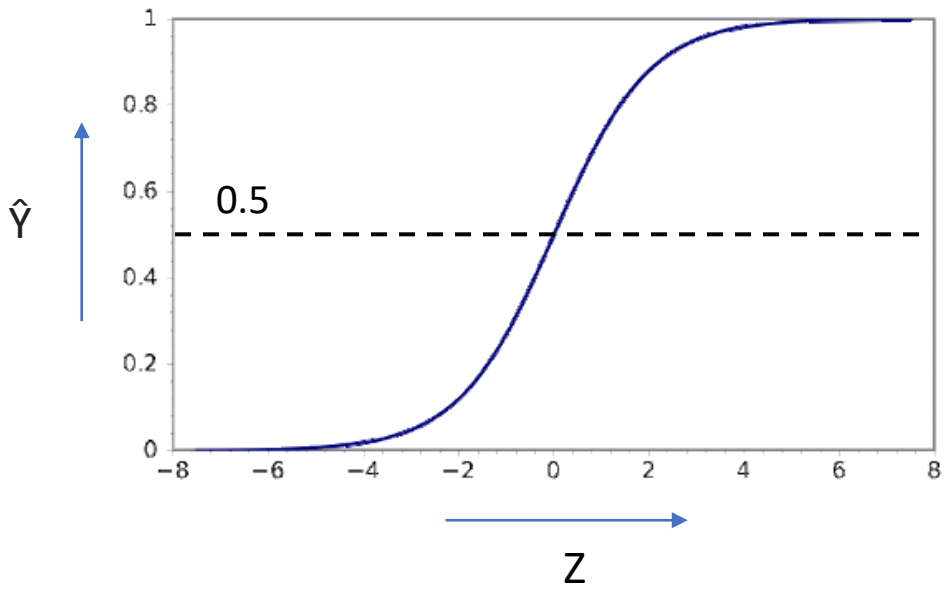
Siddhardhan

Math behind Logistic Regression

Logistic Regression



$$\hat{Y} = \frac{1}{1 + e^{-Z}}$$

$$Z = w.X + b$$

Sigmoid Function

Ŷ - Probability that (y = 1)

Ŷ = P(Y=1 | X)

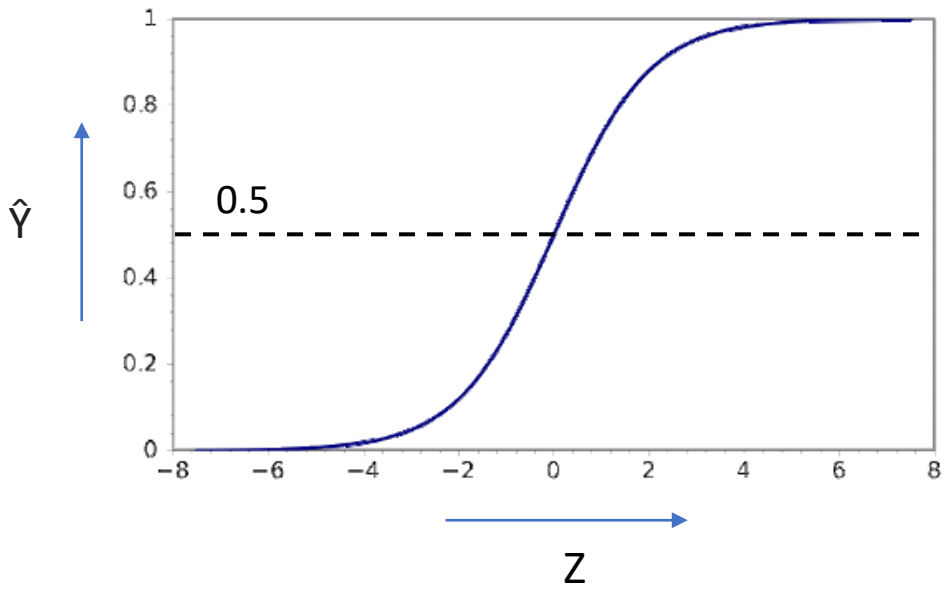
X - input features

w – weights
(number of weights is equal to the number of input features in a dataset)

b - bias

Ŷ = σ (Z)

Logistic Regression



$$\hat{Y} = \frac{1}{1 + e^{-Z}}$$

Sigmoid Function

Z = 5X + 10

Ŷ - Probability that (y = 1)

Ŷ = P(Y=1 | X)

X - input features

w – weights
(number of weights is equal to the number of input features in a dataset)

b - bias

Ŷ = σ (Z)

Logistic Regression

X	-9	-8	0	8	9
$\hat{Y}$					

$$Z = 5X + 10 \qquad \hat{Y} = \frac{1}{1+e^{-Z}}$$

X = -9

Z = 5(-9) + 10

Z = -35

$$\hat{Y} = \frac{1}{1+e^{35}}$$

$\hat{Y} = 0$

X = -8

Z = 5(-8) + 10

Z = -30

$$\hat{Y} = \frac{1}{1+e^{30}}$$

$\hat{Y} = 0$

X = 0

Z = 5(0) + 10

Z = 10

$$\hat{Y} = \frac{1}{1+e^{-10}}$$

$\hat{Y} = 1$

X = 8

Z = 5(8) + 10

Z = 50

$$\hat{Y} = \frac{1}{1+e^{-50}}$$

$\hat{Y} = 1$

X = 9

Z = 5(9) + 10

Z = 55

$$\hat{Y} = \frac{1}{1+e^{-55}}$$

$\hat{Y} = 1$

Logistic Regression

X	-9	-8	0	8	9
$\hat{Y}$	0	0	1	1	1

$$Z = 5X + 10 \qquad \hat{Y} = \frac{1}{1+e^{-Z}}$$

X = -9

Z = 5(-9) + 10

Z = -35

$$\hat{Y} = \frac{1}{1+e^{35}}$$

$\hat{Y} = 0$

X = -8

Z = 5(-8) + 10

Z = -30

$$\hat{Y} = \frac{1}{1+e^{30}}$$

$\hat{Y} = 0$

X = 0

Z = 5(0) + 10

Z = 10

$$\hat{Y} = \frac{1}{1+e^{-10}}$$

$\hat{Y} = 1$

X = 8

Z = 5(8) + 10

Z = 50

$$\hat{Y} = \frac{1}{1+e^{-50}}$$

$\hat{Y} = 1$

X = 9

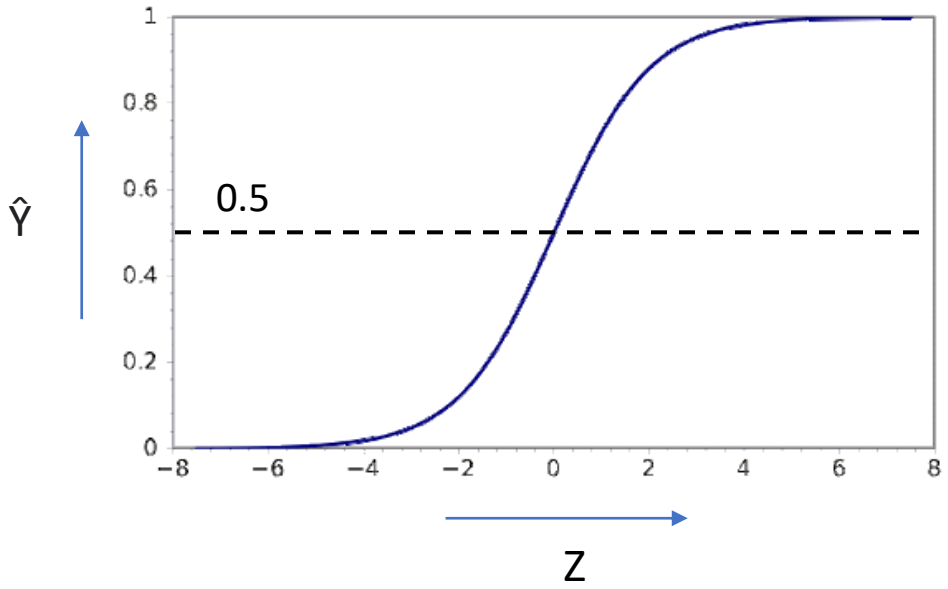
Z = 5(9) + 10

Z = 55

$$\hat{Y} = \frac{1}{1+e^{-55}}$$

$\hat{Y} = 1$

Logistic Regression



$$\hat{Y} = \frac{1}{1 + e^{-Z}}$$

$$Z = w.X + b$$

Sigmoid Function

Inference:

If Z value is a large positive number, $\hat{Y} = \frac{1}{1 + 0}$

$\hat{Y} = 1$

If Z value is a large negative number, $\hat{Y} = \frac{1}{1 + (large\ positive\ number)}$

$\hat{Y} = 0$