Assignment 01 - Linear Regression Assignment: Part 2

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Alpha (Learning Rate): Controls the step size during weight updates.

Epochs: The number of times the model sees the entire training dataset.

Experiments and Results:

Observations:

Alphas	Epochs	Training Loss	Testing Loss	Weights
0.0001	93089	0.00582130	0.00757410	[21.07772523, 46.98908338, 75.06583492, 76.19575298]
0.001	12000	0.00015584	0.00020950	[21.07734465, 46.95684358, 75.15428547, 76.25243578]
0.002	7500	0.0000029	0.0000040	[21.07663541, 46.94931326, 75.16861454, 76.26178203]
0.002	5000	0.00226574	0. 00297734	[21.07804265, 46.97620148, 75.10598923, 76.2213652]
0.01	900	0.0084959	0.0110142	[21.07742366, 46.99577947, 75.04355955, 76.18157478]
0.01	1000	0.0021839	0.0028722	[21.078077, 46.97589201, 75.10722798, 76.22214929]
0.1	90	0.00572476	0.00749398	[21.07848821, 46.99129109, 75.06735467, 76.19654316]
0.13	90	0.00011398	0.00015454	[21.07736656, 46.95602032, 75.15686077, 76.25407703]
0.195	50	0.00124329	0.00166167	[21.0786281, 46.97207085, 75.12380404, 76.23261308]

Analysis:

Impact of Alpha:

- Smaller alpha values (e.g., 0.0001) required more epochs to converge but achieved stable results.
- Larger alpha values (e.g., 0.13) allowed faster convergence with fewer epochs.

Impacts of Epochs:

- Increasing the number of epochs improved the model's performance up to a certain point.
- Beyond a certain number of epochs, the model started to overfit, as seen by the increasing gap between training and testing loss.

The best performance was achieved with alpha = 0.13 and epochs = 90, resulting in a testing loss of 0. 00015454.

Relationship between Alpha and Epochs

There is an inverse relationship between alpha and epochs:

- A larger alpha allows the model to converge faster, requiring fewer epochs.
- A smaller alpha required more epochs to achieve similar performance.

Like, with alpha = 0.0001, the model required 93089 epochs to achieve a testing loss of 0.00757410.

And with alpha = 0.13, the model achieved a much lower testing loss of 0. 00015454 in just 90 epochs.

Conclusion:

The observations demonstrated the importance of tuning hyperparameters in linear regression. The best performance was achieved with alpha = 0.13 and epochs = 90, resulting in a testing loss of 0.00015454. This highlights the trad-off between alpha and epochs, where a larger alpha allows for faster convergence with fewer epochs.