Activation Functions

Dr. K. Vijayarekha
Associate Dean
School of Electrical and Electronics Engineering
SASTRA University, Thanjavur-613 401
Table of Contents

1. Activation Functions ................................................................ 3

1.1. Identity functions ................................................................................................................. 3
1.2. Binary step function .............................................................................................................. 3
1.3. Sigmoid functions .................................................................................................................. 3
1.4. Binary sigmoid ...................................................................................................................... 3
1.5. Bipolar Sigmoid ..................................................................................................................... 3
1. Activation Functions

The operation of an artificial neural network is to sum up the product of the associated weight and the input signal and produce an output or activation function. For the input unit this activation function is the identity function. The neuron of a particular layer gets the same type of activation function. In almost all cases non-linear activation functions are used.

The various types of activation functions used in a neural network are identity function, binary step function, binary sigmoid functions and bipolar sigmoid functions.

1.1. Identity functions

This function is denoted by $f(x) = x$ for all $x$

Single layer neural networks make use of a step function while converting a continuously varying input function to a binary output (0 or 1) or a bipolar output (1 or -1).

1.2. Binary step function

This function makes use of a threshold.

A binary step function with a threshold $T$ is given by

$$f(x) = 1 \text{ if } x \geq T$$
$$f(x) = 0 \text{ if } x < T$$

1.3. Sigmoid functions

Sometimes S shaped functions called sigmoid functions are used as activation functions which are found useful. Logistic and hyperbolic tangent functions are commonly used sigmoid functions. The sigmoid functions are extensively used in back propagation neural networks because it reduces the burden of complication involved during training phase.

1.4. Binary sigmoid

The logistic function, which is a sigmoid function between 0 and 1 are used in neural network as activation function where the output values are either binary or varies from 0 to 1. It is also called as binary sigmoid or logistic sigmoid.

1.5. Bipolar Sigmoid

A logistic sigmoid function can be scaled to have any range of values which may be appropriate for a problem. The most common range is from -1 to 1. This id called bipolar sigmoid.