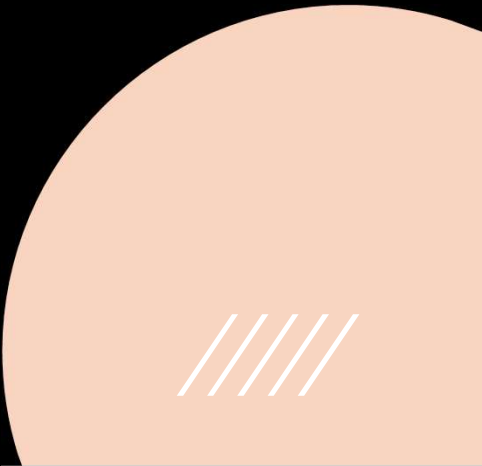




Logistic Regression

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Outline

Philosophy of Logistic Regression Algorithm

Role of Sigmoid in Logistic Regression

Linear Regression vs Logistic Regression

Why Logistic Regression?

Linear Regression predicts the **numerical** responses but is not suitable for predicting **categorical** variable

For **categorical dependent variable**, we apply **classification**

Logistic Regression is suitable for **binary classification** problems

What is Logistic Regression?

Classification Algorithm (Mostly Binary)

It outputs probabilities for a class

If the probability, $p \geq 0.5$:

- Data is classified as 1

If the probability, $p < 0.5$:

- Data is classified as 0

age	income	Region	credit_rating	Buy Mobile	
<20	high	USA	Low	no	0.25
<20	high	USA	High	no	0.33
21...50	high	USA	Low	yes	0.78
>50	medium	USA	Low	yes	0.87
>50	low	PK	Low	yes	0.88
>50	low	PK	High	no	0.43
21...50	low	PK	High	yes	0.99
<20	medium	USA	Low	no	0.12
<20	low	PK	Low	yes	0.67
>50	medium	PK	Low	yes	0.89
<20	medium	PK	High	yes	0.76


Applications

- Used for binary classification like:
 - Email is spam or not spam
 - Transaction is fraudulent/not fraudulent
 - It will rain/not rain
 - Customer will buy a product/not buy


Advantages

Doesn't require too many computational resources

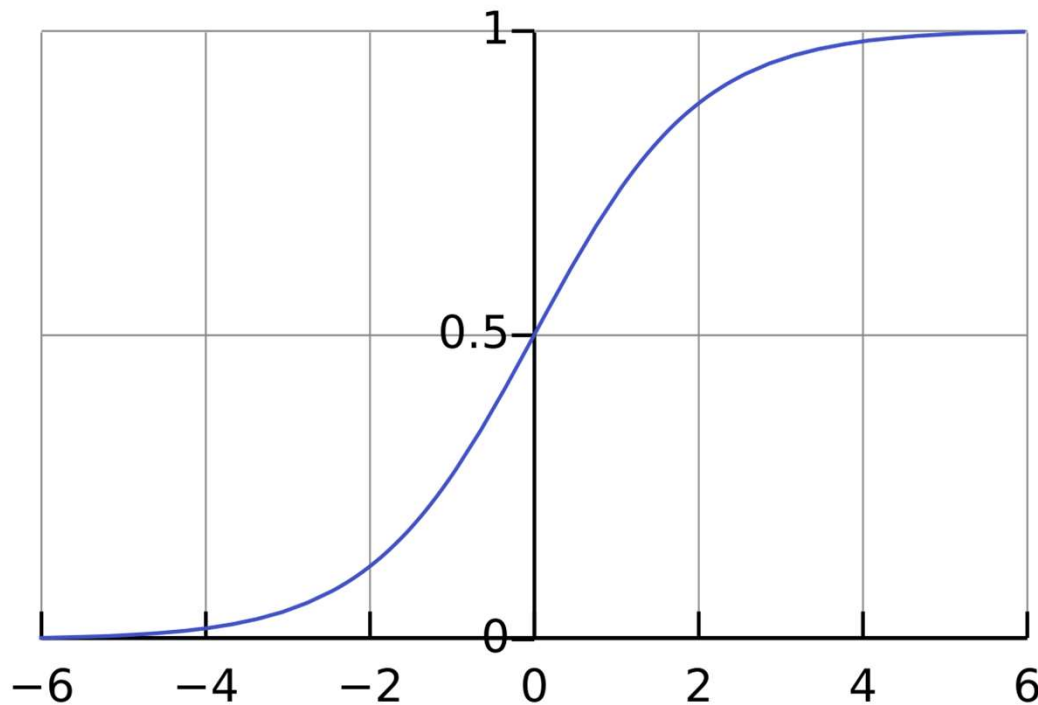
Performs better when data is linearly separable, as it learns a linear decision boundary



Linear Regression	Logistic Regression
Used to solve regression problems	Used to solve classification problems
The response variables are continuous in nature	The response variable is categorical in nature
It helps estimate the dependent variable when there is a change in the independent variable	It helps to calculate the possibility of a particular event taking place
It is a straight line	It is an S-curve (S = Sigmoid)



Sigmoid Function/Logistic Function (S shaped Curve)



$$S(x) = \frac{1}{1 + e^{-x}}$$

$S(x)$ = sigmoid function

e = Euler's number

$e = 2.71828$

How Sigmoid Works

X (input)	F(x)=X	Output of Sigmoid function
1	F(1) = 0.73	0.73
10	F(10) = 0.99	0.99
100	F(100) = 1	1
-1	F(-1) = 0.268	0.268

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