Linear Regression Example

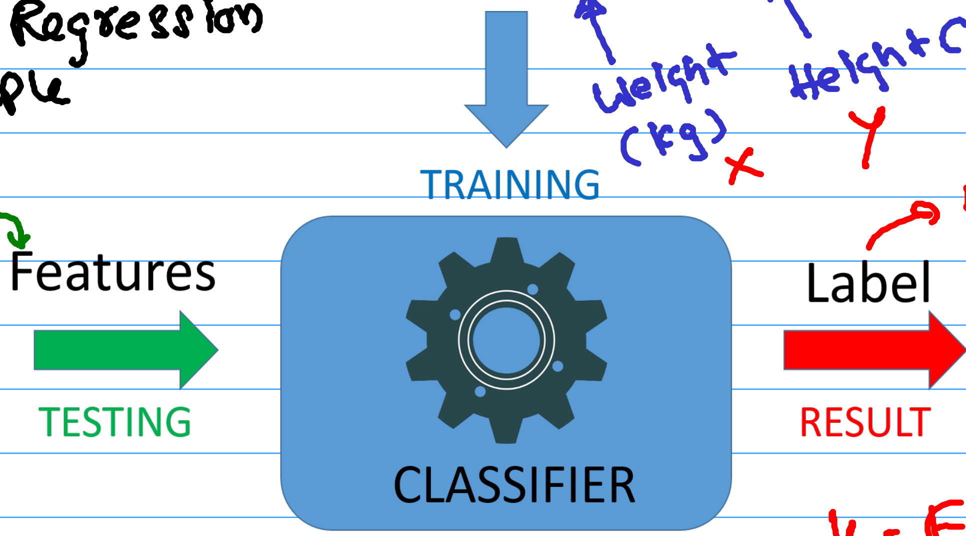
Features, Labels

Weight (kg) X

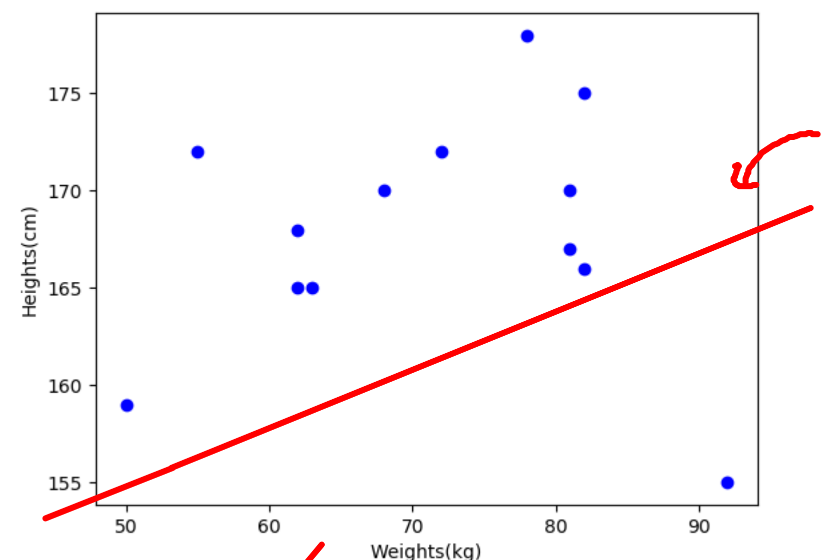
Height (cm) Y

weight (kg)

Height (cm)



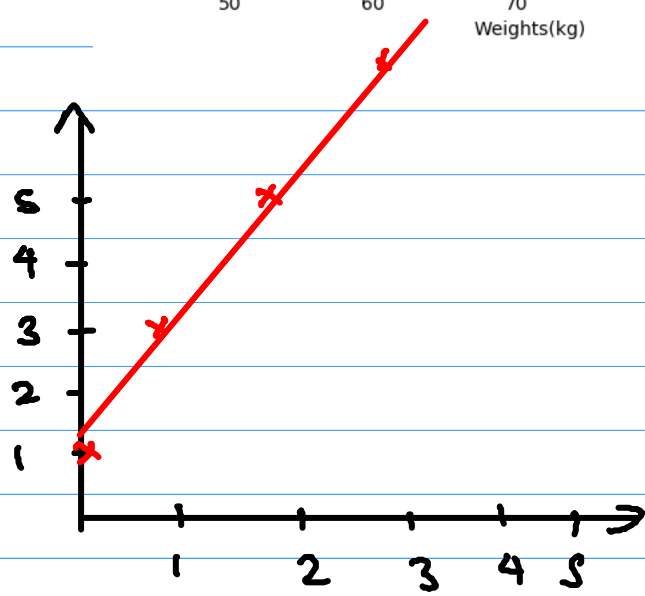
$y = F(x)$



$y = mx + c$

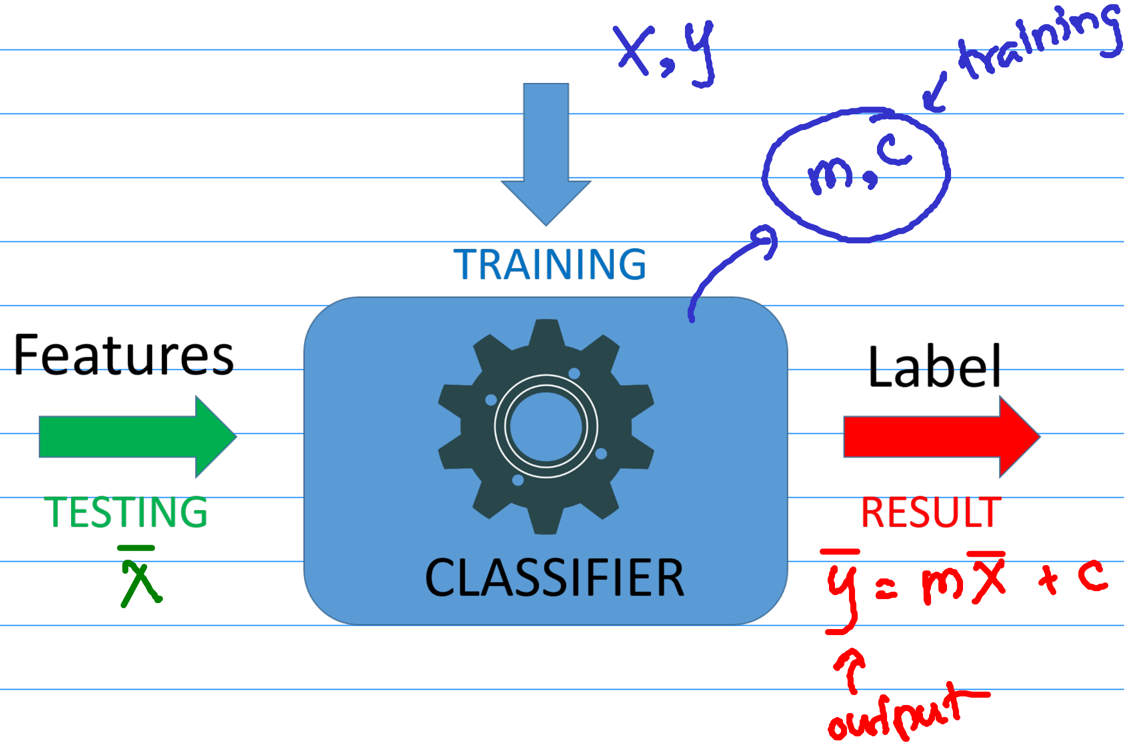
$y = mx + c$

$m = 2, \; c = 1$



X	Y
0	1
1	3
2	5
3	7

How Linear Regression Works?



* m, c → Gradient, intercept of the Best Fit line drawn for the train data and train target (x, y)

$$y = m^*x + c$$

$$m = \frac{\bar{x} \cdot \bar{y} - \overline{xy}}{(\bar{x})^2 - \overline{x^2}}$$

$$b = \bar{y} - m\bar{x}$$

	x	y	xy	x^2
0	x_1	y_1	x_1y_1	x_1^2
1	x_2	y_2	x_2y_2	x_2^2
2				
⋮				
n				
	Σx		Σxy	Σx^2

$$\overline{x^2} = \frac{\Sigma x^2}{n}$$

$$\bar{x}^2$$

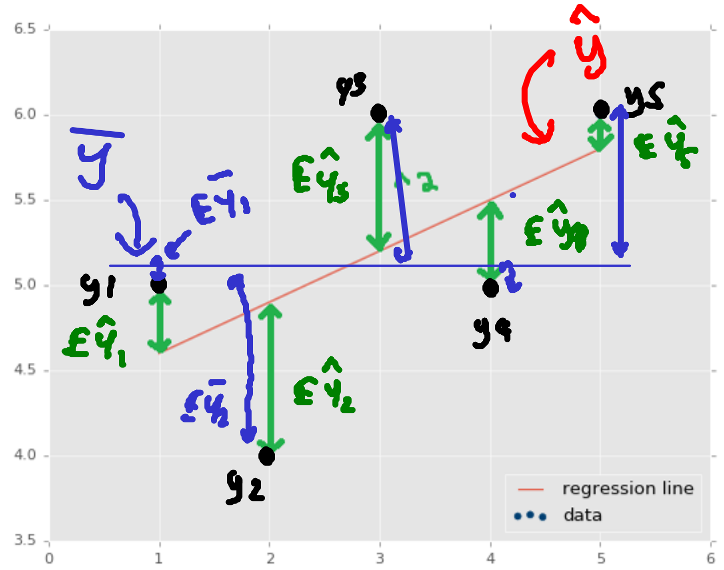
$$\bar{x} = \frac{\Sigma x}{n}$$

$$\bar{y} = \frac{\Sigma y}{n}$$

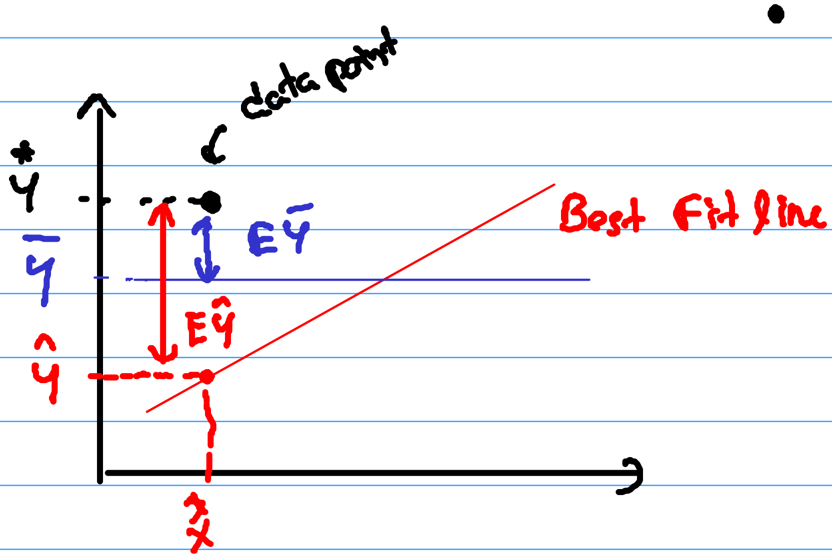
$$\overline{xy} = \frac{\Sigma xy}{n}$$

R^2 value

$$r^2 = 1 - \frac{SE_{\hat{y}}}{SE_{\bar{y}}}$$



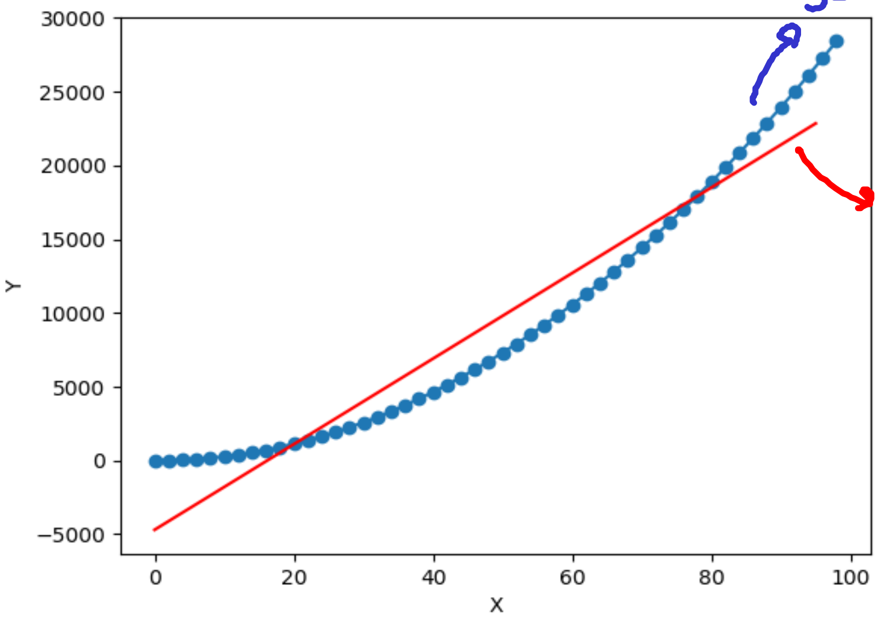
- $\bar{y} = \frac{\sum y}{n}$ (mean)



Linear Regression for Non Linear Data

$y = a_1x + a_2x^2 + a_0$

$y = 3x^2 - 4x + 5$



$y = mx + c$

Polynomial Function

$y = a_1x + a_2x^2 + a_3x^3 + \ldots + a_nx^n + a_0$ constant (c)

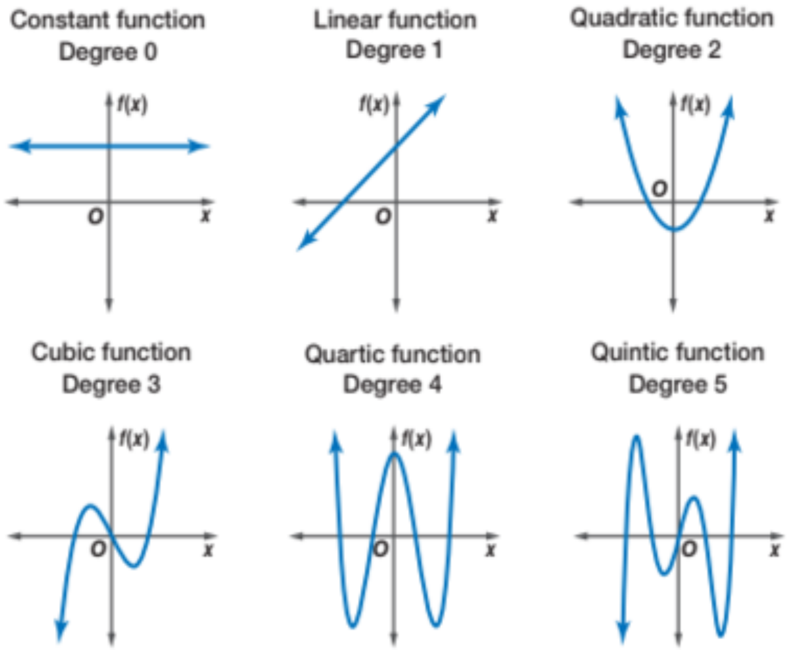
degree = 2 $\rightarrow$ $y = a_1x + a_2x^2 + a_0$

d = 3 $\rightarrow$ $y = a_1x + a_2x^2 + a_3x^3 + a_0$

d = 1 $\rightarrow$ $y = a_1x + a_0$ $(a_1 = m,\ a = c)$

$y = mx + c$

d = 0 $\rightarrow$ $y = a_0$




```python
from sklearn.linear_model import LinearRegression
from sklearn.preprocessing import PolynomialFeatures

poly=PolynomialFeatures(degree=2,include_bias=False)
x_new=poly.fit_transform(x)
```

$x \rightarrow d=1$

x_1, x_2, x_3, x_4, $\vdots$

$x\_new \rightarrow d=2$

x_1	x_1^2
x_2	x_2^2
x_3	x_3^2
$\vdots$	$\vdots$

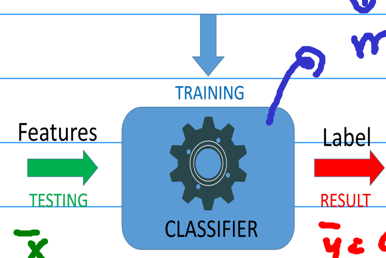
x, y

$a_1 \quad a_0$

$\downarrow \quad \downarrow$

m, c

$d=1$



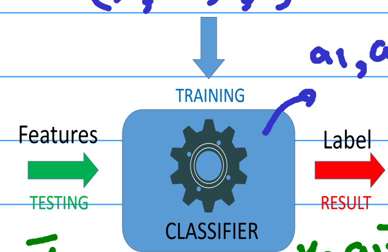
$\bar{x}$

$\bar{y} = a_1 \bar{x} + a_0$

$(x, x^2), y$

a_1, a_2, a_0

$d=2$



$\bar{x}$

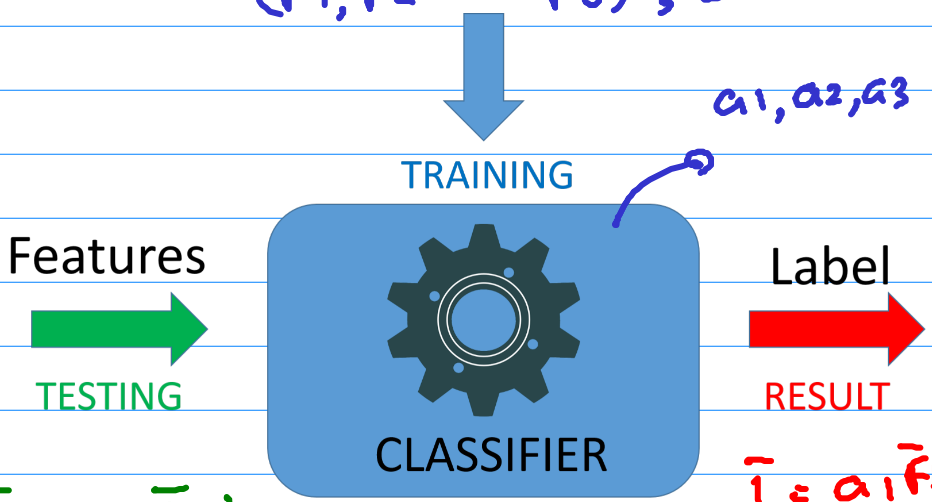
$y = a_1 \bar{x} + a_2 \bar{x}^2 + a_0$

Polynomial Regression

Linear Regression for cardio dataset

$(F1, F2 \cdots F6), L$

$a1, a2, a3 \ldots a6$



$(\bar{F1}, \bar{F2} \cdots \bar{F6})$

$\bar{L} = a_1 \bar{F1} + a_2 \bar{F} + \cdots a_6 \bar{F}_6$