Section 1: Linear regression implementation

1.

Multiplying by is like summing the vector and we get a scalar as expected.

2.

A graph of a line

Description automatically generated with medium confidence

3.

A graph of a test

Description automatically generated with medium confidence

We can see that when the leaning rate is too small we don’t see any learning because every step doesnt change the gradients enough. When the learning rate is too high we can see a spiked curve because the update steps miss the minima. When the learning rate is right (e.g lr = 0.001) e get a smooth decaying curve converging to the minima.

It makes sense to increase the number of steps because it seems we didnt reach a platue and with more steps we can achieve lower loss and a better model. more steps can lead to overfitting so we should also implement early stopping.

4.

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| Model | Section | Train MSE | Valid MSE |
|  |  | Cross validated | |
| Dummy | 2 | -3.727 | -3.738 |

5.

A graph of a graph of a graph

Description automatically generated with medium confidence

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| Model | Section | Train MSE | Valid MSE |
|  |  | Cross validated | |
| Dummy | 2 | -3.727 | -3.738 |
| Linear | 2 | -3.652 | -3.748 |

6. If we wouldn’t have normarlized the features beforehand it wouldn’t affect the Dummy model because it only cares about the labels (it takes avg of it) and not the features.

It would affect our model because without normalization dimensions may differ in scale considerably and we are using a single learning rate for all of them, which probably wouldn’t suit all the different scales.

7.

A graph of a number of scores

Description automatically generated with medium confidence

Best reg-



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| --- | --- | --- | --- |
| Model | Section | Train MSE | Valid MSE |
|  |  | Cross validated | |
| Dummy | 2 | -3.727 | -3.738 |
| Linear | 2 | -3.652 | -3.748 |
| Lasso | 3 | -3.721 | -3.736 |