POPULAR REGRESSION METRICS I

- Like classification metrics, Regression methods are supported with several metrics (listed below) to evaluate the performance of the model.
- The main idea of these metrics is to calculate the difference between the actual and predicted value. The actual value is the actual value of the class given whereas, predicted is the value forecasted by the model.
- As in regression, the class labels are numerical in nature so we can only use evaluation metrics which can perform the numerical computations hence, below listed metrics are used.

1. Mean Absolute Error
2. Root Mean Squared Error
3. R-squared

POPULAR REGRESSION METRICS II

Mean Absolute Error (MAE)

- MAE measures the average magnitude of the errors. In other words, It is the average over the test sample of the absolute differences between prediction and actual observation where all individual differences have equal weight.

- Equation 17 represents method of computing MAE. Here, n is the total number of observations given. The actual value is represented by y and predicted is indicated by $\hat{y}$.

$$MAE = \frac{1}{n}\sum_{i=1}^{n} | y_i - \hat{y}_i | \qquad (17)$$

POPULAR REGRESSION METRICS III

Example Illustration

Consider hypothetical data set in Table 11, where the height is the class value.

x	y (actual)	$\hat{y}$	$\lvert y - \hat{y} \rvert$
5.1	2.1	3.2	1.1
5.7	2.8	4.5	1.7
4.7	3.2	1.3	1.9
5.5	3.4	6.7	3.3
6.5	2.8	4.6	1.8
5.5	2.3	4	1.7
4.9	3	1.4	1.6
6.2	1.8	4.7	2.9
5.1	3.5	1.4	2.1
5	3.6	1.4	2.2
RAE			20.3

Table 11: Illustration of computing MAE

Lesser is the MAE of the model, better is the performance.

POPULAR REGRESSION METRICS IV

Root Mean Square Error (RMSE)

Like MAE, it also measures the average magnitude of the error. It is the square root of the average of squared differences between prediction and actual observation.

RMSE is computed using Equation 18.

$$\text{RMSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}((y_i - \hat{y}_i)^2)} \qquad (18)$$

POPULAR REGRESSION METRICS V

Example Illustration Consider hypothetical data set in Table 12, where the height is the class value.

x	y (actual)	$\hat{y}$	$\lvert y - \hat{y} \rvert^2$
5.1	2.1	3.2	1.21
5.7	2.8	4.5	2.89
4.7	3.2	1.3	3.61
5.5	3.4	6.7	10.89
6.5	2.8	4.6	3.24
5.5	2.3	4	2.89
4.9	3	1.4	2.56
6.2	1.8	4.7	8.41
5.1	3.5	1.4	4.41
5	3.6	1.4	4.84
RMSE			$\sqrt{40.95}$

Table 12: Illustration of computing RMSE

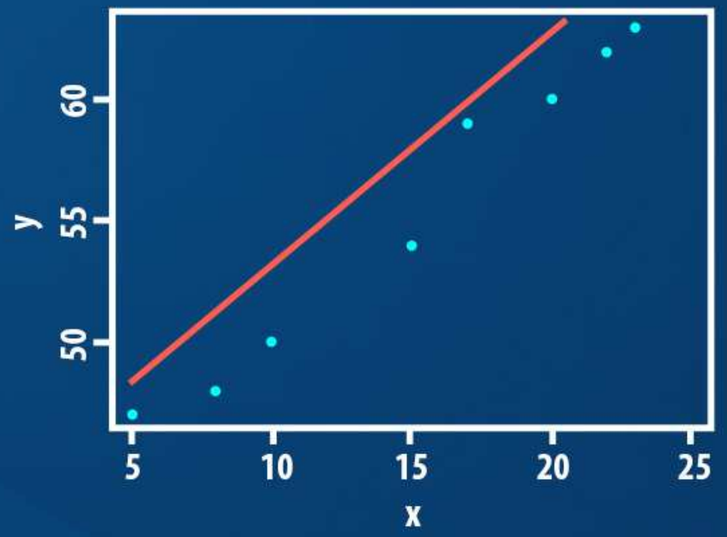
Lesser is the RMSE of the model, better is the performance.

Higher variance explained by the model better is the model.

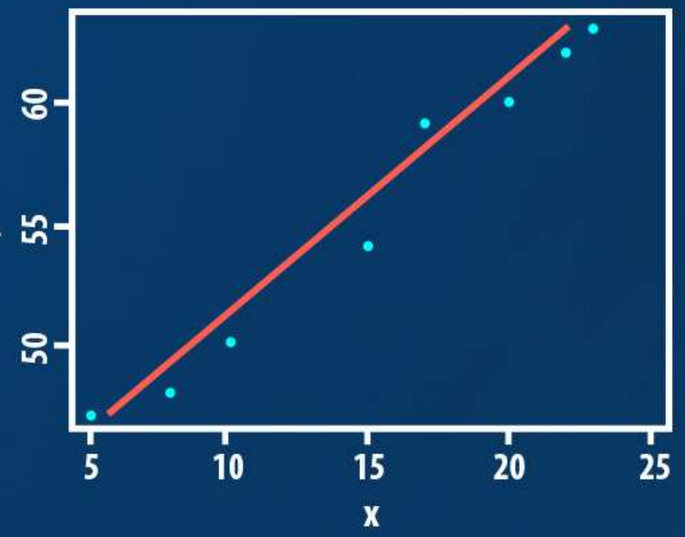
POPULAR REGRESSION METRICS VI

How to choose between RAE, RMSE and R-Squared ?

- R-squared is a statistical measure of how close the data are to the fitted regression line. It is also known as the coefficient of determination, or the coefficient of multiple determination for multiple regression.
- Figure 62a and Figure 62b different R-squared values for regression models. The red line in the plots represents the model fit.



(a) Fitted model on observed data points



(b) Fitted model on observed data points

- The regression model on the left has more variation as the data points are away from the fitted line.
- In the figure right, data points are relatively closer to the model. The R-squared for the left will be smaller than the model on the right.
- Theoretically, we pick models with higher R-squared value.

POPULAR REGRESSION METRICS VII

How to choose between RAE, RMSE and R-Squared ?

1. Both MAE and RMSE measures the average model prediction error in the variable of interest. However, they have interesting implications. RMSE being squared error highlights the errors by weights. As the errors grows in the model, RMSE squares it so as it get visibility by the user. RMSE is particularly useful when large error are undesirable.

2. R-squared not only indicates the performance of the model but also describes the variance captured by the model. A good model should be able to capture or explain the most of the variance in the data. Higher R-squared value is preferred. This metric is preferred in situations where it is important to know the relationship between predictor and indicator variables. Higher R-squared value indicates the strong relation between indicator and predictive variables.