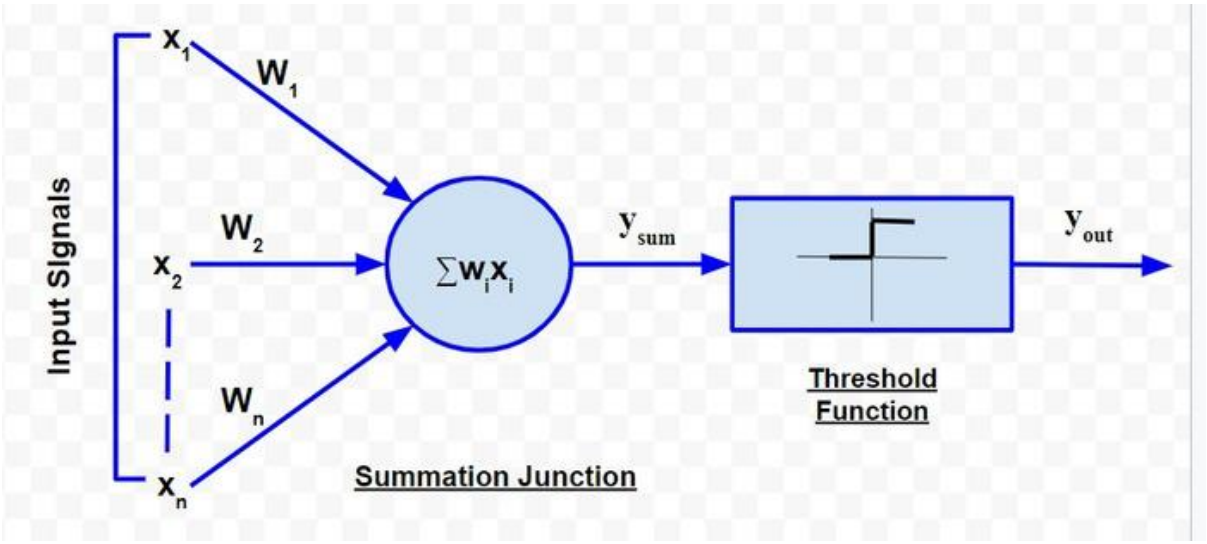
ADALINE Network Model

Adaptive Linear Neural Element (ADALINE) is an early single-layer ANN.

As depicted in the below diagram, it has only output neurons. The output value can be +1 or -1.

A bias input x_0 (where $x_0 = 1$) having a weight w_0 is added. The activation function is such that if weighted sum is positive or 0, the output is 1, else it is -1



The supervised learning algorithm adopted by ADALINE network is known as **Least Mean Square (LMS)** or **DELTA Rule.** A network combining a number of ADALINE is termed as **MADALINE (many ADALINE)**. MEADALINE networks can be used to solve problems related to non-linear separability.

Adaline madaline comes under the supervised learning networks.

- **ADALINE:**
- Known as Adaptive Linear Neuron
- Adaline is a network with a single linear unit
- The Adaline network is trained using the delta rule

1.1 Architecture

As already stated Adaline is a single-unit neuron, which receives input from several units and also from one unit, called bias. An Adeline model consists of trainable weights. The inputs are of two values (+1 or -1) and the weights have signs (positive or negative).

Initially random weights are assigned. The net input calculated is applied to a quantizer transfer function (possibly activation function) that restores the output to +1 or -1. The Adaline model compares the actual output with the target output and with the bias and the adjusts all the weights.

1.2 Training Algorithm

The Adaline network training algorithm is as follows:

Step0: weights and bias are to be set to some random values but not zero. Set the learning rate parameter α.

Step1: perform steps 2-6 when stopping condition is false.

Step2: perform steps 3-5 for each bipolar training pair s:t

Step3: set activations foe input units i=1 to n.

Step4: calculate the net input to the output unit.

Step5: update the weight and bias for i=1 to n

Step6: if the highest weight change that occurred during training is smaller than a specified tolerance then stop the training process, else continue. This is the test for the stopping condition of a network.

1.3 Testing Algorithm

It is very essential to perform the testing of a network that has been trained. When the training has been completed, the Adaline can be used to classify input patterns. A step function is used to test the performance of the network. The testing procedure for the Adaline network is as follows:

Step0: initialize the weights. (The weights are obtained from the training algorithm.)

Step1: perform steps 2-4 for each bipolar input vector x.

Step2: set the activations of the input units to x.

Step3: calculate the net input to the output units

Step4: apply the activation function over the net input calculated.

2. Madaline

- Stands for multiple adaptive linear neuron
- It consists of many adalines in parallel with a single output unit whose value is based on certain selection rules.
- It uses the majority vote rule
- On using this rule, the output unit would have an answer either true or false.
- On the other hand, if AND rule is used, the output is true if and only if both the inputs are true and so on.
- The training process of madaline is similar to that of adaline

2.1 Architecture

It consists of "n" units of input layer and "m" units of adaline layer and "1"

Unit of the Madaline layer

Each neuron in the adaline and madaline layers has a bias of excitation "1"

The Adaline layer is present between the input layer and the madaline layer; the adaline layer is considered as the hidden layer.

2.2 Uses

The use of hidden layer gives the net computational capability which is not found in the single-layer nets, but this complicates the training process to some extent.

2.2 Training Algorithm:

In this training algorithm, only the weights between the hidden layers are adjusted, and the weights for the output units are fixed. The weights v1, v2……vm and the bias b0 that enter into output unit Y are determined so that the response of unit Y is 1.