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ECE 1395 – Dr. Dallal

Assignment 7

4/7/2023

Question 0: Read Data

Part a

- Verify dimensions of feature matrix X and label vector y

```
Dimensions of X: (150, 4)
Dimensions of y: (150, 1)
```

Question 1: Forward Propagation

Part a

- Function predict.py

Part b

- Accuracy of prediction on entire dataset

```
Accuracy: 0.98
```

Question 2: Cost Function

Part a

- Function nnCost.py

Part b

- Value of J when lambda = 0, 1, and 2

```
The cost when lambda = 0 is: 0.20252633908551312
The cost when lambda = 1 is: 1.0326189817073517
The cost when lambda = 2 is: 1.8627116243291904
```

Question 3: Derivative of the Activation Function (Sigmoid Gradient)

Part a

- Function sigmoidGradient.py

- Sigmoid Gradient when z = [-10, 0, 10]’

```
The sigmoid gradient of z = [-10, 0, 10] is: [4.53958077e-05 2.50000000e-01
4.53958077e-05]
```

Question 4: Backpropagation for Gradient of Cost Function and Stochastic Gradient Descent

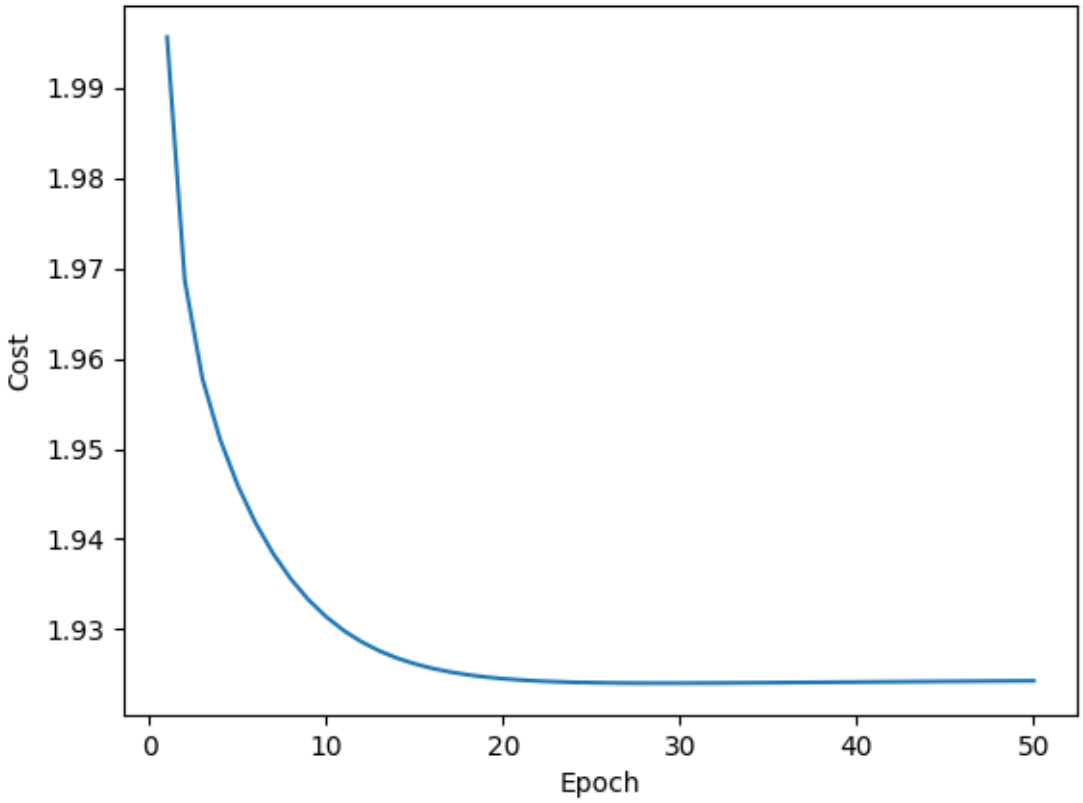
Part d

- Report the alpha used

```
The value used for alpha: 0.005
```

Part e

- Figure showing the training cost versus the iteration



Question 5: Testing the Network

Part a

- Complete table 1

lambda	Training Data Accuracy @ 50 Epochs	Testing Data Accuracy @ 50 Epochs	Training Data Accuracy @ 100 Epochs	Testing Data Accuracy @ 100 Epochs
lambda = 0	0.984252	0.956522	0.952756	0.956522
lambda = 0.01	0.984252	0.956522	0.96063	0.956522
lambda = 0.1	0.692913	0.521739	0.826772	0.695652
lambda = 1	0.354331	0.217391	0.354331	0.217391

- Compute the cost for each case in the table

lambda	Training Data Cost @ 50 Epochs	Testing Data Cost @ 50 Epochs	Training Data Cost @ 100 Epochs	Testing Data Cost @ 100 Epochs
lambda = 0	0.990026	1.0253	0.72837	0.795481
lambda = 0.01	1.01836	1.05664	0.904252	0.951721
lambda = 0.1	1.47089	1.49899	1.39411	1.42158
lambda = 1	1.90705	1.94862	1.90705	1.949

- Discuss the results

In our tables, we received a higher accuracy with a lower value of lambda. This indicates that the model is performing well on the data with a lower effect of the regularization parameter. As the lambda value is increased, we can see the accuracy decrease which indicates that the model is no longer fitting the data well. The regularization parameter may be causing the data to be underfit in these cases (assumption made since the training data accuracy does not seem to be overfit). The table of cost values shows that as the accuracy is lower the cost is greater. This all shows that choosing the correct value for lambda has a big impact on the effectiveness of the model.