NEURAL NETWORKS AND DEEP LEARNING

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Kerman Sanjuan Malaxechevarria

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Chapter 1

Introduction to Neural Networks

1.1 DEFINITION AND USES

A neural network is a network or circuit of neurons, composed by artificial neurons. These networks are used on the field of artificial intelligence, specifically, as a machine learning algorithm. The applications of this algorithm are many, for example, hand-writing recognition, this will be the main example of the first chapter. As we said , neural networks are circuits made out of neurons. But, what does a neuron mean? Formally, an artificial neuron is a mathematical function conceived as a model of biological neurons. Each neuron has it's multiple own inputs and a single output, the output will always depend on the inputs and the "type" of neuron. Now, we will talk about Perceptrons, which are the most simple type of artificial neuron.
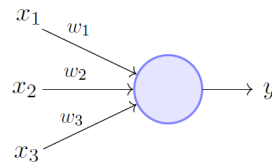
Figure 1.1: Graphical Example of a Neural Network
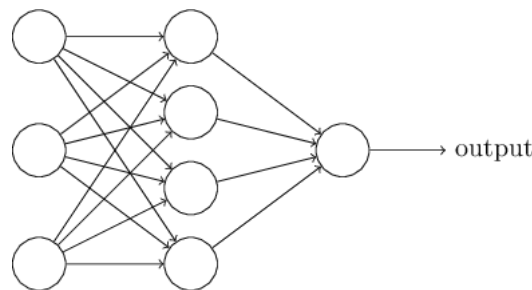
1.2 PERCEPTRONS

The perceptron takes a several binary inputs and produces a single binary output. x_1, x_2, x_3 are the inputs, and w_1, w_2, w_3 the weights , these weights determines the relevance of the input on the output. In other words, a way you can think about a perceptron is that it's

Figure 1.2: Perceptron

Perceptron Model (Minsky-Papert in 1969)

a device that makes decisions by weighing up evidence. Depending on the weights and the threshold, we can get different models of decision making.

Obviously, with only one perceptron we are not able to create a neural network, that is why they're structured in such a way that three layers are generated (in most of cases, there are more possibilities).

Figure 1.3: Basic Structure of a Neural Network
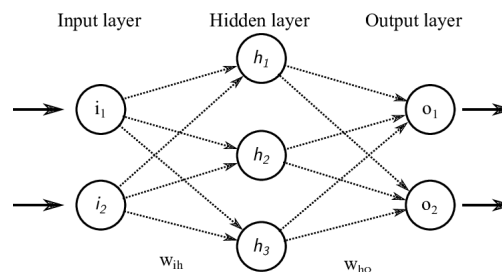
1.3 SIGMOID NEURONS

The main audience of this report could be any organization or government, obviously the ability to predict the consequence of an accident is something that generates a lot of interest. The applications of this predictions could be used for example, for real-time accident prediction, studying accident hot-spot locations, casualty analysis and extracting cause and effect rules to predict accidents, or studying the impact of precipitation or other environmental stimuli on accident occurrence.