

Rayan Hassan
4511021

ECE 1395 – Homework 7 – report

Part 1

The accuracy for my predictions is 98%

```
Desktop )  
Reloaded modules: sigmoid, predict, nnCos  
Part 1  
  
Accuracy is: 98.0
```

Part 2

Here are the costs I got for $\lambda=0,1$ and 2 respectively

```
Part 2  
  
Cost with  $\lambda=0$ : 0.20252633908551304  
Cost with  $\lambda=1$ : 1.0301479458991476  
Cost with  $\lambda=2$ : 1.8577695527127822
```

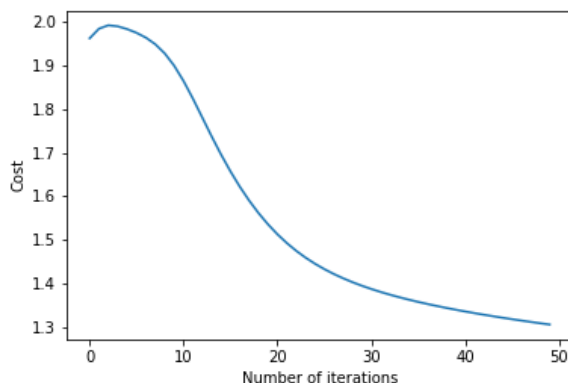
Part 3

Here is the output I got for the sigmoid gradient function. The values are as expected: $[0,0.25,0]$. (Note that I rounded them up in my code)

```
Part 3  
  
Sigmoid gradient when  $z=[-10,0,10]'$ :  
[[0.    0.25 0.   ]]
```

Part 4

The value for α I used is 0.01. As the figure below shows, this value guarantees a fairly good convergence of the cost (compared to other values I tried). (picture: ps7-4-e-1.png)



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This figure shows training cost vs number of iterations (50 epochs in that case)

Part 5

Here are the results I got for maxEpochs = 50

Part 4

For maxEpochs=50

```
Training accuracy with lambda=0 is: 92.91338582677166
Cost: 0.7935160199762348
Training accuracy with lambda=0.01 is: 89.76377952755905
Cost: 0.9048905941142387
Training accuracy with lambda=0.1 is: 66.14173228346458
Cost: 1.178787931291469
Training accuracy with lambda=1 is: 66.14173228346458
Cost: 1.5031445978310718
Testing accuracy with lambda=0 is: 100.0
Cost: 0.8251525109326504
Testing accuracy with lambda=0.01 is: 100.0
Cost: 0.9041907955365769
Testing accuracy with lambda=0.1 is: 73.91304347826086
Cost: 1.1935825519961716
Testing accuracy with lambda=1 is: 69.56521739130434
Cost: 1.5054336282124257
```

Here are the results I got for maxEpochs = 100

For maxEpochs=100

```
Training accuracy with lambda=0 is: 96.06299212598425
Cost: 0.3760007815405685
Training accuracy with lambda=0.01 is: 94.48818897637796
Cost: 0.5865813830554977
Training accuracy with lambda=0.1 is: 69.29133858267717
Cost: 1.1536298594001404
Training accuracy with lambda=1 is: 66.14173228346458
Cost: 1.5136085371002546
Testing accuracy with lambda=0 is: 100.0
Cost: 0.4016341856423168
Testing accuracy with lambda=0.01 is: 100.0
Cost: 0.677481265129785
Testing accuracy with lambda=0.1 is: 78.26086956521739
Cost: 1.1536564897382247
Testing accuracy with lambda=1 is: 69.56521739130434
Cost: 1.5199927595495515
```

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Here is a clearer representation of my results (values are rounded up, please view screenshot above for exact values)

For maxEpochs = 50

	Training accuracy	Testing accuracy
$\lambda=0$	92.9%	100%
$\lambda=0.01$	89.7%	100%
$\lambda=0.1$	66.1%	73.9%
$\lambda=1$	66.1%	69.6%
	Training cost	Testing cost
$\lambda=0$	0.79	0.825
$\lambda=0.01$	0.9	0.9
$\lambda=0.1$	1.178	1.19
$\lambda=1$	1.5	1.5

For maxEpochs = 100

	Training accuracy	Testing accuracy
$\lambda=0$	96%	100%
$\lambda=0.01$	94.5%	100%
$\lambda=0.1$	69%	78%
$\lambda=1$	66%	69.6%
	Training cost	Testing cost
$\lambda=0$	0.376	0.4
$\lambda=0.01$	0.587	0.677
$\lambda=0.1$	1.154	1.15
$\lambda=1$	1.513	1.52

We can see that with more epochs, we get higher accuracies (both for training and testing).

Also, if lambda is too high (=1 for example), accuracies decrease. So lambda should be picked carefully, we see that for lambda = 0.01, we get better accuracy.

PS: My algorithm was giving really weird, unpredictable accuracies. It would jump from a 99% to a 55% for different runs. This is the closest to “good” I was able to get. So the accuracies are not going to drastically drop now after you run it multiple times, they are going to remain consistent (at least in the range from $\approx 85\%$ to 100%)