Numericals from Backpropagation

1. Draw the neural architecture and calculate the output of a neural network having two hidden layers each with 2 neurons, single output neuron with sigmoid activation function applied to all network, bias b=0.5, all associated weights are 1 and input matrix is [1 2 3 1].

2. Draw the neural architecture and compute output of a neural network with input x=[1 2 -1], 1 hidden layer with 1 neuron, activation function in network=f(x)=1/(1-x), weight vectors w=[1 0 -1] and v=[0.5] respectively and bias b=0.

3. Draw the neural architecture for a single linear output neuron with input x=2, weight=0.5, bias b=0.1, target output=1 and learning rate α =0.1. Considering MSE loss function $L=(1/2)(y-t)^2$, find out the updated weight and bias after one forward pass through the network.

4. Draw the neural architecture for a single linear output neuron with inputs x_1=1, x_2=2 w_1=1, w_2=-1, bias b=0.1, target output t=1.2 and learning rate α =0.1. Considering MSE loss function $L=(1/2)(y-t)^2$, find out the updated weights w_1, w_2=0.5 and bias after one forward pass through the network.

5. Draw the neural architecture for a perceptron with single output neuron using sigmoid activation function and MSE Loss function with input x=1, weight w=2, bias b=-1, target output t=0 and learning rate α=0.1. Compute the updated weight and bias value after one forward pass through the network.

6. Draw the neural architecture for a neural network with 1 hidden layer containing single neuron and single output neuron using sigmoid activation function and MSE Loss function with input x=1, weight w=[0.5,-1.5], bias b=[0,0.1], target output t=0 and learning rate α=0.1. Compute the updated weights and bias values after one forward pass through the network.

Numericals from Momentum based Learning and parameter specific learning.

7. Using the concept of momentum based learning equations, calculate the updated velocity v and weight w after 1st and 2nd iterations if loss function $L=(1/2)(w-3)^2$ and friction parameter $\beta=0.9$, provided initial parameters of weight and velocity=0.

8. Using the concept of Nesterov momentum based learning equations, calculate the updated velocity v and weight w after 1st and 2nd iterations if loss function $L=(1/2)(w-3)^2$ and friction parameter $\beta=0.9$, provided initial parameters of weight and velocity=0.

9. For a neural network using the concept of parameter specific learning with initial values of parameters=0, learning rate=0.1, $\varepsilon=10^{-8}$,loss function $L=(1/2)(w-3)^2$, compute the updated values of weights after 1st and 2nd iterations if

   (a) The network is using the Adagrad method with initial parameter aggregate value $A_i=0$.
   (b) The network is using the RMSprop method with initial parameter aggregate value $A_i=0$ and $\rho=0.9$.