MAE vs MSE vs RMSE Vs RMSLE

In terms of comparison, primary differences are between MAE & MSE because they both are calculated in different ways. RMSE & RMSLE are extension of MSE therefore they share lots of properties with MSE.

|  |  |  |  |
| --- | --- | --- | --- |
| **Mean absolute Error (MAE)** | **Mean square Error (MSE)** | **Root mean square error (RMSE)** | **Root mean square log Error (RMSLE)** |
| It doesn’t account for the direction of the value. Even if value is negative, positive value is used for calculation. | It does account for positive or negative value. | It does account for positive or negative value. | It does account for positive or negative value. |
|  | RMSE & MSE share many properties with MSE because RMSE is simply the square root of MSE. | RMSE & MSE share many properties with MSE because it is simply the square root of MSE. |  |
| MAE is less biased for higher values. It may not adequately reflect the performance when dealing with large error values. | MSE is highly biased for higher values. | RMSE is better in terms of reflecting performance when dealing with large error values. |  |
|  |  | RMSE is more useful when lower residual values are preferred. |  |
| MAE is less than RMSE as the sample size goes up. |  | RMSE tends to be higher than MAE as the sample size goes up. |  |
| MAE doesn’t necessarily penalize large errors. | MSE penalize large errors. | RMSE penalize large errors. | RMSLE doesn’t penalize large errors. It is usually used when you don’t want to influence the results if there are large errors. RMSLE penalize lower errors. |
| MAE is more useful when the overall impact is proportionate to the actual increase in error. For example- if error values go up to 6 from 3, actual impact on the result is twice. It is more common in financial industry where a loss of 6 would be twice of 3. |  | RMSE is more useful when the overall impact is disproportionate to the actual increase in error. For example- if error values go up to 6 from 3, actual impact on the result is more than twice. This could be common in clinical trials, as error goes up, overall impact goes up disproportionately. |  |
|  |  | When actual and predicted values are low, RMSE & RMSLE are usually same. | When actual and predicted values are low, RMSE & RMSLE are usually same. |
|  |  | When either of actual or predicted values are high, RMSE > RMSLE. | When either of actual or predicted values are high, RMSE > RMSLE. |

MAE vs MSE vs RMSE Vs RMSLE Conclusion

I have mentioned only important differences. If there is no valid point for one, I haven’t included in the above table and that’s why we have empty cells in the table.

Few important points to remember when using loss functions for your regression;

* Never compare apple with oranges, that is, never compare different metrics with each other. For example- don’t compare values of MSE with MAE or others. They would be different.
* Try to use more than 1 loss function.
* Always calculate evaluation metrics (loss functions) for both testing and training data set.
* Compare evaluation metrics between test and training data set. There shouldn’t be a huge difference between them. If there is, there is a problem with your model. For example- if you are using RMSE, calculate RMSE for testing and training data set. There should be huge difference between these values for this data set.
* If you have outlier in the data and you want to ignore them, MAE is a better option but if you want to account for them in your loss function, go for MSE/RMSE.