neural-network-matrix.R

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```
# Problem 5

# Part A

rm(list=ls())
## define the initial weights, input and sigmoid function

# Hidden Input Layer
weight_ih<- c(0.5, 0.6, 0.8, 0.6, 0.2, 0.7 ,0.9, 0.8, 0.4, 0.2)
weight_ih
```

```
##  [1] 0.5 0.6 0.8 0.6 0.2 0.7 0.9 0.8 0.4 0.2
```

```
Mw_ih<- matrix(weight_ih , nrow = 5, ncol = 2,byrow = FALSE)
Mw_ih
```

```
##      [,1] [,2]
## [1,]  0.5  0.7
## [2,]  0.6  0.9
## [3,]  0.8  0.8
## [4,]  0.6  0.4
## [5,]  0.2  0.2
```

```
# Hidden Output Layers
weight_ho<-c(0.5,0.9,0.9)
weight_ho
```

```
## [1] 0.5 0.9 0.9
```

```
Mw_ho<-matrix(weight_ho,nrow=3,ncol=1)
Mw_ho
```

```
##      [,1]
## [1,]  0.5
## [2,]  0.9
## [3,]  0.9
```

```
# Input Layer
i<-c(1, 0.4, 0.7, 0.7, 0.2)
i
```

```
## [1] 1.0 0.4 0.7 0.7 0.2
```

```
# Sigmoid Function
sigmoid <-function(x )
{ z=1/(1+exp(-x))
return(z)
```

```
}


# i %*% Mw_ih
out_hiddenL<-  sigmoid (i %*% Mw_ih)
input_outputL<- c(1,out_hiddenL)
is.vector(input_outputL)
```

```
## [1] TRUE
```

```
out_outL<-  sigmoid (  input_outputL%*% Mw_ho )

## Back propagation calculation
Actual<-.90
eta<- .1
# error
e<-out_outL-Actual
e
```

```
##            [,1]
## [1,] -0.0135677
```

```
# Little delta
delta<- -1*(out_outL)*(1-out_outL)*e
delta
```

```
##             [,1]
## [1,] 0.001365861
```

```
# Large delta
DELTA<-eta*delta%*%input_outputL
DELTA
```

```
##              [,1]         [,2]         [,3]
## [1,] 0.0001365861 0.0001165366 0.0001194244
```

```
# Update Hidden Output with Large delta
New_ho<-Mw_ho+t(DELTA)
New_ho
```

```
##           [,1]
## [1,] 0.5001366
## [2,] 0.9001165
## [3,] 0.9001194
```

```
e_hidden<-Mw_ho[-1]%*%delta
delta_h<- (t(e_hidden)*(-1*(out_hiddenL)*(1-out_hiddenL)))
delta_h
```

```
##              [,1]          [,2]
## [1,] -0.000153958 -0.0001350488
```

```
DELTA<-eta*(as.matrix(i)%*%delta_h)
DELTA
```

```
##               [,1]          [,2]
## [1,] -1.539580e-05 -1.350488e-05
## [2,] -6.158322e-06 -5.401950e-06
## [3,] -1.077706e-05 -9.453413e-06
```

```
## [4,] -1.077706e-05 -9.453413e-06
## [5,] -3.079161e-06 -2.700975e-06
```

```
# Part B with altered weights

rm(list=ls())

## define the initial weights, input and sigmoid function

# Hidden Input Layer
weight_ih<- c(0.5, 0.6, 0.8, 0.6, 0.2, 0.7 ,0.9, 0.8, 0.4, 0.2)
weight_ih
```

```
##  [1] 0.5 0.6 0.8 0.6 0.2 0.7 0.9 0.8 0.4 0.2
```

```
Mw_ih<- matrix(weight_ih , nrow = 5, ncol = 2,byrow = FALSE)
Mw_ih
```

```
##      [,1] [,2]
## [1,]  0.5  0.7
## [2,]  0.6  0.9
## [3,]  0.8  0.8
## [4,]  0.6  0.4
## [5,]  0.2  0.2
```

```
# Hidden Output Layers
weight_ho<-c(0.5,0.85,0.85)
weight_ho
```

```
## [1] 0.50 0.85 0.85
```

```
Mw_ho<-matrix(weight_ho,nrow=3,ncol=1)
Mw_ho
```

```
##      [,1]
## [1,] 0.50
## [2,] 0.85
## [3,] 0.85
```

```
# Input Layer
i<-c(1, 0.4, 0.7, 0.7, 0.2)
i
```

```
## [1] 1.0 0.4 0.7 0.7 0.2
```

```
# Sigmoid Function
sigmoid <-function(x )
{ z=1/(1+exp(-x))
return(z)
}


# i %*% Mw_ih
out_hiddenL<-  sigmoid (i %*% Mw_ih)
input_outputL<- c(1,out_hiddenL)
is.vector(input_outputL)
```

```
## [1] TRUE
```

```
out_outL<-  sigmoid (  input_outputL%*% Mw_ho )

## Back propagation calculation
Actual<-.85
eta<- .1
e<-out_outL-Actual
e
```

```
##            [,1]
## [1,] 0.02744211
```

```
delta<- -1*(out_outL)*(1-out_outL)*e
delta
```

```
##               [,1]
## [1,] -0.002951055
```

```
DELTA<-eta*delta%*%input_outputL
DELTA
```

```
##                [,1]           [,2]           [,3]
## [1,] -0.0002951055 -0.0002517869 -0.0002580261
```

```
New_ho<-Mw_ho+t(DELTA)
New_ho
```

```
##           [,1]
## [1,] 0.4997049
## [2,] 0.8497482
## [3,] 0.8497420
```

```
e_hidden<-Mw_ho[-1]%*%delta
delta_h<- (t(e_hidden)*(-1*(out_hiddenL)*(1-out_hiddenL)))
delta_h
```

```
##              [,1]         [,2]
## [1,] 0.000314159 0.0002755737
```

```
DELTA<-eta*(as.matrix(i)%*%delta_h)
DELTA
```

```
##               [,1]         [,2]
## [1,] 3.141590e-05 2.755737e-05
## [2,] 1.256636e-05 1.102295e-05
## [3,] 2.199113e-05 1.929016e-05
## [4,] 2.199113e-05 1.929016e-05
## [5,] 6.283180e-06 5.511473e-06
```