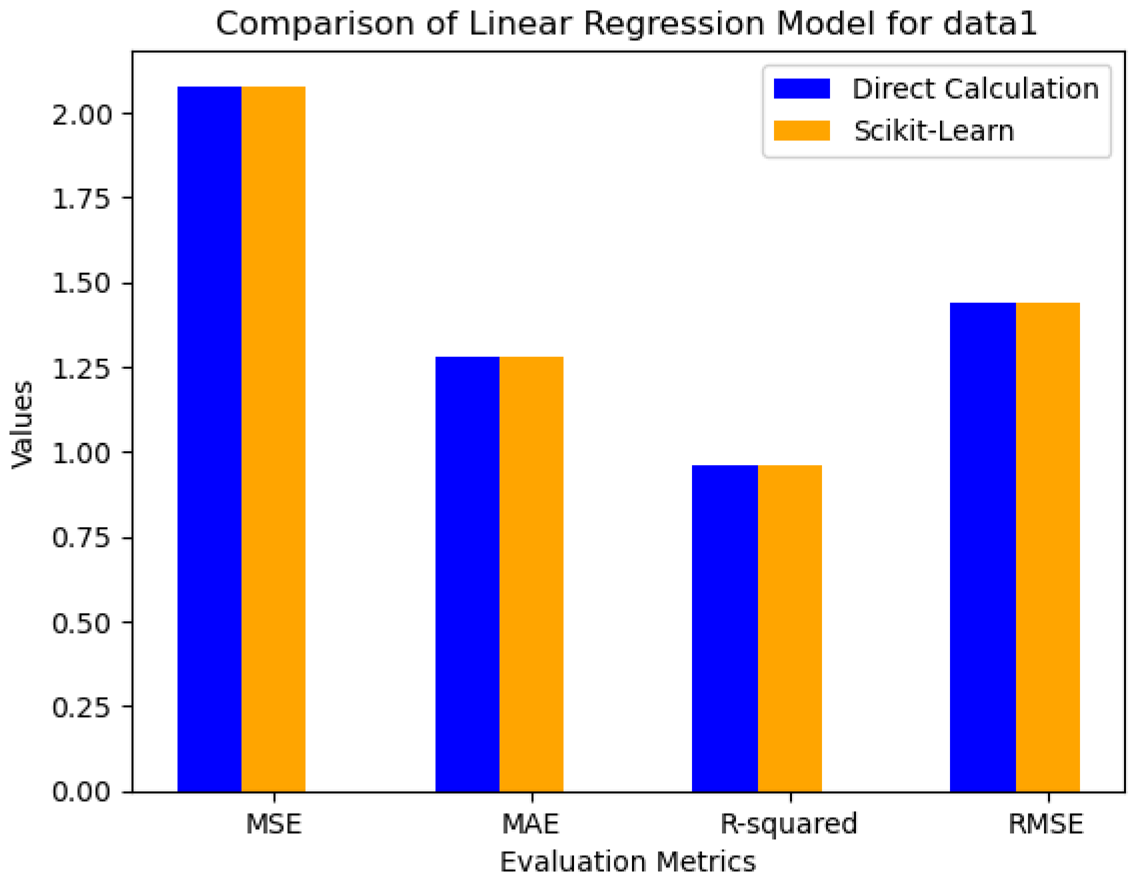
REPORT

Dataset 1:

Errors	Normal-Calculation(my model)	Scikit
Mean Squared	2.078525401777326	2.078525401777328
Mean Absolute	1.280555978429146	1.2805559784291471
R-Square	0.9579571905586358	0.9579571905586357
Root mean square	1.4417091945941547	1.4417091945941551



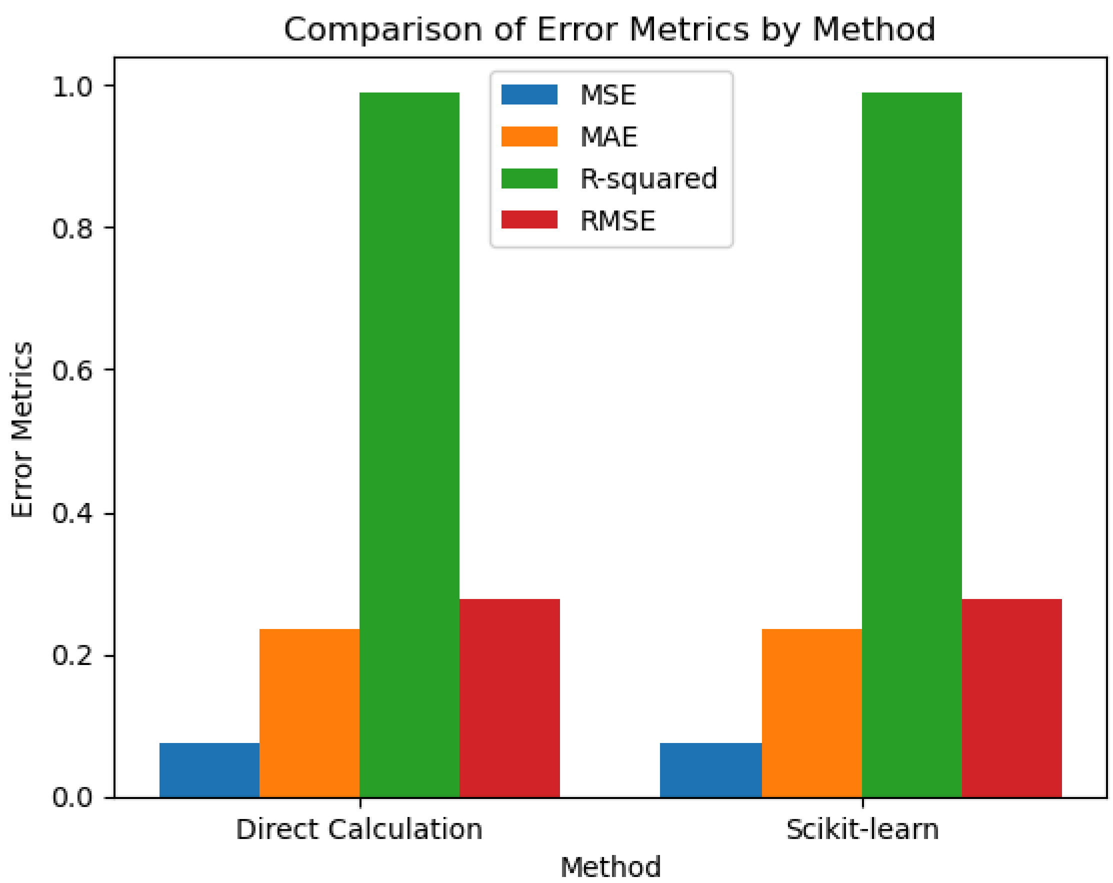
Comparison for weight:
Weight using gradient descent: [[5.68078713],[2.38406007]]
Weight using normal-calculation: [[5.68078713], [2.38406007]]

Observations:
The weight vector using direct calculation and gradient descent are the same, this means both the methods converge to the same solution. All the three methods of error have negligible differences compared to scikit-learn. R-squared values are

close to 1, meaning the model is good and has a strong relationship between the variables.
Since there are only two input features in Dataset 1, linear regression can be directly applied to find the best fit hyperplane. Hyperplane will be a straight line.

Dataset 2:

Errors	Normal-Calculation	Scikit
Mean Squared	0.07643342704351964	0.07643342704351967
Mean Absolute	0.23498835289025644	0.2349883528902572
R-Square	0.9904038522690993	0.9904038522690993
Root mean square	0.27646596000867746	0.276465960086775



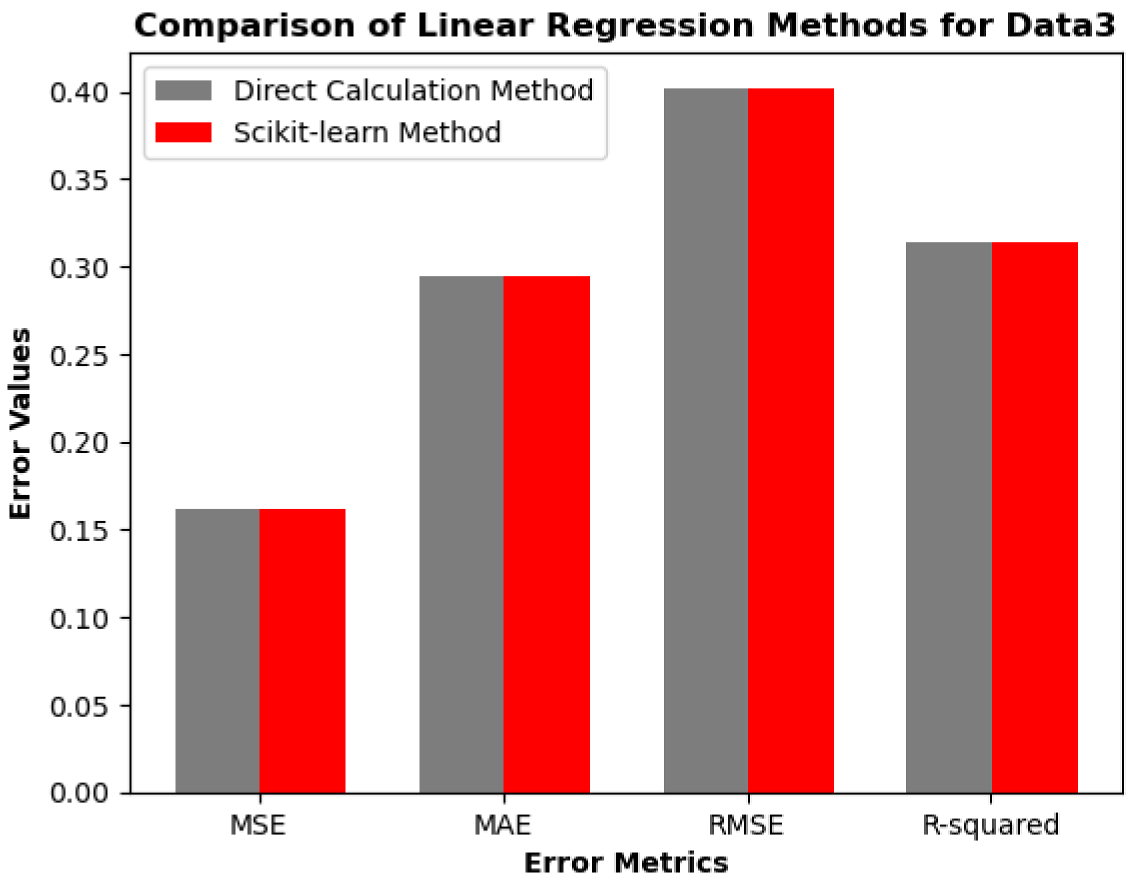
Comparison for weight:

Direct Calculation : [[3.68212267], [0.97299745]]
Gradient descent: [[3.68212267], [0.97299745]]

For dataset2, This requires a non-linear transformation to fit into a linear regression model Because its data points are exponential. I did a non-linear transformation using a logarithmic function.

Dataset 3:

Errors	Normal-Calculation	Scikit
Mean Squared	0.16173044143088555	0.16173044143088552
Mean Absolute	0.29467793301310385	0.29467793301310374
R-Square	0.40215723471160575	0.4021572347116057
Root mean square	0.3136973226728078	0.3136973226728079



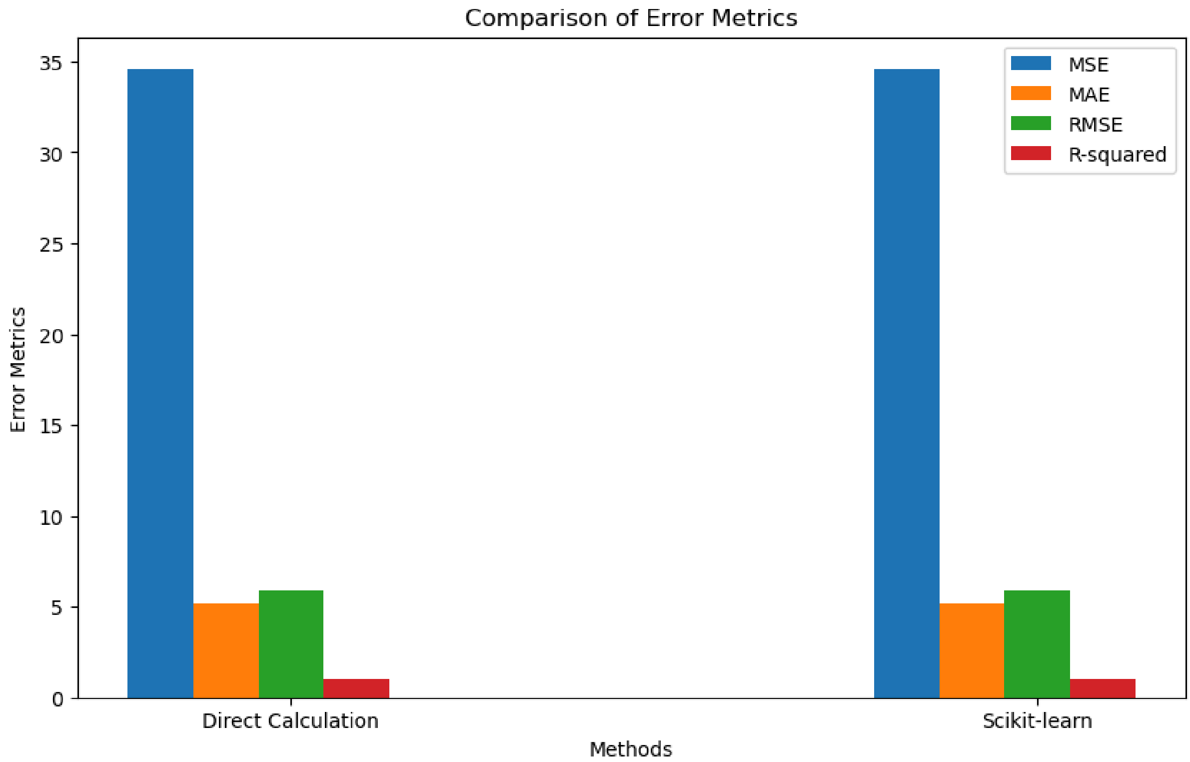
Comparing weight:

For direct calculation : [[1.17706208], [0.09419021]]
For gradient descent : [[1.17706208], [0.09419021]]

Direct calculation method and Scikit method gave the same results in terms of error calculation. R-square error is close to 0 and far from 1.our model is not good for dataset 3. I have plotted the graph in my code, there you can clearly see that Linear regression model will not fit for this. Hence there will be no hyperplane.

Dataset 4 :

Errors	Normal-Calculation	Scikit-learn
Mean Squared	34.62048082924356	34.62048082924357
Mean Absolute	5.155505630379489	5.155505630378744
R-Square	0.9841749058943147	0.9841749058943147
Root mean square	5.883917133104745	5.883917133104745



Comparing weight:

Normal Calculation: [[13.23947782] [6.13243763] [2.39226554] [7.74681038]]
Gradient descent: [[13.23947579 6.13243433 2.3922683   7.74681094]]

By looking at 3-4 columns in the dataset, It seems that it may be multiple linear regression. After applying multiple regression, the R-squared value was close to 1. That means my model is good for dataset 4.

Conclusion:

Dataset 1 is suitable for standard Linear Regression, Dataset 2 requires a non-linear transformation. Dataset 3 requires a different regression method as linear regression is not applicable on it. Dataset 4 is suitable for standard Linear regression and also multiple linear regression.