**Deep Learning**

**Feedforward Neural Network - Backpropagation**

**Example No. 1**

Consider the following artificial neural network, with the current weights as:

***v*01** = **0.4 *v*02** = **0.7 *w*01** = **0.1**

***v*11** = **0.2 *v*12** = **0.2 *w*11** = **0.3**

***v*21** = **0.7 *v*22** = **0.1 *w*21** = **0.6**

The input pattern being presented to the network is:

**s = [ 0.9 0.1 ]**

The corresponding output (target) pattern is:

**t = [ 0.9 ]**

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Use linear activation functions (y = x) and a learning rate of 0.2.

Determine the updated weights by applying standard back-propagation algorithm.

Solution

1. **Forward Propagation (feedforward stage)**

Response of Hidden Neurons

Response of Output Neuron

1. **Backpropagation of Error**

Error for Output Neuron

Errors for Hidden Neurons

Weight Adjustments for Output Layer

Weight Adjustments for Hidden Layer

1. **Weight Update**

Weight Updates for Output Layer

Weight Updates for Hidden Layer

**Example No. 2**

Consider the following feedforward neural network,



where the current weights are:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

The input pattern being presented to the network is . The corresponding output (target) pattern is . Use linear activation functions and a learning rate of . Determine the updated weights by applying standard back-propagation algorithm (forward propagation (2 marks), back-propagation (3 marks) and Updating of weights (1 mark)).

Solution

1. **Forward Propagation (feedforward stage)**

Response of Hidden Neurons

Response of Output Neuron

1. **Backpropagation of Error**

Error for Output Neuron

Errors for Hidden Neurons

Weight Adjustments for Output Layer

Weight Adjustments for Hidden Layer

1. **Weight Update**

Weight Updates for Output Layer

Weight Updates for Hidden Layer