Performance Metrics for Regression Problem

Error = Y (actual) — Y (predicted)

Mean Absolute Error (MAE)

$$\mathrm{MAE} = \frac{1}{N}\sum_{i=1}^{N} |y_i - \hat{y}_i|$$

> *Where,*
>
> *N = total number of data points*
>
> *Yi = actual value*
>
> *Ŷi = predicted value*

the lower the MAE, the less error in your model.

When DSet having outlier MAE is more beneficial

MAE the value should be near to zero. Then model perfom well.

MAE more beneficial to outlier.

For outlier MAE is more preferable than MSE.

Mean Squared Error (MSE)

$$\text{MSE} = \frac{1}{n} \sum_{i=1}^{n} (y_i - \tilde{y}_i)^2$$

> *Where,*
>
> *n = total number of data points*
>
> *Yi = actual value*
>
> *Ŷi = predicted value*

Thus, as with MAE, the lower the MSE, the less error in the model.

Root Mean Squared Error (RMSE)

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

> *Where,*
>
> *n = total number of data points*
>
> *Yi = actual value*
>
> *Ŷi = predicted value*

lower RMSE → lower error.

R-Squared (R^2)

The R^2 metric gives an indication of how well a model fits your data, but is unable to explain if your model is good or not.

$$R^2 = 1 - \frac{\sum (y_i - \hat{y}_i)^2}{\sum (y_i - \bar{y}_i)^2}$$

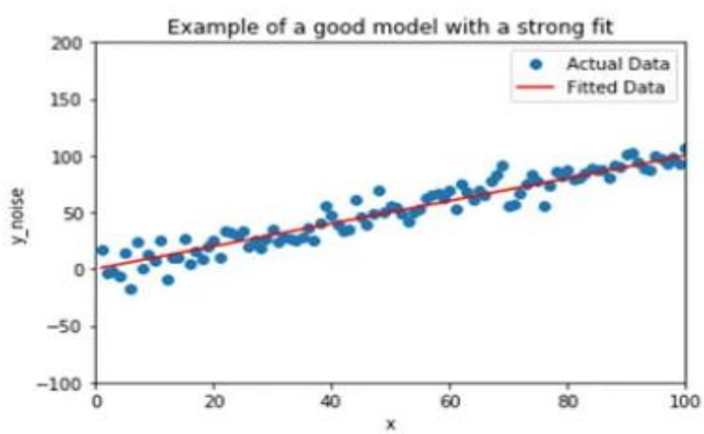
y = dependent variable values, y_hat = predicted values from model, y_bar = the mean of y

The R^2 value ranges from 0 to 1, with higher values denoting a strong fit, and lower values denoting a weak fit. Typically, it's agreed that:

$R^2 < 0.5$ → Weak fit

$0.5 \leq R^2 \leq 0.8$ → Moderate fit

$R^2 > 0.8$ → Strong fit

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R^2 =  0.9186211060937284
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The line shoul max numb of point and distance between line and datapoint should be minimum.

in sk learn all is available apart from R2

When to use regression?

If target variable is a continuous numeric variable (100–2000), then use a regression algorithm.

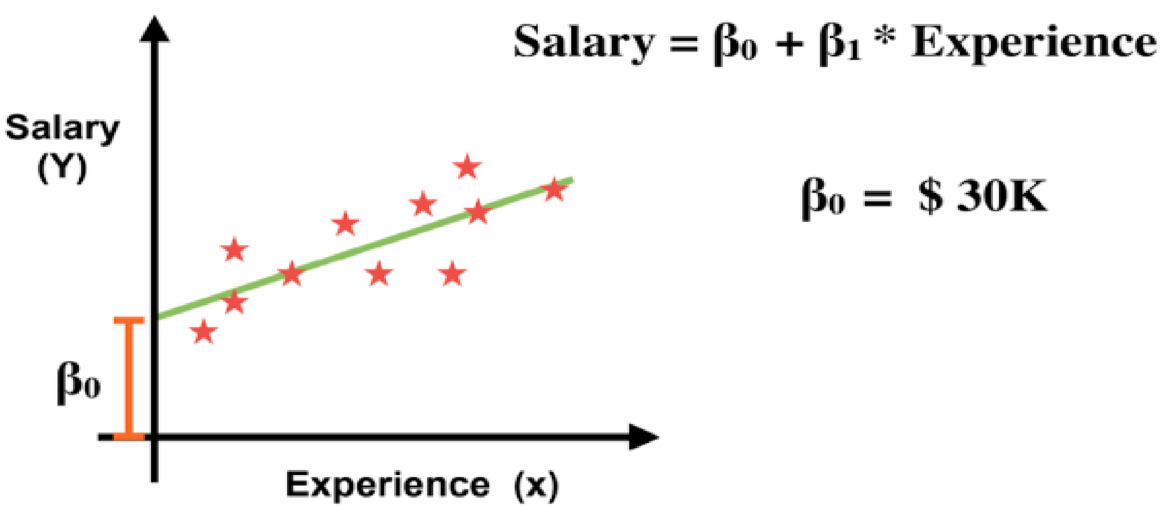
Types of Regression Algorithms:

- Linear regression
- Multiple linear regression
- Polynomial regression
- Ridge regression
- Lasso regression
- ElasticNet regression

Linear Regression

Linear Regression is a statistical model used to predict the relationship between independent and dependent variables denoted by x and y respectively

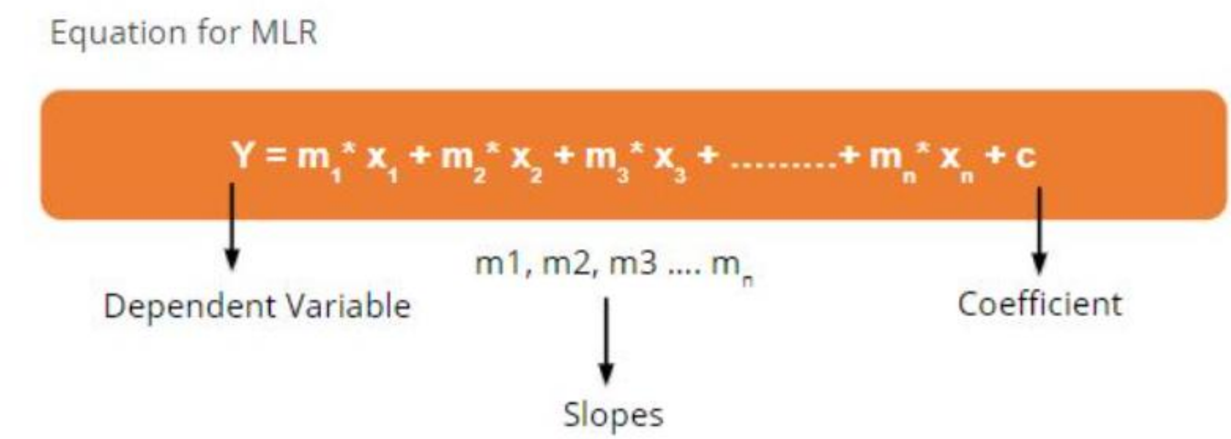
Simple Linear Regression is where only one independent variable is present and the model has to find the linear relationship of it with the dependent variable

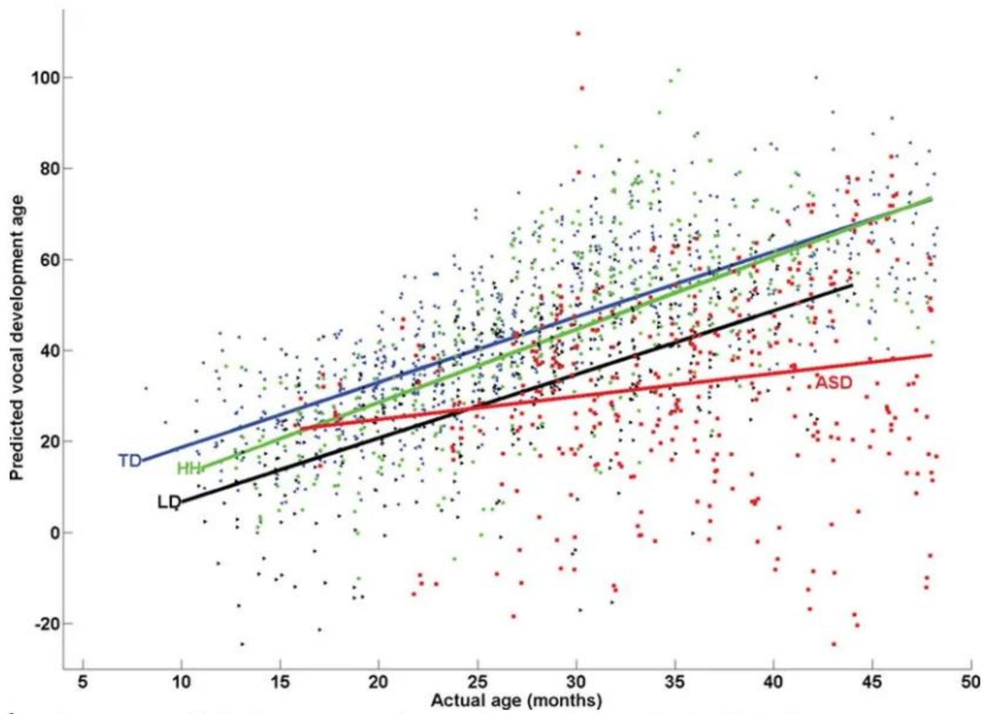


Y = mx + c

Muliple Linear Regression:

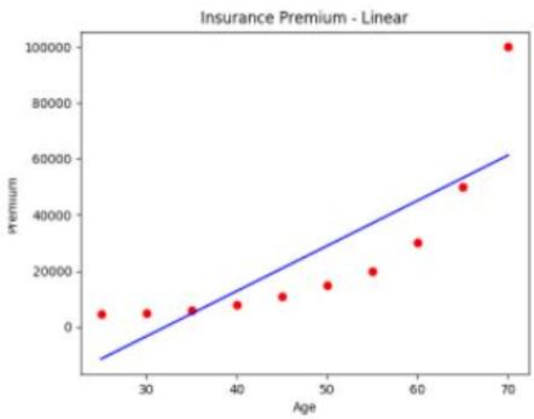
Multiple Linear Regression is one of the important regression algorithms which models the linear relationship between a single dependent continuous variable and more than one independent variable.

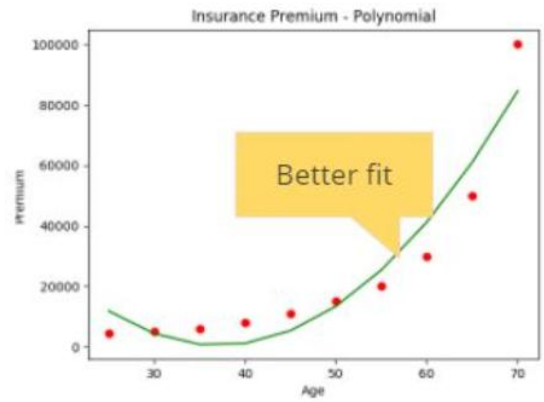


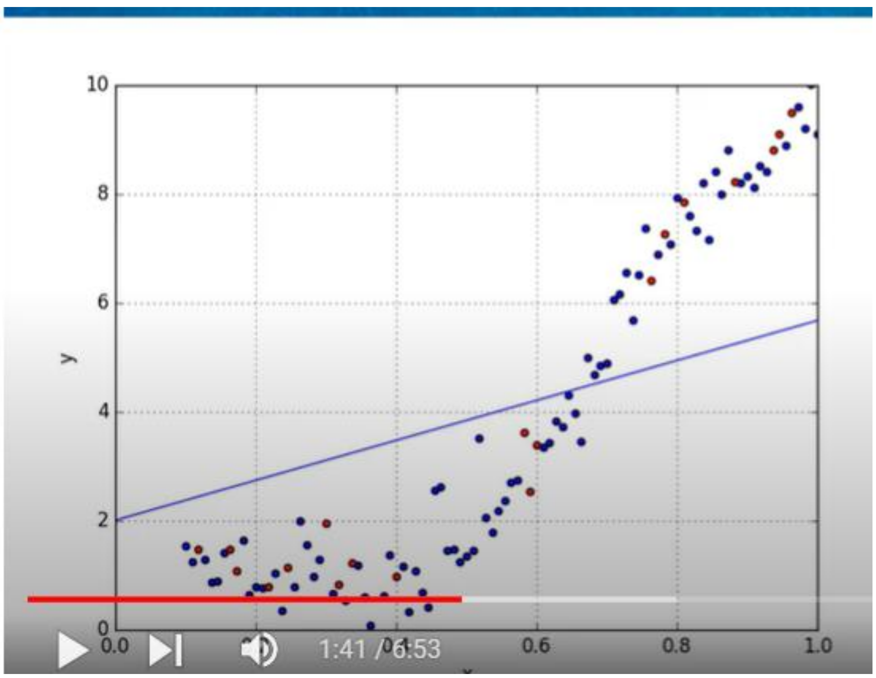


Polynomial Regression:

It is a form of regression analysis in which the relationship between the independent variables and dependent variables are modeled in the **nth degree polynomial**.







Simple Linear Regression

$$y = b_0 + b_1 x_1$$

Multiple Linear Regression

$$y = b_0 + b_1 x_1 + b_2 x_2 + \dots + b_n x_n$$

Polynomial Linear Regression

$$y = b_0 + b_1 x_1 + b_2 x_1^2 + \dots + b_n x_1^n$$

Polynomials	Form	Degree	Examples
Linear Polynomial	$p(x)$: $ax+b$, $a \neq 0$	Polynomial with Degree 1	$x + 8$
Quadratic Polynomial	$p(x)$: ax^2+b+c, $a \neq 0$	Polynomial with Degree 2	$3x^2-4x+7$
Cubic Polynomial	$p(x)$: ax^3+bx^2+cx, $a \neq 0$	Polynomial with Degree 3	$2x^3+3x^2+4x+6$

It does not require the relationship between the independent and dependent variables to be linear in the data set.