POLITECHNIKA POZNAŃSKA

Poznan University of Technology

Basics of Smart Systems
exercise 1

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Exercise 1.1

There is a unipolar sigmoidal activation function

$$\varphi(v) = \frac{1}{1 + e^{-av}}, \quad a > 0,$$

Find asymptotes of functions; what is the value of the function for v=0?

Find derivative of function, prove that

$$\varphi'(v) = \frac{d\varphi(v)}{dv} = a\varphi(v)[1 - \varphi(v)]$$

What is the value of $\varphi'(0)$?

Draw a graph of the function

Exercise 1.2

Activation function is defined by formula

$$\varphi(v) = \tanh\left(\frac{av}{2}\right)$$

Find asymptotes of functions; what is the value of the function for v=0?

Find derivative of function, prove that

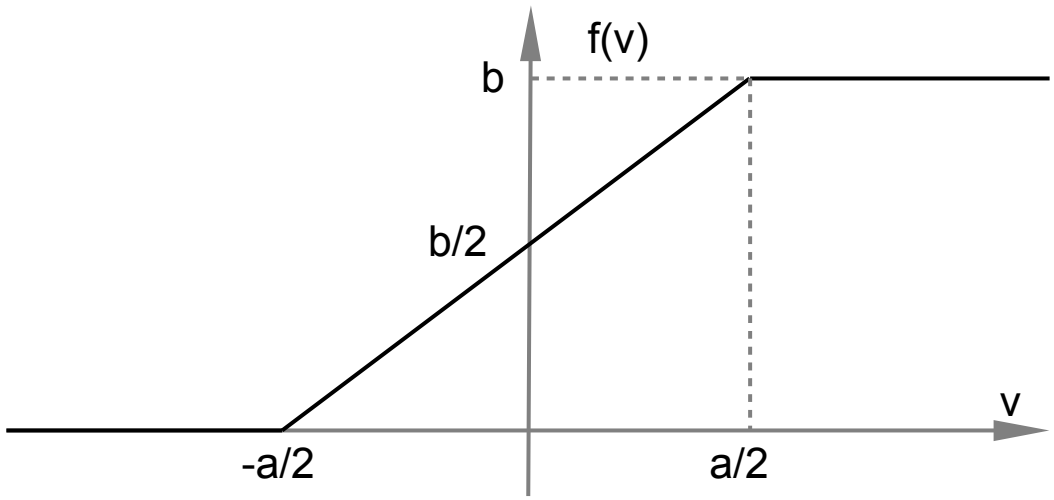
$$\varphi'(v) = \frac{d\varphi(v)}{dv} = \frac{a}{2}[1 - \varphi^2(v)]$$

What is the value of $\varphi'(0)$?

Draw a graph of the function

Exercise 1.3

Write the equation of the function shown in figure. What equation is when '**a**' goes to zero.



Exercise 1.4

Single neuron receives input signals from 4 different synapses. The values of this signals are $\underline{x}=[10, -20, 4, -2]^T$.

Synaptic weights are $\underline{w}=[0.8, 0.2, -1, -0.9]^T$.

Calculate the output signal of the neuron to assume a threshold signal (bias) equal to 0.

The calculations will be made for three diferent activation signal:

a) Linear function;

b) Step function;

c) Unipolar sigmoidal function wher a=1.

Exercise 1.5

Sketch a multi-layer feedforward networks with all the connections and weights different from zero. The network consists of:

- 10 inputs signal,
- 2 hidden layers (the first has 4 neurons, the other has 3 neurons),
- single output neuron.

What are the dimensions of each matrix weights?