Homework2

by Adhiraj Budukh

To calculate optimum value for alpha, so that test losses are minimum,

computed in **function_alpha (Xtest, Ytest, Xtrain, Ytrain)**, keeping number of epochs constant at 500. Here, Optimum_alpha is **0.69** for minimum test loss.

#To calculate optimum value for number of epochs so that test losses are minimum:

function_epochs (Xtest, Ytest, Xtrain, Ytrain, alpha) passing the optimum value of alpha calculated through function_alpha.

Here, Optimum_epochs = 62

Minimum_TestLoss = 6.446571317466108e-29,

Minimum_TrainLoss = 7.85863233781172e-29

#Predicted value of Y (Yhat) for test samples:

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PS C:\Users\adhir\Documents\Machine Learning Adhiraj\hw2> py application.py
Predicted value for Y on test dataset:  [-284.0587837465623, 72.44062122027688, 31.26848147888778, -11.557371683167945, -19.183861371583475, 48.812042100133056, -54.720771790407206, -102.28860783037726, -141.79744596237708, -20.866985945347125, -29.805596285102425, 8.468930199115007, 143.40572261606047, 114.44537125689592, 40.9718434071014, -14.442901218812153, -30.53962782637532, 130.54604438303167, 44.863036108458446, 3.234340392396774, 28.50017934543 95, -134.90340520220758, 62.770521976391926, -131.96006910375004, -44.5976544102638, 61.63229494281977, 224.54779808448205, -36.918612006557616, 52.6184922871696 66, 2.5098722354548393, -41.01444030253478, -94.69285646763643, 80.85088866452537, 40.29290324674286, -216.91472058220495, -23.07995398516242, -55.40986446158508, -68.22753047896373, 3.653287335699588, -20.64036619919102, -14.888059216146289, 51.04713962777707, -27.97566295506401, -69.42429418840595, 60.962455322465 91, 214.43357125110452, -14.303125762235332, 72.53815201052765, -171.91186167885863, 34.82433588404621, -75.16404284755717, -25.136188250026585, -143.27376374728317, 65.04959192732593, 110.43465817638423, -69.78292291305848, 130.1241890724346, 263.48555270612275, -87.71130360906847, 57.48450132324646, -81.52044007089805, -49.376029617307694, 77.78505841770733, 51.28642322845364, 213.63108699976652, 206.2247351917207, 164.66693318277765, 116.38672397906278, 132.2671686134072, 77.1398698545003, 175.61566189284719, 12.74434072644803, -247.15457301254347, -98.511156306672, -168.57483660022143, 49.53898762501794, -93.26333122990943, -109.96918398966841, 28.1952692288414 43, -42.16694791881369, -52.514324799155276, -107.13740495038348, -45.53075090605472, 105.26768282295828, -106.92662664981499, -463.51727783703893, 33.42304362614408, -59.42705886515388, 0.4538408519026156, 11.795913353541678, 66.98936763274519, 6.408474487258488, 120.64927697477466, 111.60403302054465]
Optimum alpha for minimum Test Loss:  0.69
Optimum number of epochs for minimum Test Loss:  62
Minimum Test Loss:  6.446571317466108e-29
Minimum Train Loss:  7.85863233781172e-29
PS C:\Users\adhir\Documents\Machine Learning Adhiraj\hw2>
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#The relation between alpha and number of epochs is computed in function:
get_alpha_epochs_relation (Xtrain, Ytrain, Xtest, Ytest).

Here, alpha is iterated from 1 to 0.1 and number of epochs are iterated from 10 to 100. Training loss and test losses are calculated for each combination.

The following screenshot depicts the relation (generated by **get_alpha_epochs_relation function**):

Alpha List	Number of Epochs	Training Loss	Testing Loss
1	10	[[8.41046075e-05]]	[[6.23585054e-05]]
1	20	[[1.17726338e-11]]	[[8.9537929e-12]]
1	30	[[1.65766657e-18]]	[[1.26289198e-18]]
1	40	[[2.35689803e-25]]	[[1.7990806e-25]]
1	50	[[0.]]	[[0.]]
1	60	[[0.]]	[[0.]]
1	70	[[0.]]	[[0.]]
1	80	[[0.]]	[[0.]]
1	90	[[0.]]	[[0.]]
0.5	10	[[0.44510481]]	[[0.56761231]]
0.5	20	[[0.00012746]]	[[0.00017609]]
0.5	30	[[4.24852148e-08]]	[[5.97707881e-08]]
0.5	40	[[1.42776255e-11]]	[[2.01652915e-11]]
0.5	50	[[4.80009637e-15]]	[[6.78535055e-15]]
0.5	60	[[1.61381324e-18]]	[[2.28170892e-18]]
0.5	70	[[5.4267116e-22]]	[[7.67316456e-22]]
0.5	80	[[1.82105448e-25]]	[[2.59494343e-25]]
0.5	90	[[2.07501973e-28]]	[[3.89444852e-28]]
0.333333333	10	[[13.3463769]]	[[15.98798586]]
0.333333333	20	[[0.06197181]]	[[0.08014688]]
0.333333333	30	[[0.00039215]]	[[0.00053327]]
0.333333333	40	[[2.68876055e-06]]	[[3.73924026e-06]]
0.333333333	50	[[1.87372569e-08]]	[[2.63058676e-08]]
0.333333333	60	[[1.3098116e-10]]	[[1.84632514e-10]]
0.333333333	70	[[9.16149892e-13]]	[[1.29365872e-12]]
0.333333333	80	[[6.4087351e-15]]	[[9.05631379e-15]]

For this scenario, it signifies that given a value for alpha, test loss decreases with increased number of epochs. And given a value of epoch, test loss increases on decreasing value of alpha.