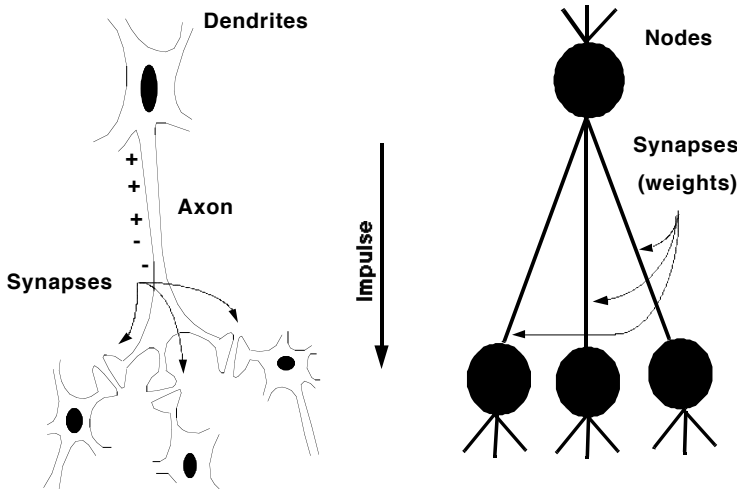
NEURAL NETWORKS

Today

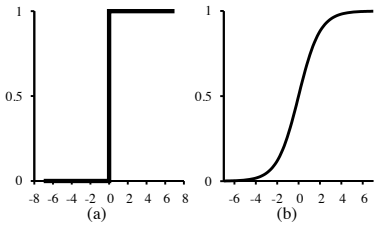
- Biological Inspiration
- Types of Networks
- Training a Feed Forward Network

Motivation: Our Nervous System

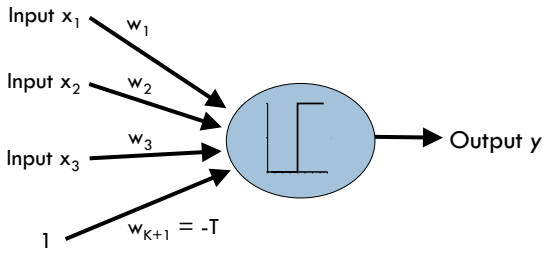


The Simplest Model

Activation functions



Threshold versus "dummy" variable



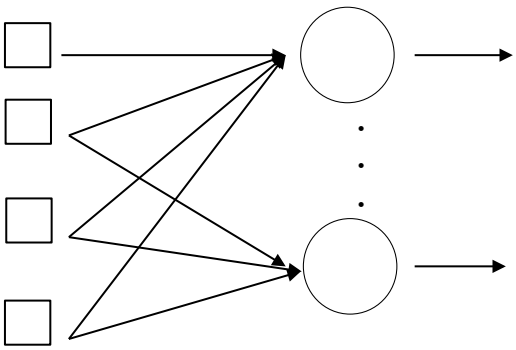
- Having a threshold T is equivalent to creating a "dummy" variable with value always 1

$$\sum_i x_i w_i \geq T \Longrightarrow 1$$

$$\sum_i x_i w_i - T \geq 0 \Longrightarrow 1$$

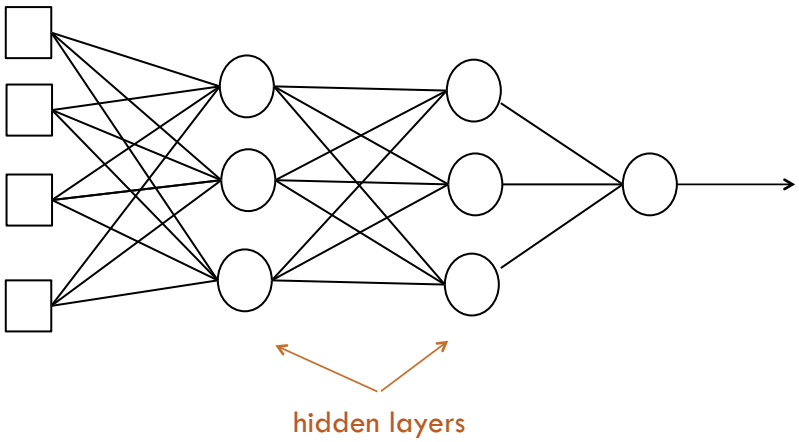
Types of networks

Perceptron Network

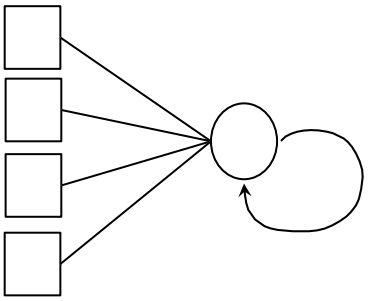


Reduces to K independent perceptrons

Feed Forward Neural Network



Recurrent Neural Network



Expressive Power

- Perceptron Network
  - Can classify any data that is linearly separable
  - Learns a linear decision boundary in the input space

- Feed Forward Neural Network
  - A single-layer network can represent any continuous function with arbitrary accuracy.
  - A multi-layer network can represent discontinuous functions with arbitrary accuracy.

Training a Feed Forward Network

Backpropagation

Backpropagation

Backpropagation

Backpropagation