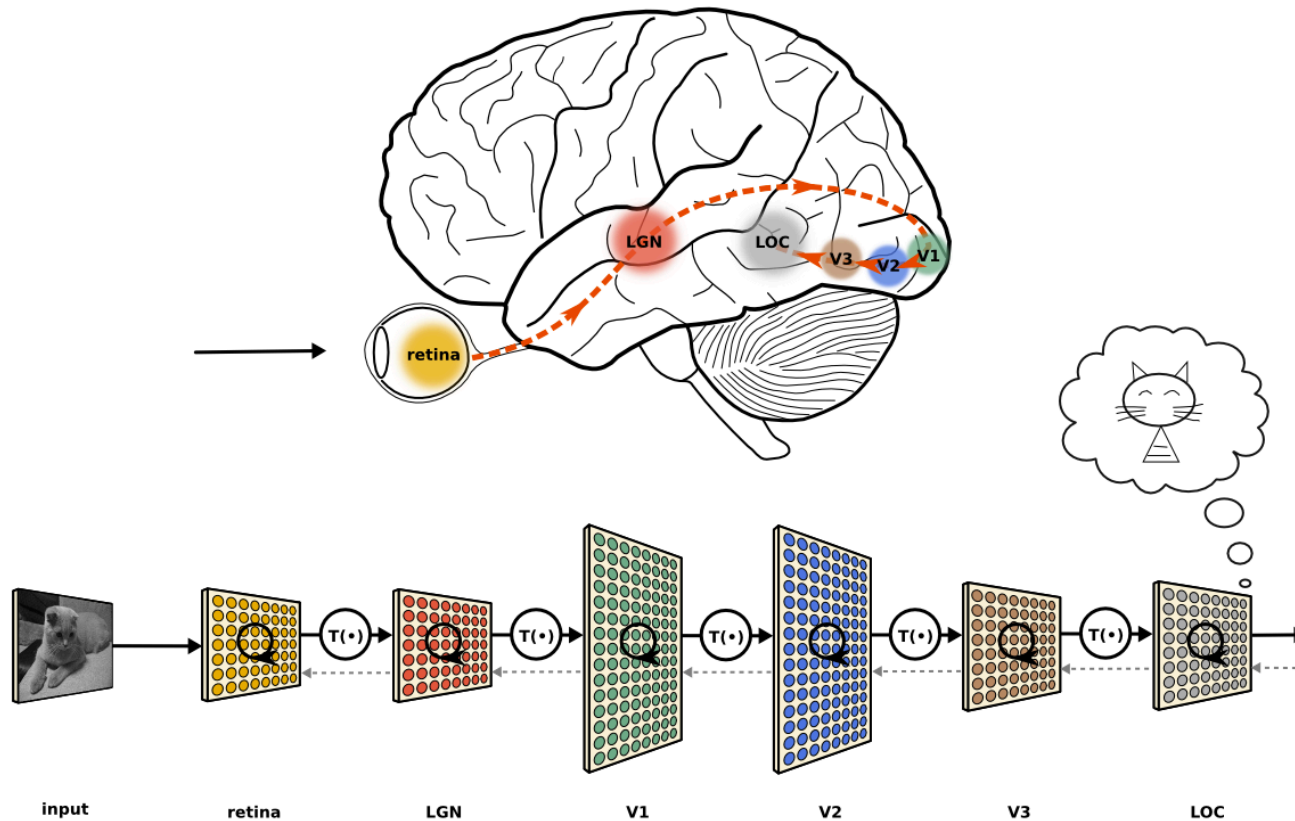
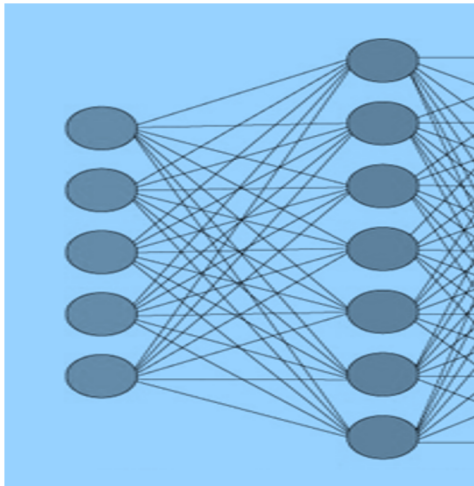
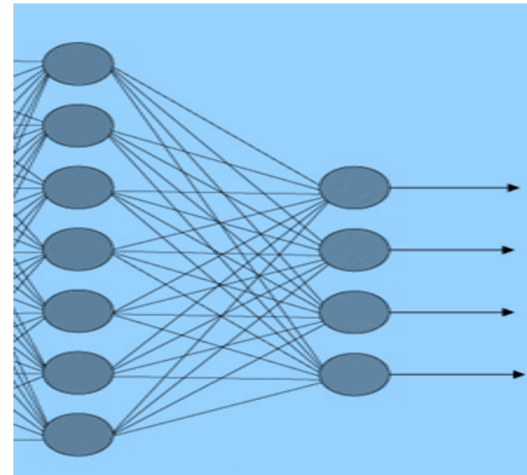


Figure source: <https://neuwritesd.org/2015/10/22/deep-neural-networks-help-us-read-your-mind/>

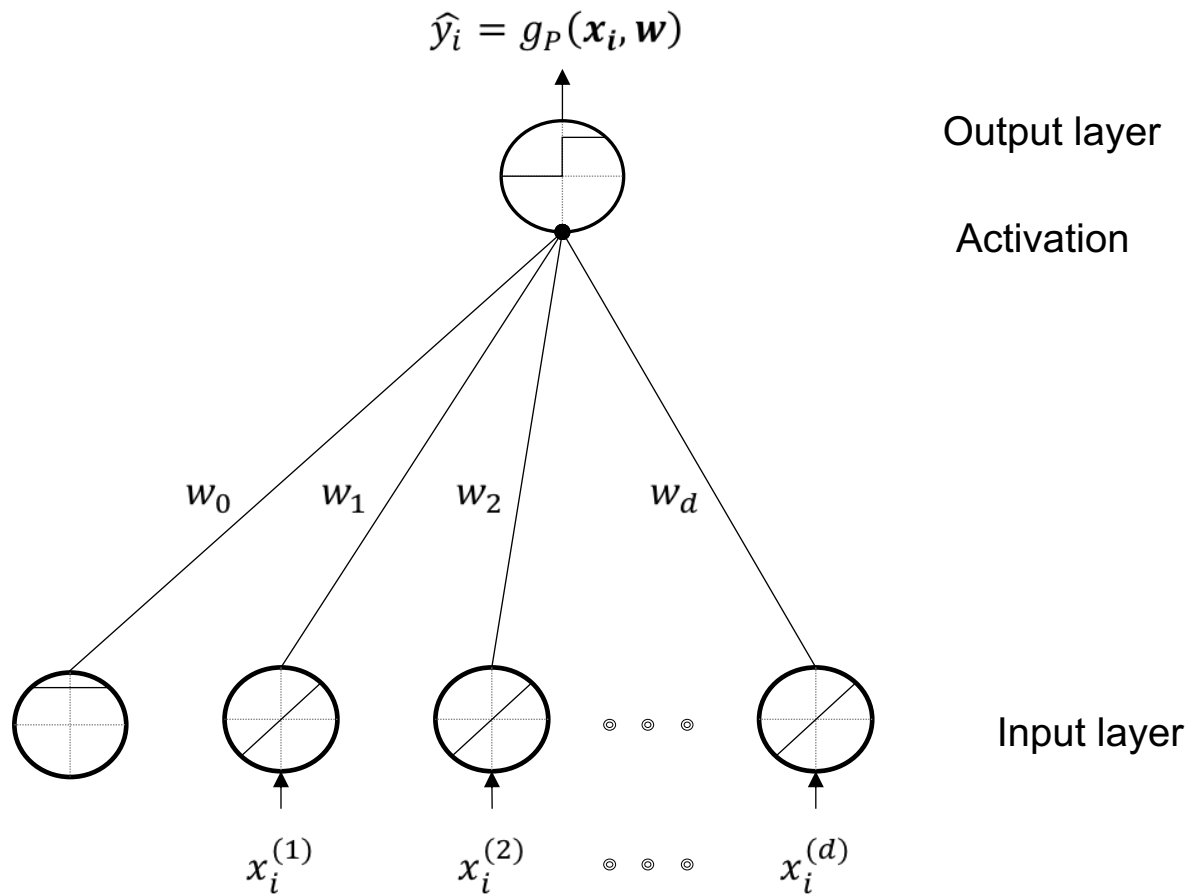
Artificial Neural Networks



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Building Artificial Neural Networks

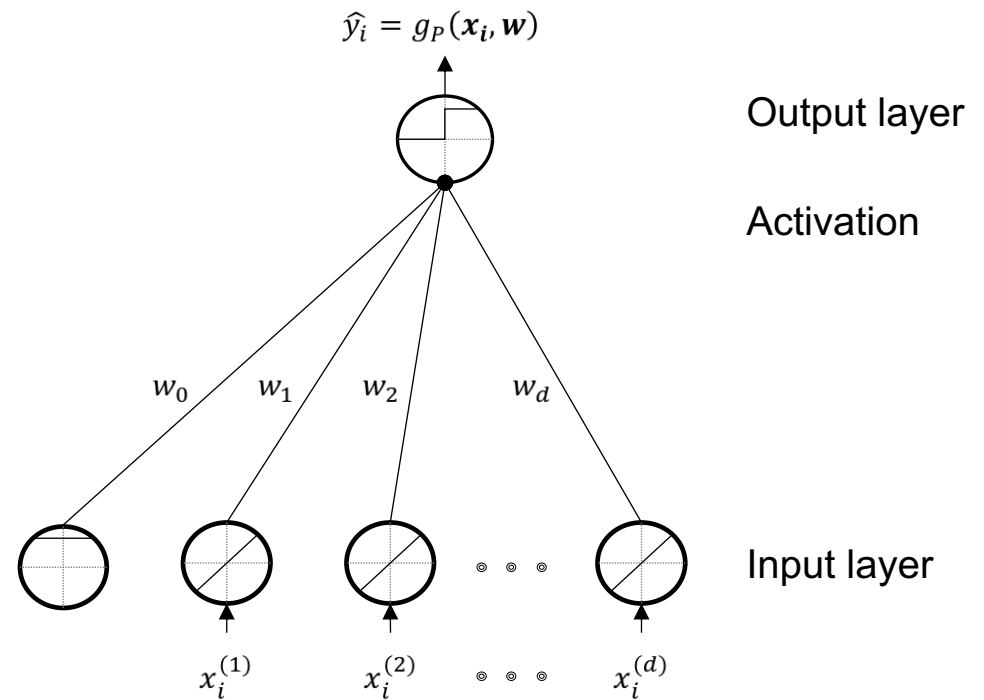


Building Artificial Neural Networks (cont'd)

What does this “neuron” do?

$$g_P(\mathbf{x}_i, \mathbf{w}) = \begin{cases} 1, & \text{if } \mathbf{w}^T \mathbf{x}_i > 0 \\ 0, & \text{otherwise} \end{cases}$$

➡ The Perceptron model



Logistic Neuron

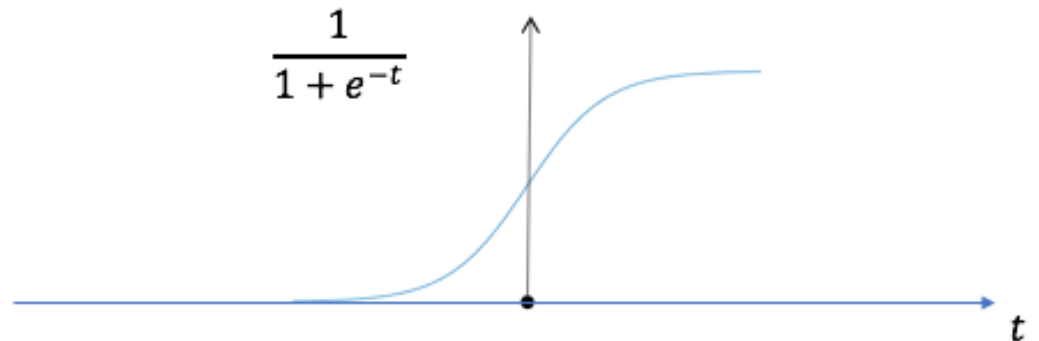
| In Perceptron:

$$g_P(\mathbf{x}_i, \mathbf{w}) = \begin{cases} 1, & \text{if } \mathbf{w}^T \mathbf{x}_i > 0 \\ 0, & \text{otherwise} \end{cases}$$

| If we let:

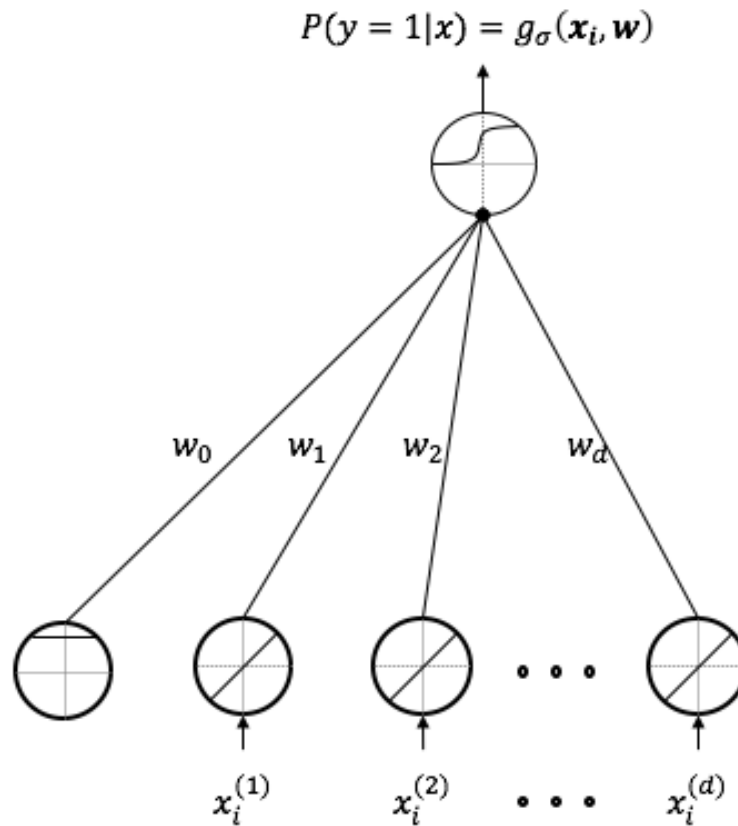
$$g_\sigma(\mathbf{x}_i, \mathbf{w}) = \frac{1}{1 + e^{-\mathbf{w}^T \mathbf{x}_i}}.$$

| The logistic function:



Logistic Neuron, continued

| We have:



A probability prediction

Activation

Input layer