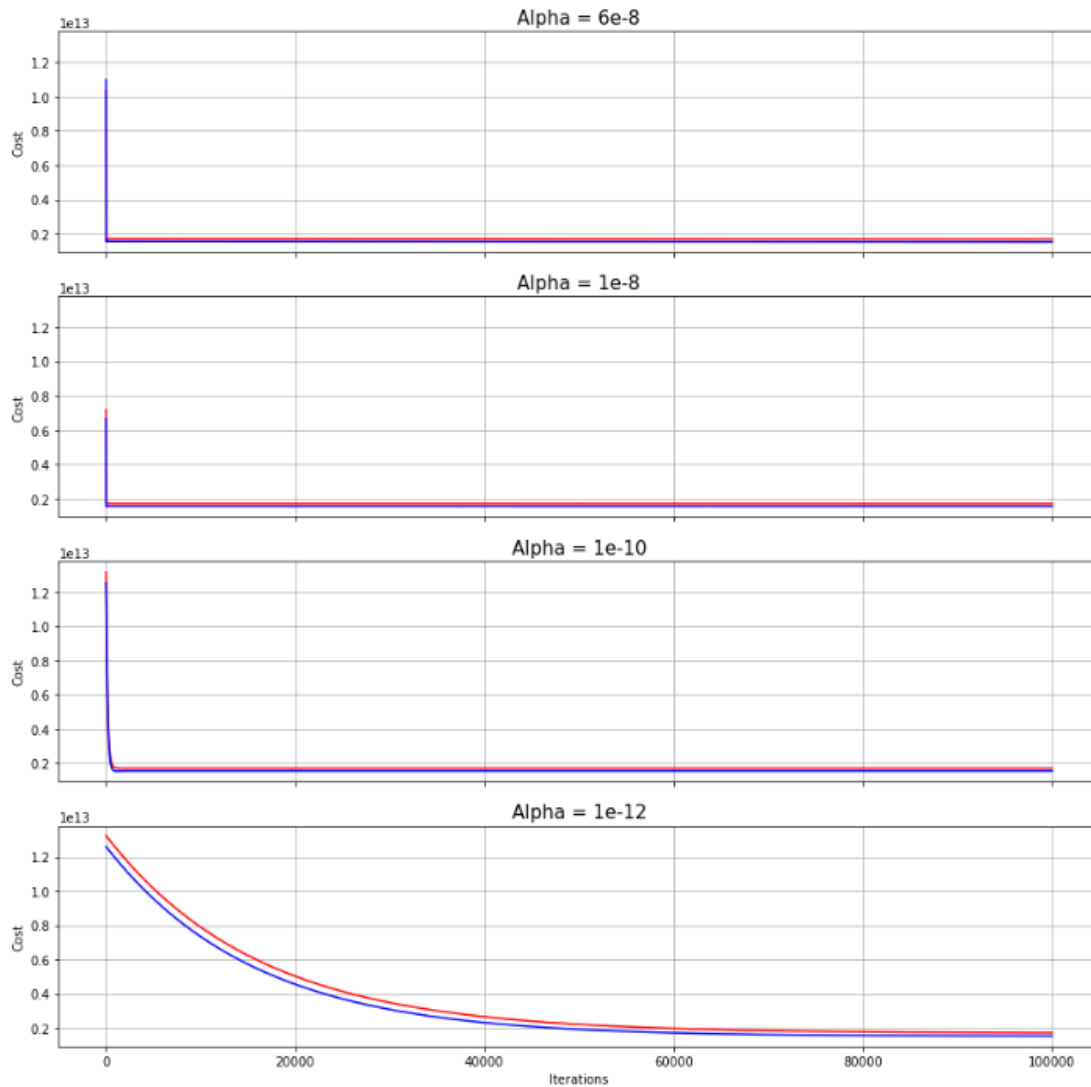


https://github.com/Christian-Martens-UNCC/ECGR-4105/tree/main/Homework_1-Bias_Overfitting_%26_Regularization

Problem 1:

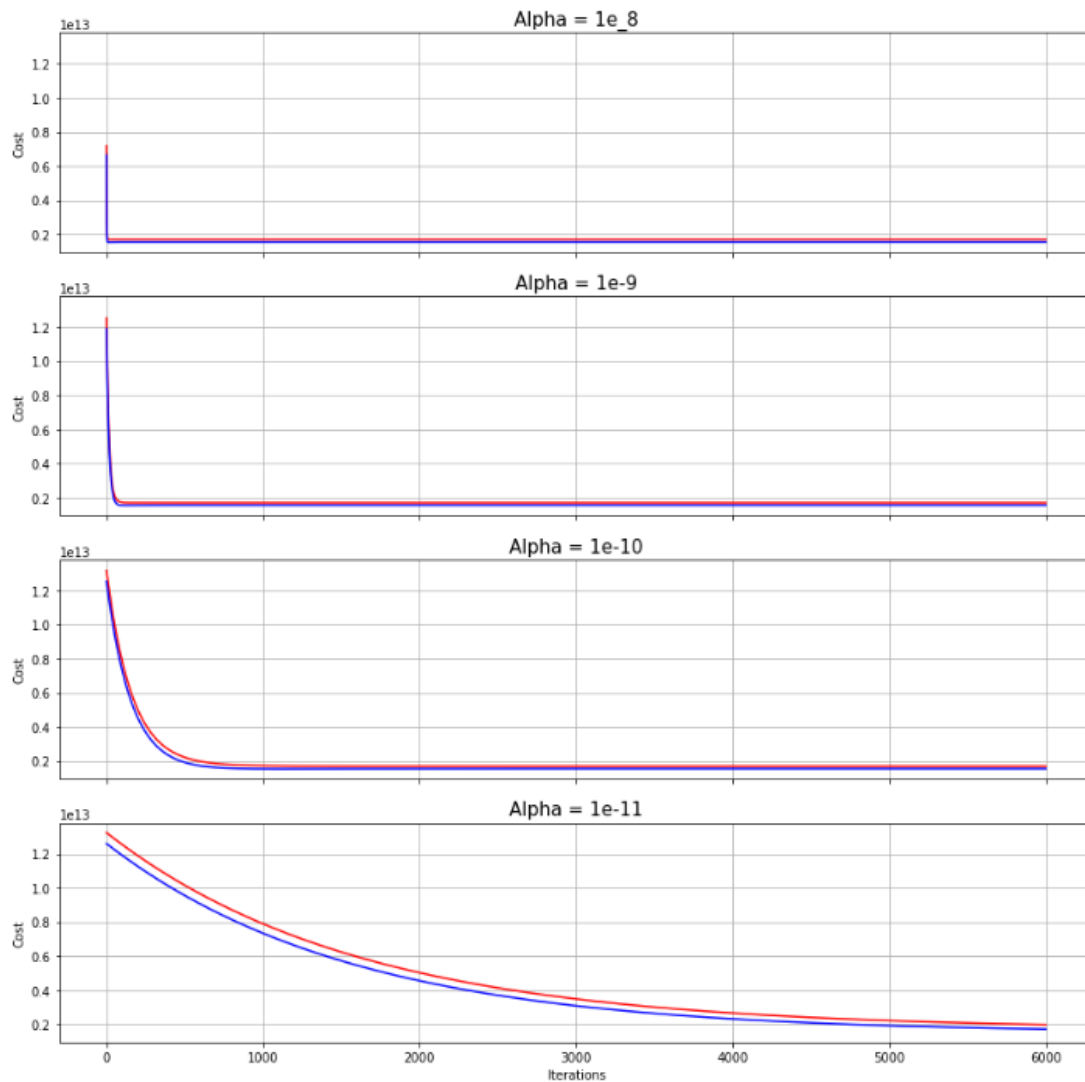
- A) The best parameters for the linear regression model occurred when alpha equals $6e-8$
 a. [2034.29771715, 853.37472502, 7941.58265386, 4478.18659348, 6907.44138244, 1987.7319843]

Fig. 1 - Loss and Validation History of Various Alpha Values for 1.a



- B) The best parameters for the linear regression model occurred when alpha equals $1e-8$
 a. [20.65551674, 860.9545051, 80.49717546, 45.23825994, 69.84655729, 18.74096743, 9.63213576, 15.74525679, 4.21977621, 18.46899341, 20.0645966, 9.76197079]

Fig. 2 - Loss and Validation History of Various Alpha Values for 1.b

**Problem 2:**

- A) Due to the scaling factor of normalization compared to standardization, it appears that normalization is more accurate than standardization although both worked and reduced the iteration time by a factor of 200 compared to the raw data used for 1.a. I would argue that the normalization input scaling achieves the best training because the validation loss history more closely resembles the trained loss history.

Fig. 3 - Loss and Validation History of Various Alpha Values for 2.a using Standardization

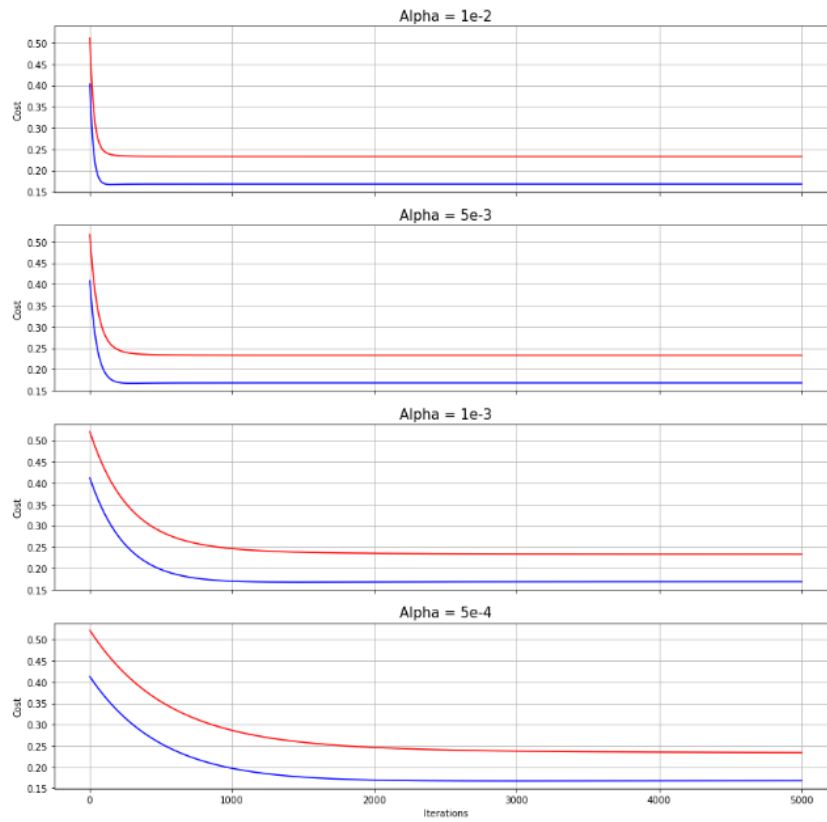
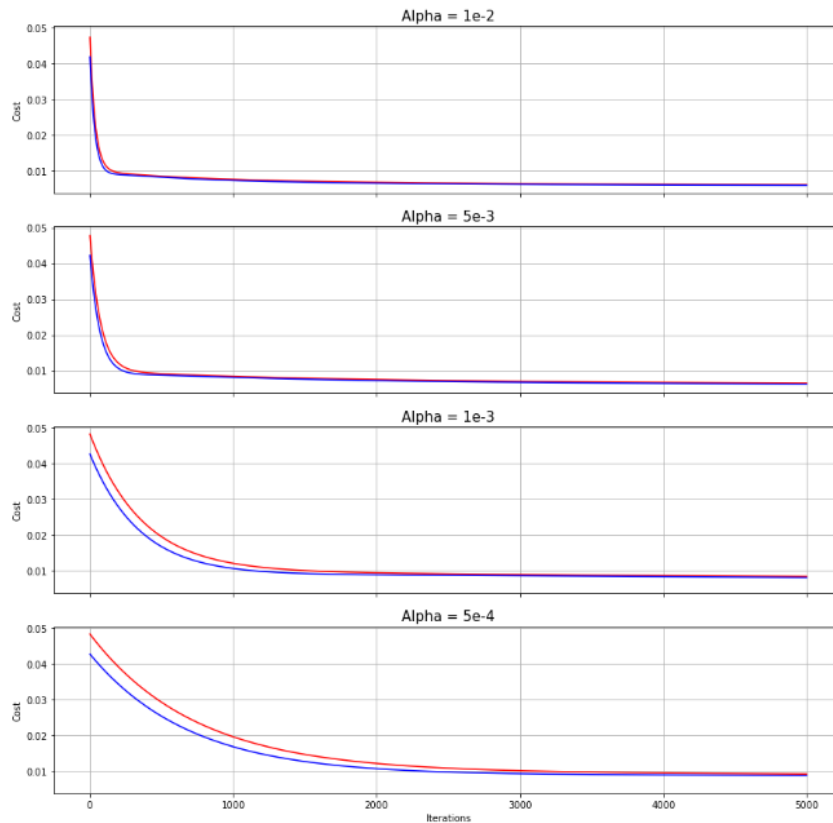


Fig. 4 - Loss and Validation History of Various Alpha Values for 2.a using Normalization



- B) Due to the scaling factor of normalization compared to standardization, it appears that normalization is more accurate than standardization although both worked and reduced the iteration time compared to the raw data used for 1.b. I would argue that the normalization input scaling achieves the best training because the validation loss history more closely resembles the trained loss history.

Fig. 5 - Loss and Validation History of Various Alpha Values for 2.b using Standardization

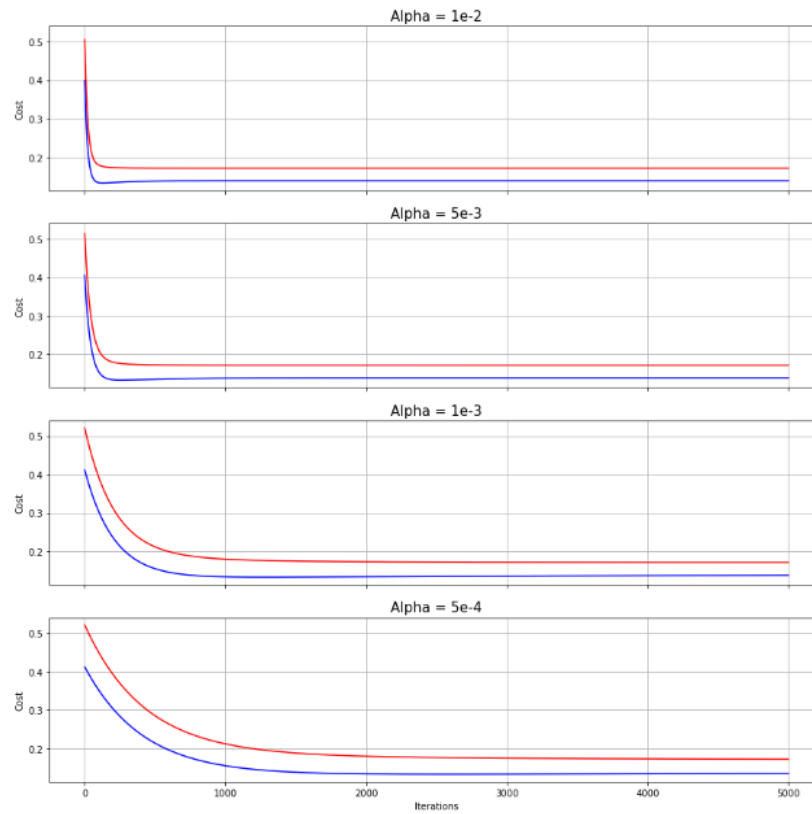
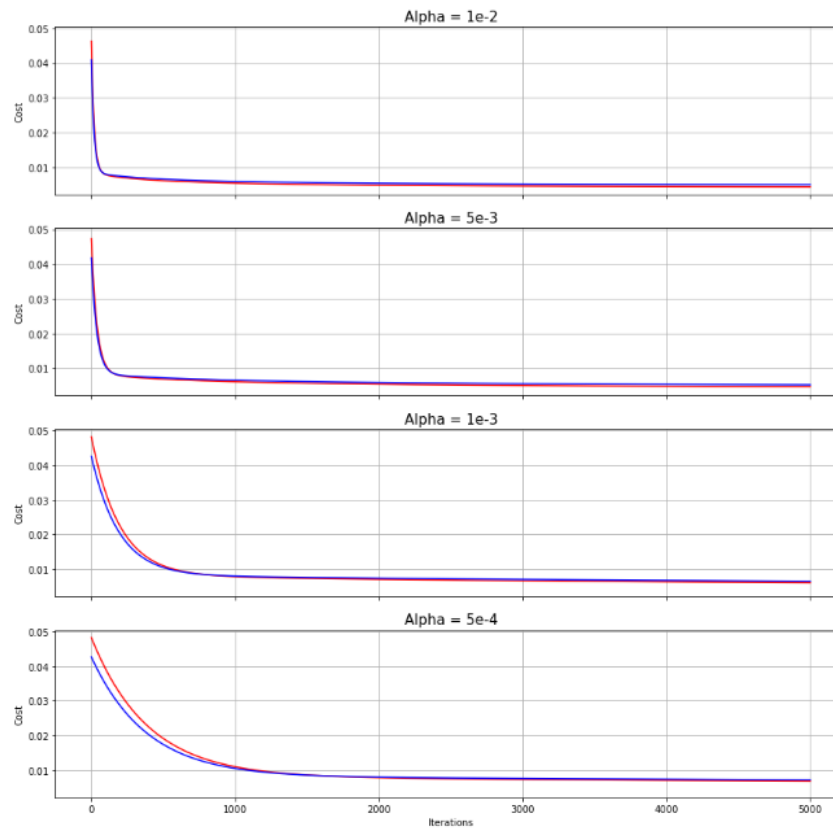


Fig. 6 - Loss and Validation History of Various Alpha Values for 2.b using Normalization

**Problem 3:**

A) The results of 3.a are extremely similar to 2.a. 3.a has slightly lower validation loss than 2.a

Fig. 7 - Loss and Validation History of Various Alpha Values for 3.a using Standardization, Parameter Penalty = 0.01

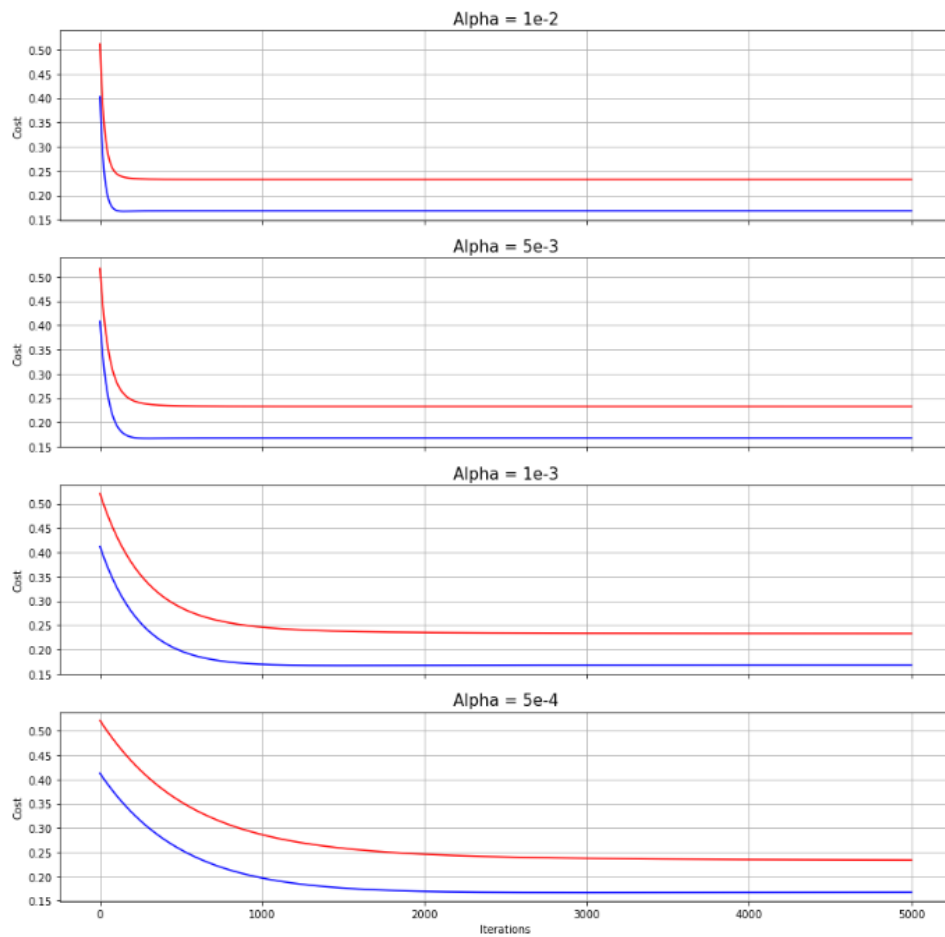
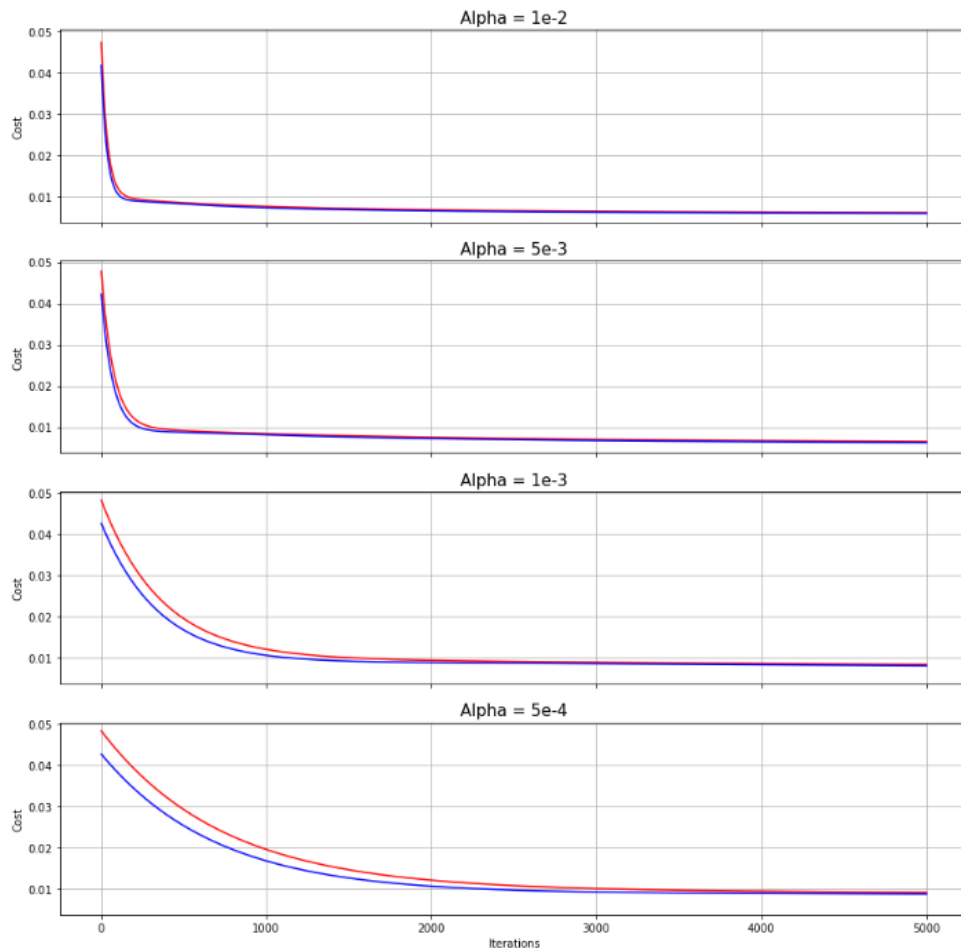


Fig. 8 - Loss and Validation History of Various Alpha Values for 3.a using Normalization, Parameter Penalty = 0.1



B) The results of 3.b are extremely similar to 2.b. 3.b has slightly lower validation loss than 2.b

Fig. 9 - Loss and Validation History of Various Alpha Values for 3.b using Standardization, Parameter Penalty = 0.1

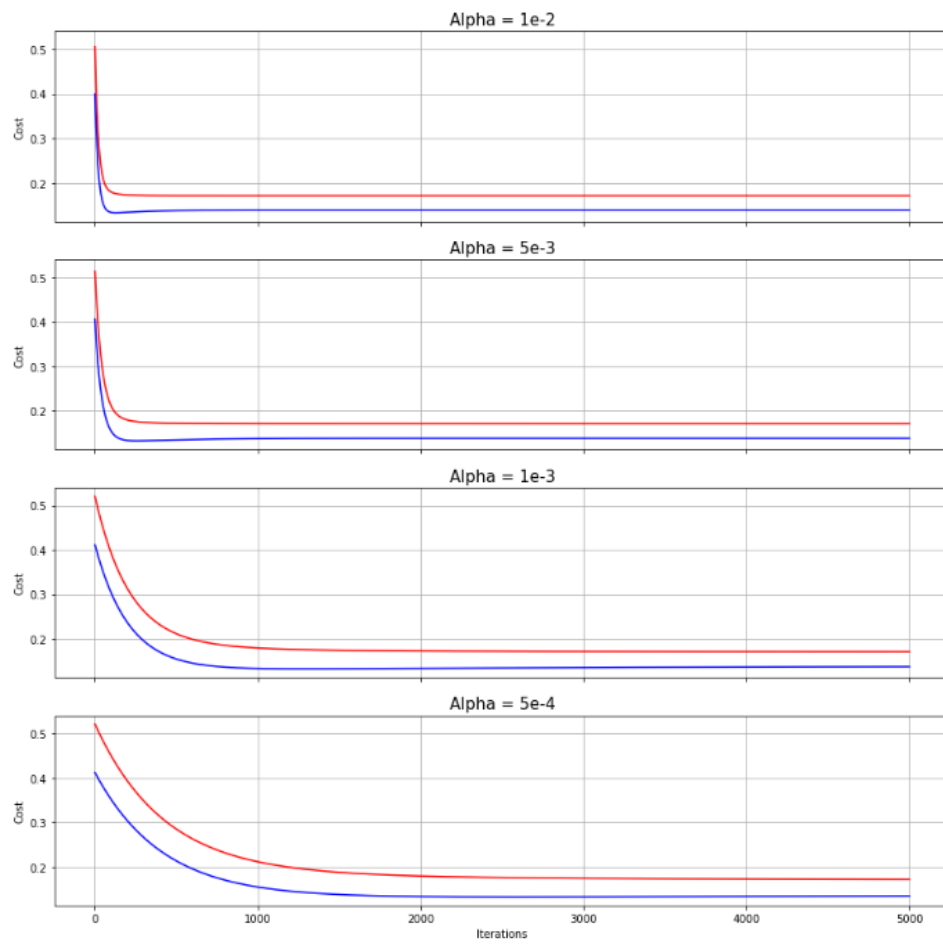


Fig. 10 - Loss and Validation History of Various Alpha Values for 3.b using Normalization, Parameter Penalty = 0.1

