Report

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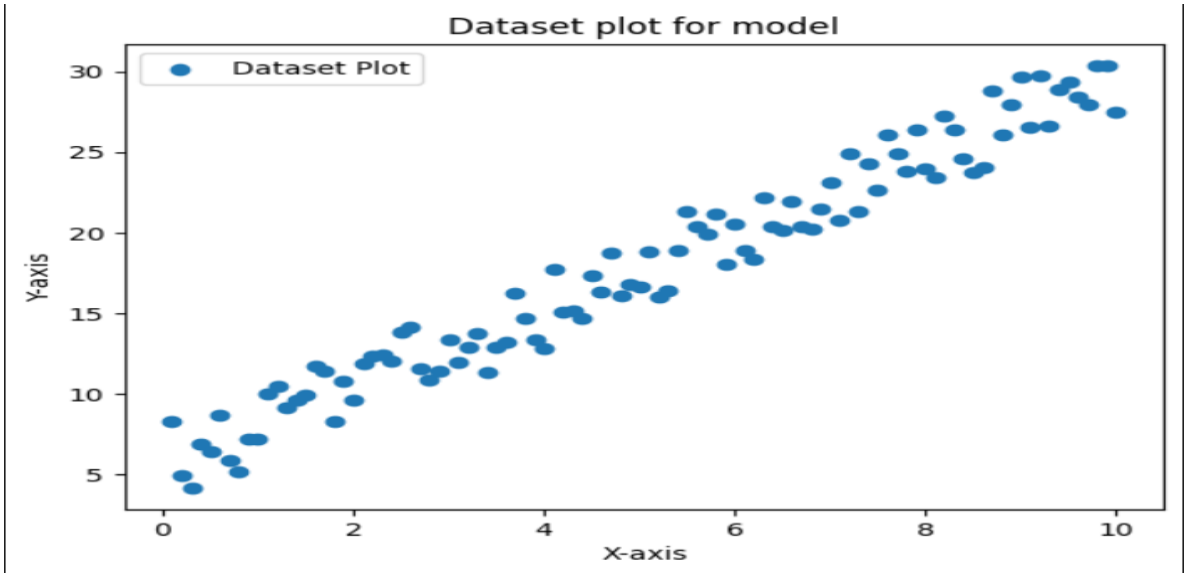
Objective:

The Purpose of this report is to show the correctness of a self implemented Linear regression algorithm by comparing with Scikit learn Linear Regression and to reason about which dataset among given ones we can apply linear regression to.

For dataset 1:

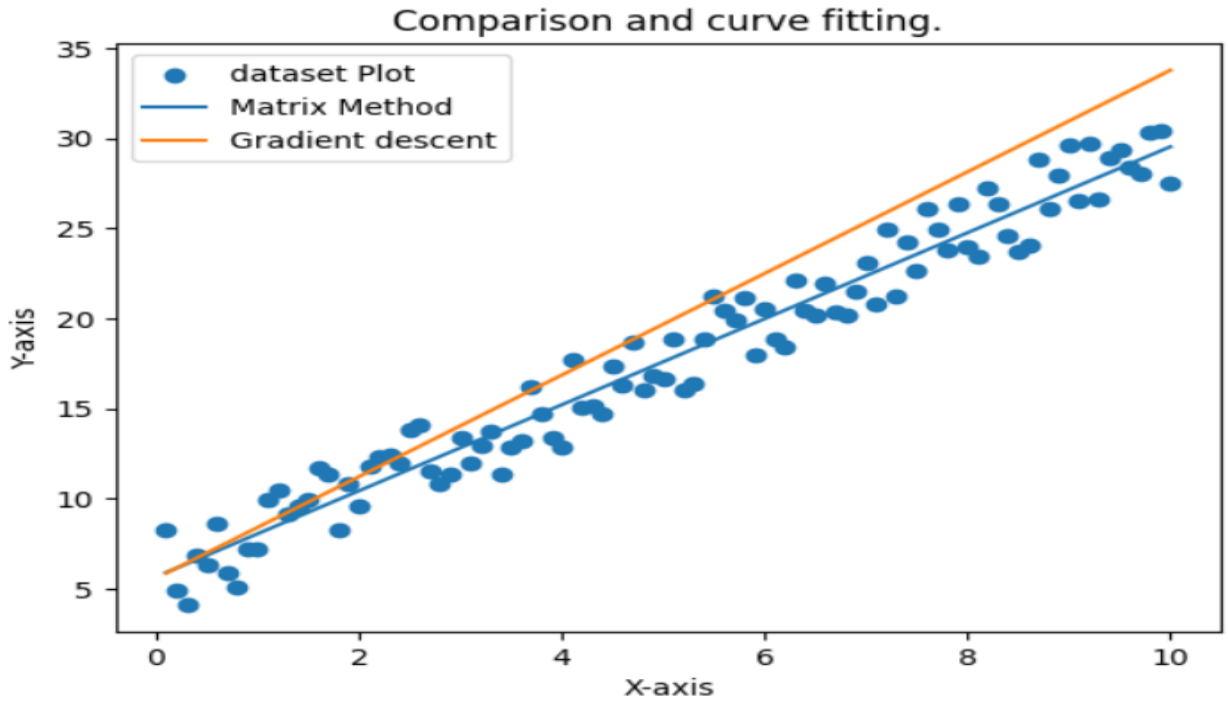


From the above plot it can be seen that the feature in the dataset is exhibiting a linear relationship with the output variable. That is why we can easily apply linear regression here to predict y.

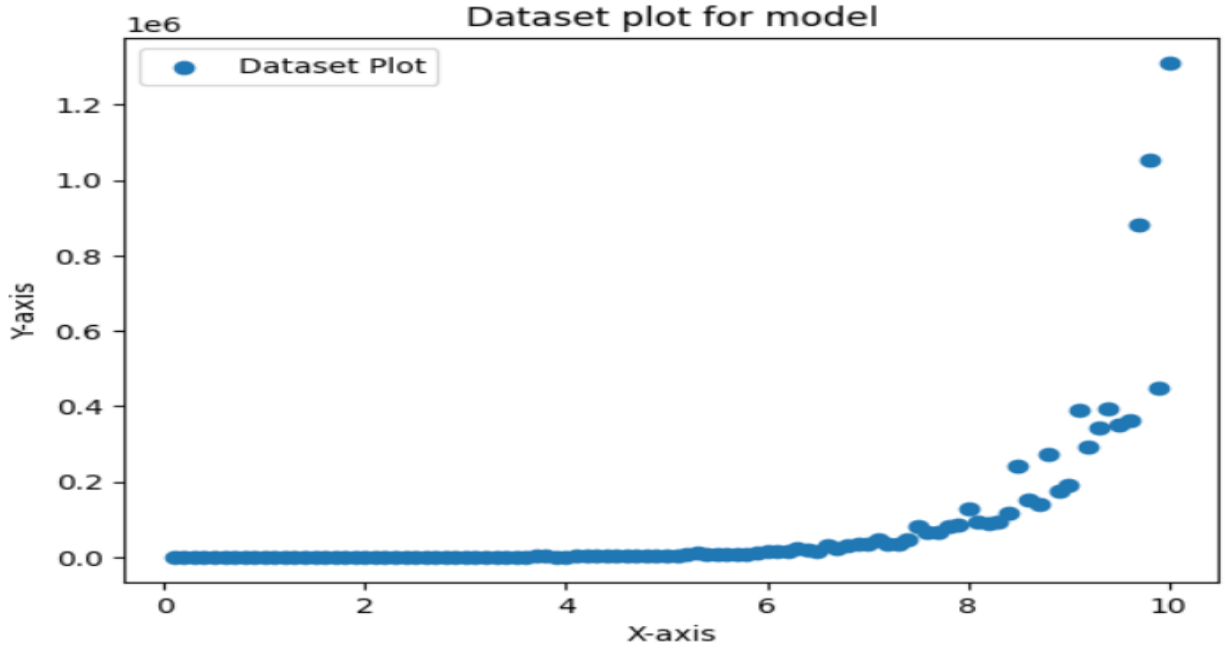
Following is the table which shows comparisons:

	R square	Eta choosed	Epochs	Comments
Matrix method(self implemented)	0.9579571905586358	-	-	R square value for gradient descent is comparatively lesser than other methods. Chosen number of epochs and eta values are the most suitable ones.
Matrix method(Scikit Learn)	0.9579571905586357	-	-	
Gradient descent	0.8372379558736306	0.00001	3030	

Following graph shows the curve fitting for the dataset where loss function is minimized by gradient descent and by simple derivative minima.



For Dataset 2:

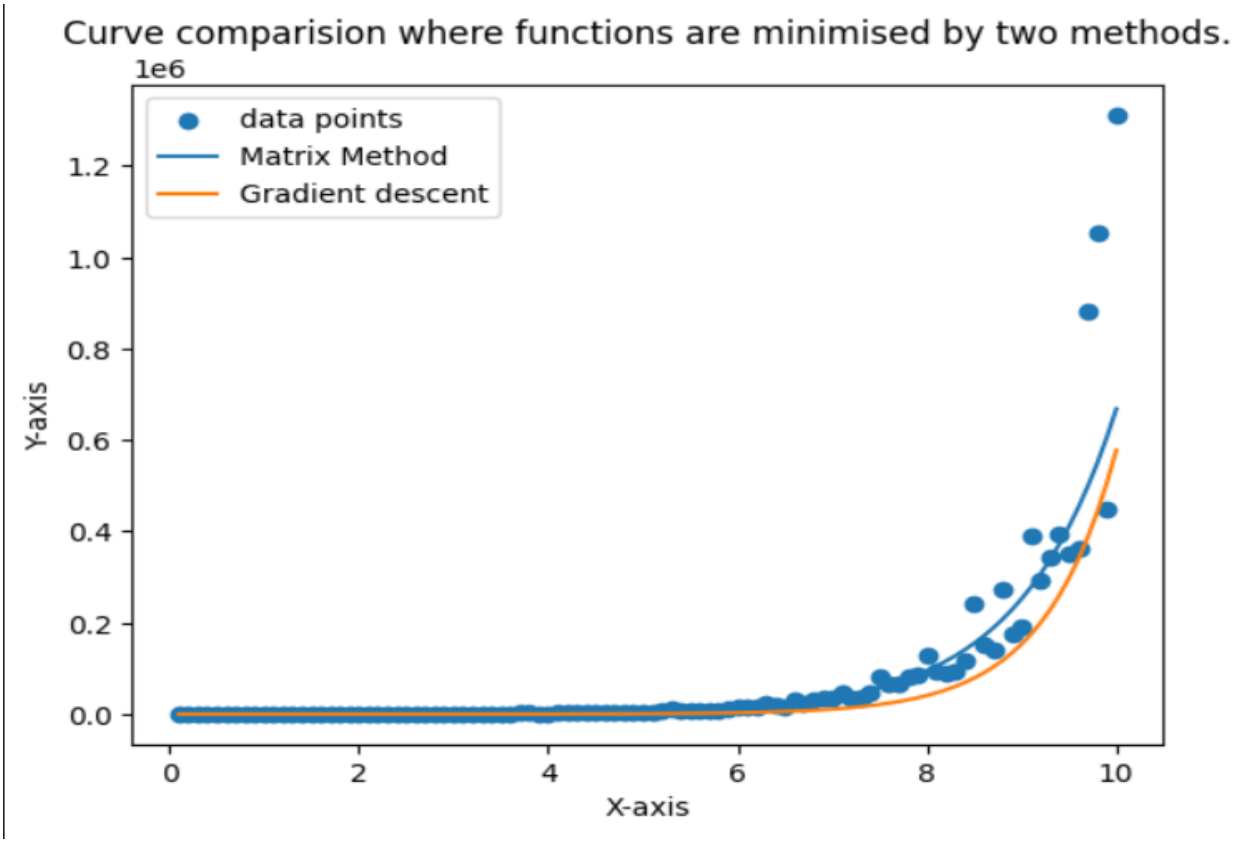


From the above plot we can see that the feature exhibits the exponential relationship with output variable y. So, we can not apply linear regression directly here. But it can be applied after transformation to a linear equation with the help of a log function.

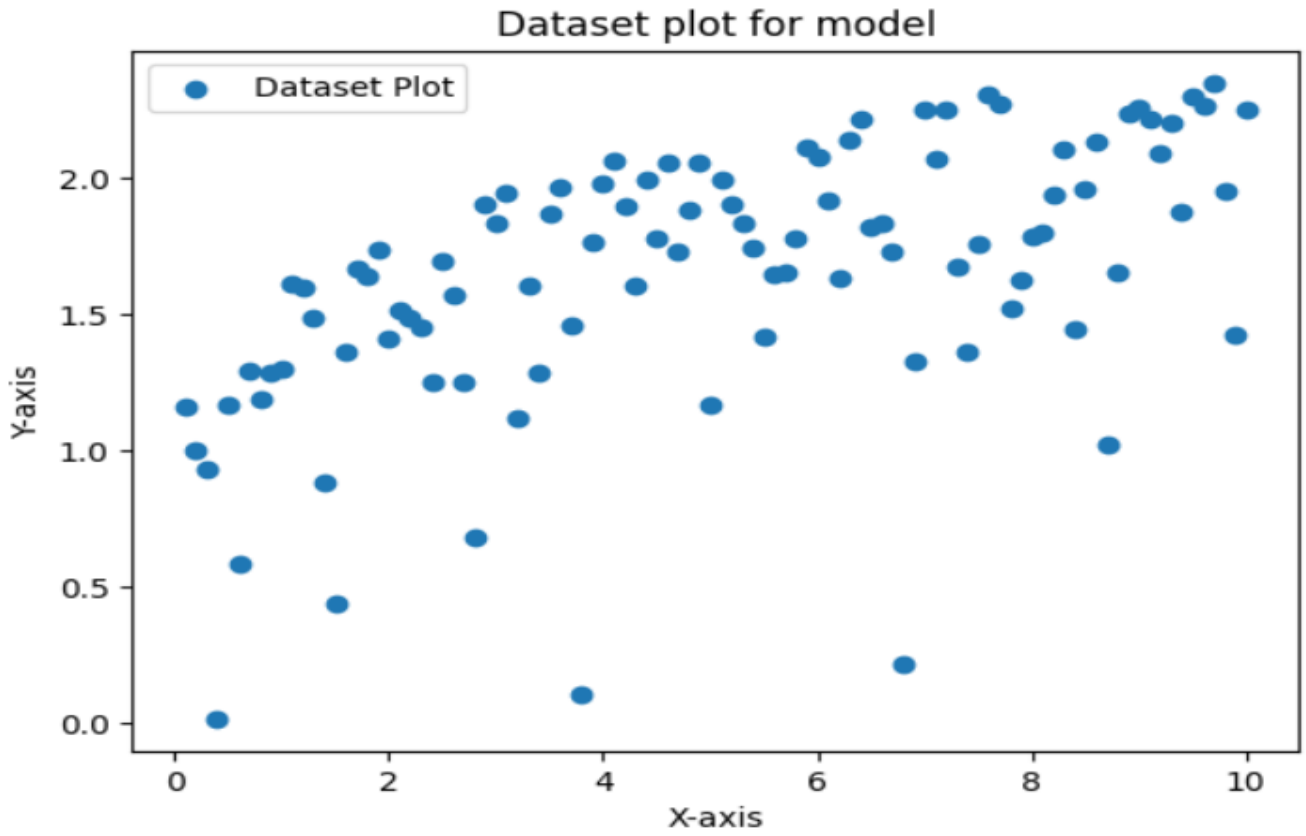
Following is the table which shows comparisons:

	R square	Eta choosed	Epochs	Comments
Matrix method(self implemented)	0.7882858000815358	-	-	R square values from scikit as well as my own implementation are around 0.8 and equal. Means 80% accuracy is there. Gradient descent is given even lesser value.
Matrix method(Scikit Learn)	0.7882858000815534	-	-	
Gradient descent	0.681116723996152	0.00001	3030	

Following graph shows the curve fitting for the dataset where loss function is minimized by gradient descent and by simple derivative minima.

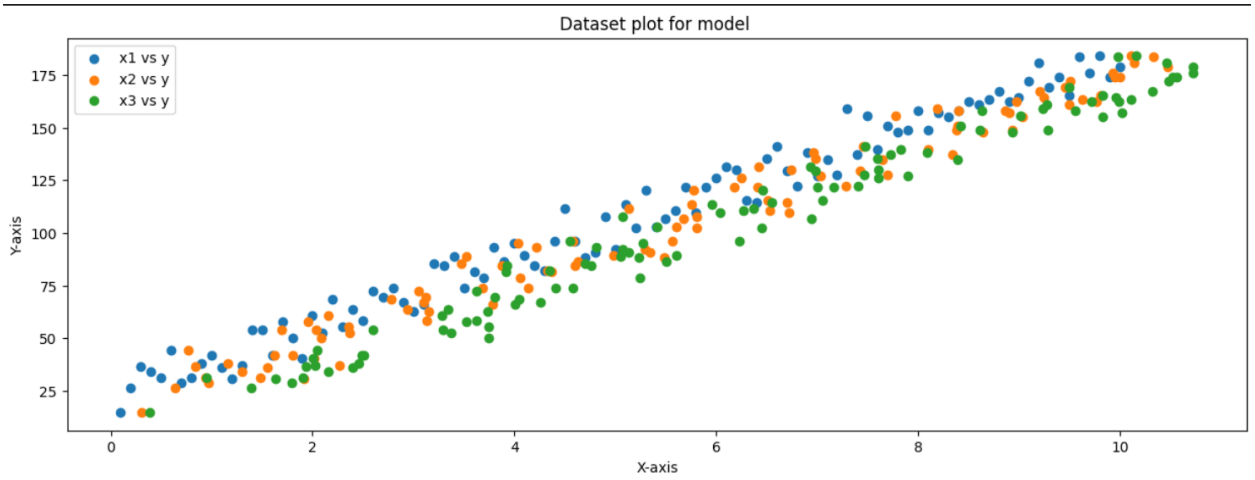


For Dataset 3:



From the above plot we can see that this curve does not satisfy any curve other than polynomials of very high degree. This will optimize the given data and learned parameters will not be able to predict y for other datasets. This means our model is not generalized. This dataset is not suitable for linear regression.

For Dataset 4:



From the above graph it can be seen that each feature in the dataset exhibits a linear relationship with output variable(y). Multiple linear regression can be applied to predict the values for output variable(y).

Following is the table which shows comparisons:

	R square	Eta choosed	Epochs	Comments
Matrix method(self implemented)	0.9621319937092727	-	-	Gradient descent having high R square value means it is giving the best fit curve for chosen eta and no. of epochs.
Matrix method(Scikit Learn)	0.9841749058943147	-	-	
Gradient descent	0.9643237976404084	0.0001	239	