**ROB313 Assignment 2**

1. **Assignment Objectives**

The objectives of Assignment 2 are as follows:

1. Derive a closed-form expression for the weights of …
2. **Question 1 – Tikhonov Regularization**
   1. **Expression for the weights of the given generalized linear model (Q1)**

Text, letter

Description automatically generated

1. **Question 2 – Generalized Linear Model** 
   1. **Estimation of α (Q2)**

Text, letter

Description automatically generated

* 1. **Comparison to dual representation in class (Q2)**

The dual representation found in class obtains the result **α** = (**K** + λ**I**)-1**y**. This is different from the result for α obtained above because…

1. **Question 3 – Radial Basis Function (RBF) Model**
   1. **Code Structure Overview & Implementation Strategies (Q3)**
   2. **Results (Q3)**

Table \_\_: Validation RMSE over different parameter combinations

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Regularization Parameters (λ)** | | | | |
| **Shape Parameters (θ)** |  | **λ = 0.001** | **λ = 0.01** | **λ = 0.1** | **λ = 1** |
| **θ = 0.05** |  |  |  |  |
| **θ = 0.1** |  |  |  |  |
| **θ = 0.5** |  |  |  |  |
| **θ = 1** |  |  |  |  |
| **θ = 2** |  |  |  |  |

Table : Test RMSE with selected hyperparameters

The following table summarizes the RMSE losses on the validation and testing sets of the mauna\_loa and rosenbrock datasets. The validation RMSE was found by running the RBF model with every possible combination of shape parameters (θ’s) and regularization parameters (λ’s); the reported validation RMSE’s were the lowest RMSE found. As well, the optimal θ and optimal λ were those parameters that resulted in the lowest RMSE. The full results for every θ and λ combination are provided in the Appendix for the validation sets as an example (for Q3).

Using the optimal parameters found (resulting in the smallest RMSE loss), the RBF model was used on the testing data. For each dataset, the resulting test RMSE was provided using their optimal θ and λ.

*Table : RMSE with selected hyperparameters*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Optimal θ** | **Optimal λ** | **Validation RMSE** | **Test RMSE** |
| **Mauna\_loa** | θ = 1 | λ = 0.001 | 0.124479 | 0.154843 |
| **Rosenbrock** | θ = 2 | λ = 0.001 | 0.193240 | 0.084572 |

1. **Question 4 – Greedy Regression Algorithm**
   1. **Code Structure Overview & Implementation Strategies (Q4)**
   2. **Results (Q4)**
2. **Appendix**

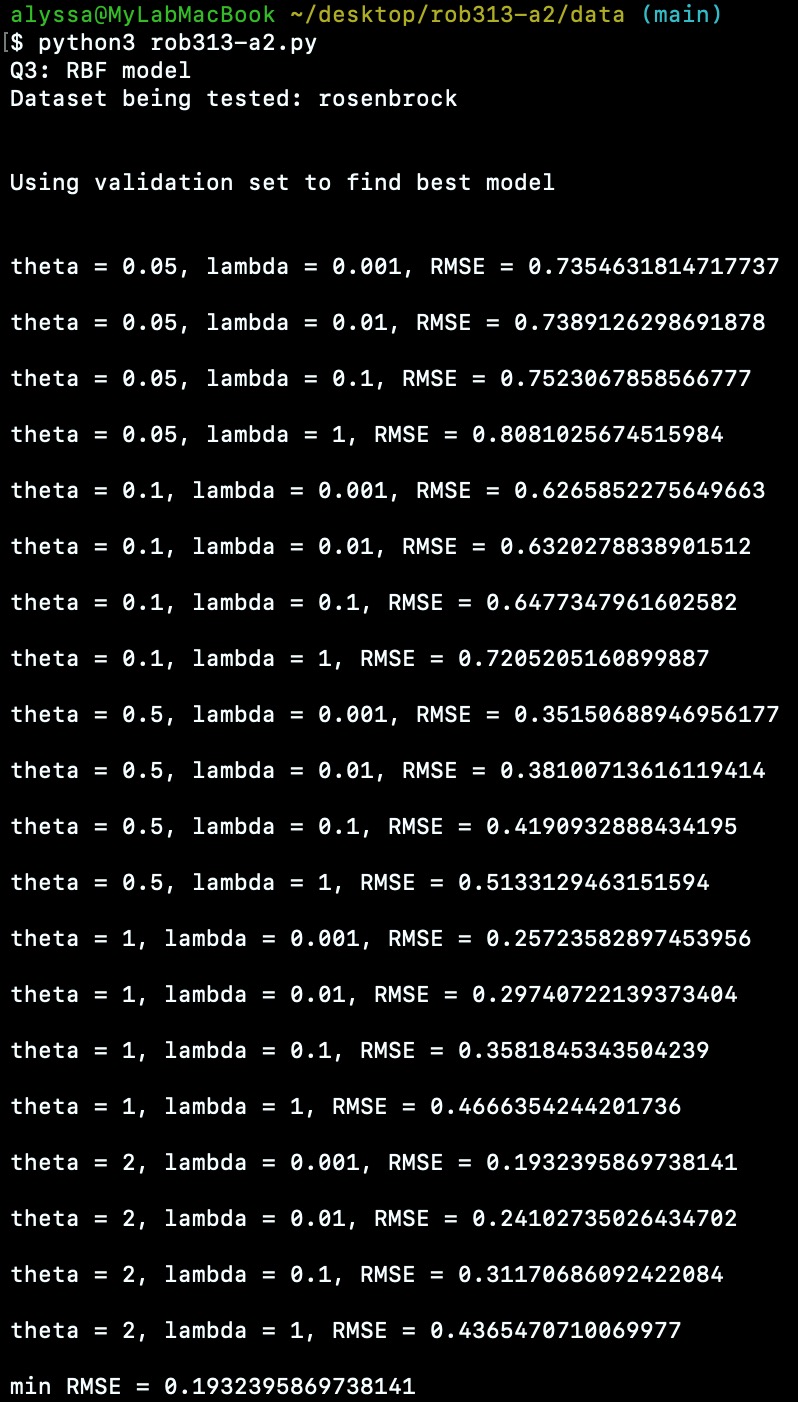
**Q3: All validation RMSE from every θ and λ parameter combination for mauna\_loa**

Text

Description automatically generatedText

Description automatically generated

**Q3: All validation RMSE from every θ and λ parameter combination for rosenbrock**

Text

Description automatically generated