UNIVERSITÀ DI PISA

Computer Engineering

Electronic and Communication Systems

Perceptron

Project Report

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1 | Introduction

1.1 Problem Description

The main goal of the activity described in this report is the following: realizing a network implementing a **perceptron** with a **sigmoid activation function**.
Before describing the whole design and implementation process a very little introduction about the architecture must be done.
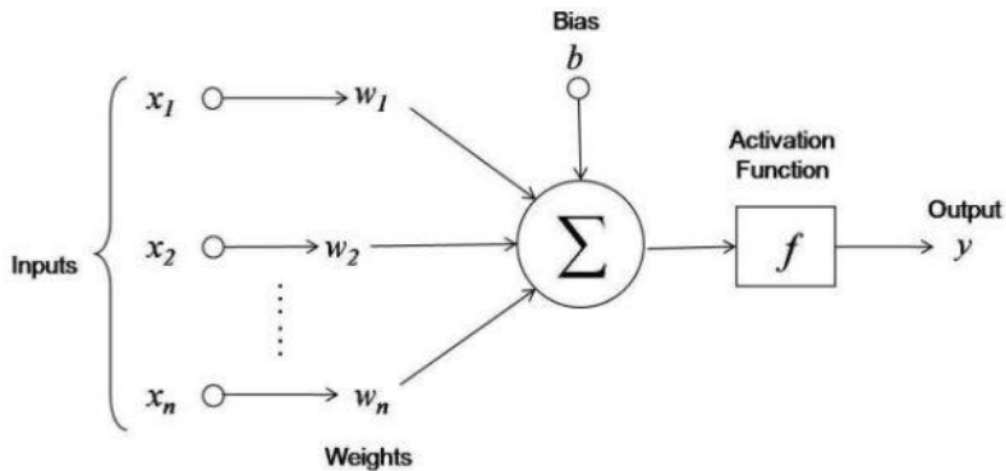

Figure 1.1: Perceptron Architecture

A **Perceptron** is a *binary classifier that maps his inputs to a specific output $y = f(z)$, where $f()$ is the* **activation function** *of the perceptron.* The inputs are real numbers and the input z of the activation function is obtained as:

$$z = b + \sum_{i=0}^{N_L-1} w_i * x_i \qquad (1.1)$$

Every input x_i, every weight w_i and the bias b are real numbers in the range of $[-1, 1]$.

The **activation function**, in our case, will be a **sigmoid function**, described as follows:

Figure 1.2: Sigmoid Function Plot
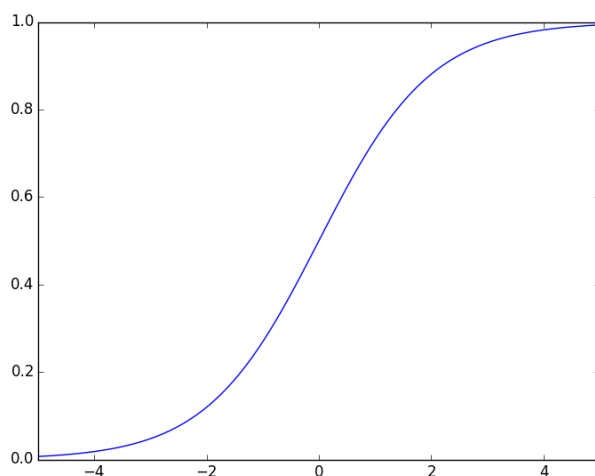
$$y = \frac{1}{1 + e^{-z}} \qquad (1.2)$$

Where z is the result of the equation (1.1).

1.2   Applications

A single perceptron is the building block of *artificial neural networks*, in which different layers of perceptrons are connected. The output of the neural network is a real number and could be use to classify *complex objects*: patterns, human faces, handwritings, medical diagnosis, e-mail spams.

Figure 1.3: Neural network example
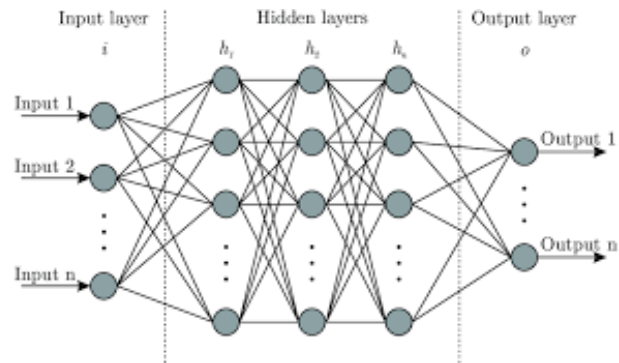
In the image abova there is a simple schema of a neural network, in which the circles represent the perceptrons.

1.3   Possible Architectures

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2 | Architecture

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