Logistic Regression
logistic classification

Arunkumar Nair

Case-Study Data

We are provided a sample of 1000 customers.

We need to predict the probability whether a **customer of a Particular Age** will buy (y) a particular magazine or

not.

As we've a categorical outcome variable, we'll use logistic regression.

Linear to Logistic – (a)

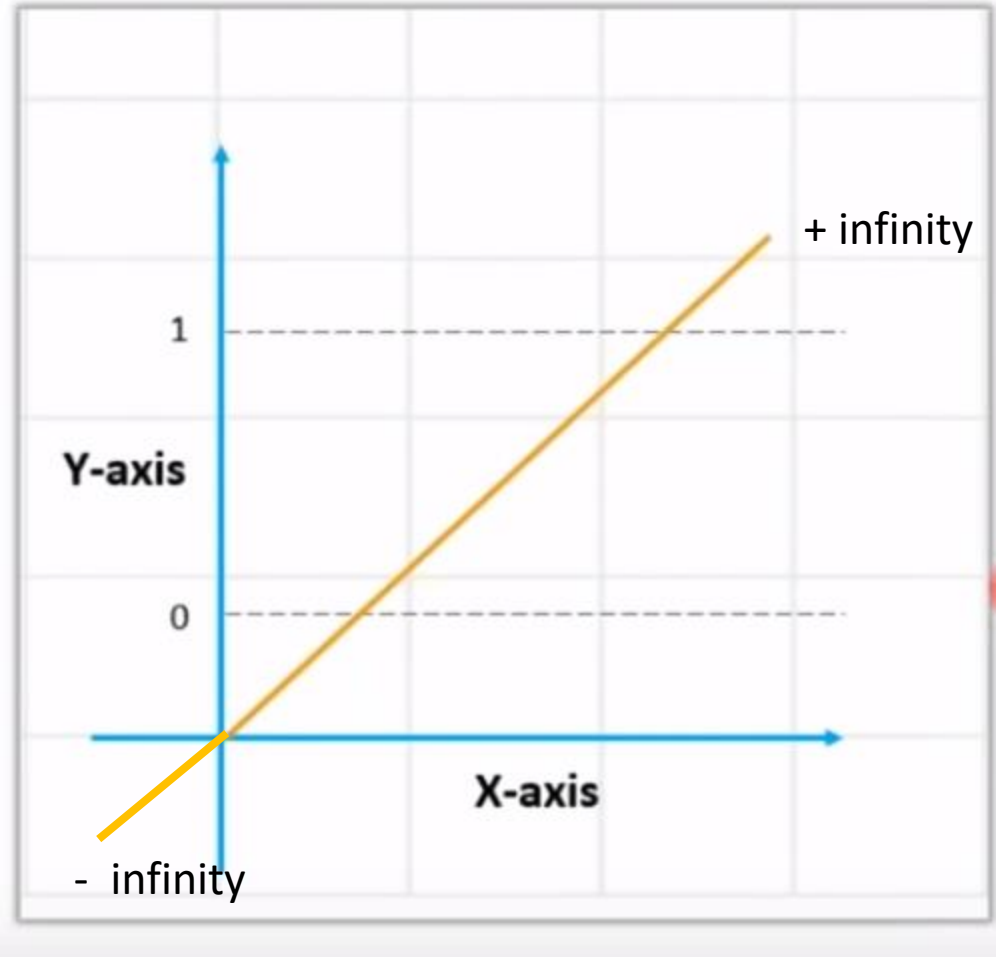
- To start with logistic regression, first write the simple linear regression equation with dependent variable enclosed in a link function:

Y = c + m X

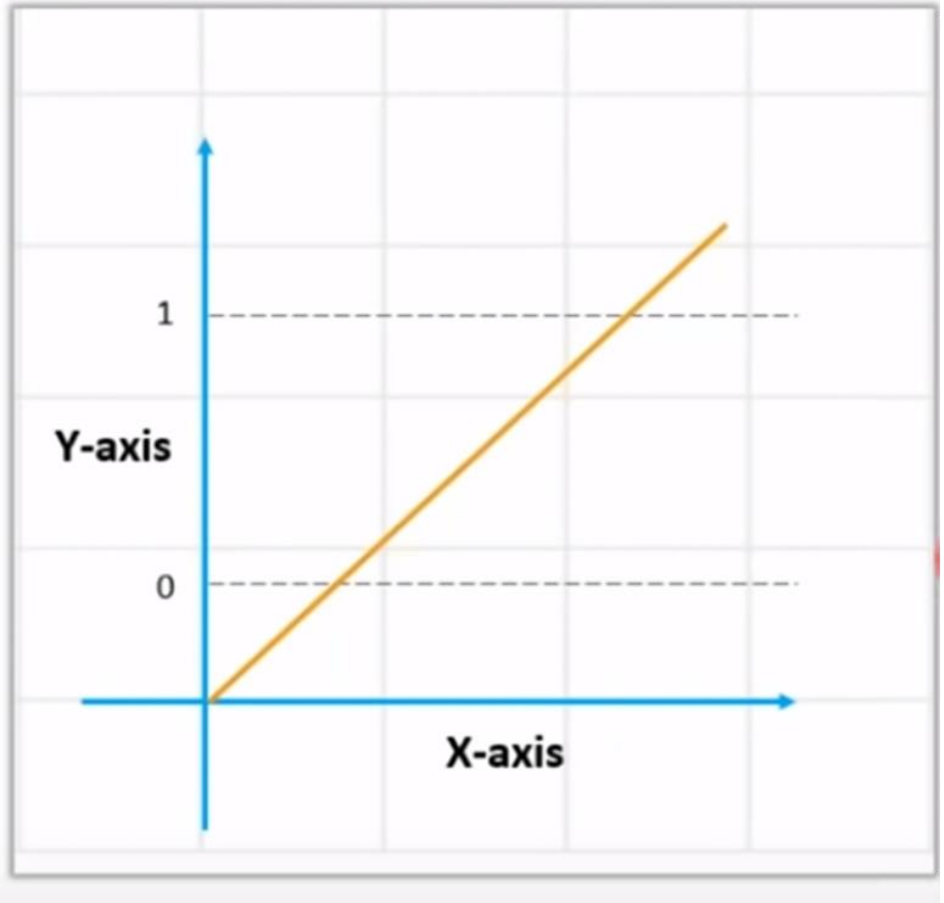
$$g(y) = \beta o + \beta(\text{Age}) \text{——} (a)$$

For understanding, consider '*Age*' as independent variable.

Linear Regression

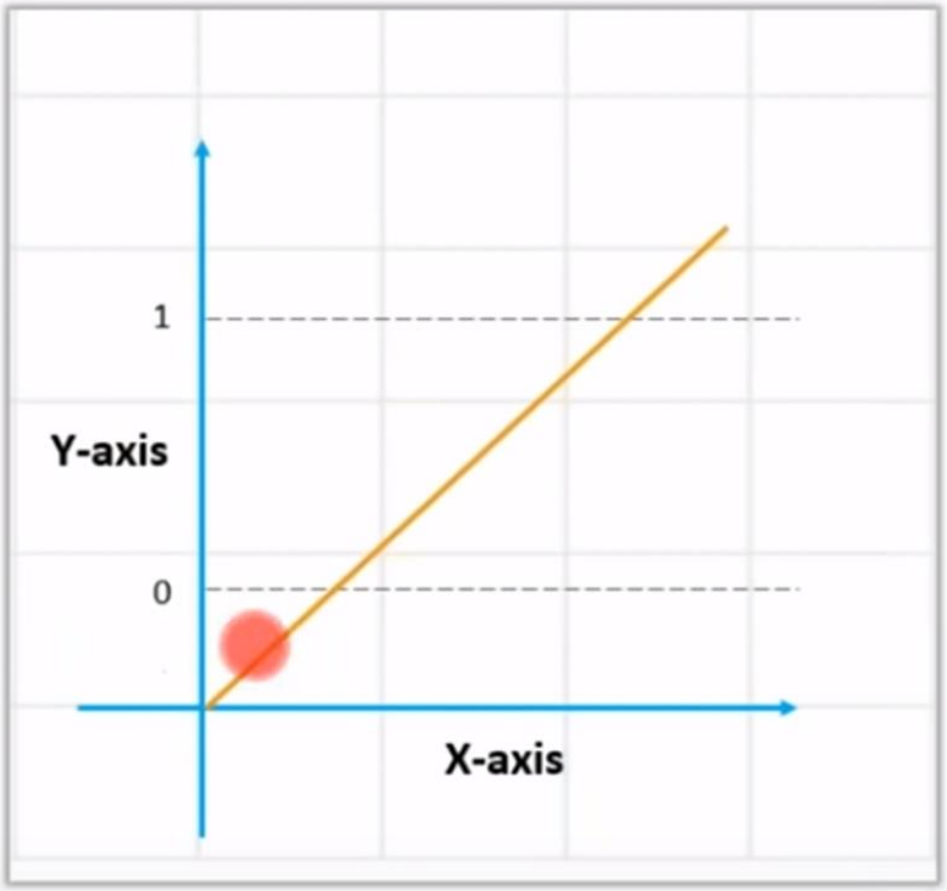


Linear regression equation: $y = \beta 0 + \beta 1X1 + \beta 2X2 \ldots. + \beta nXn$



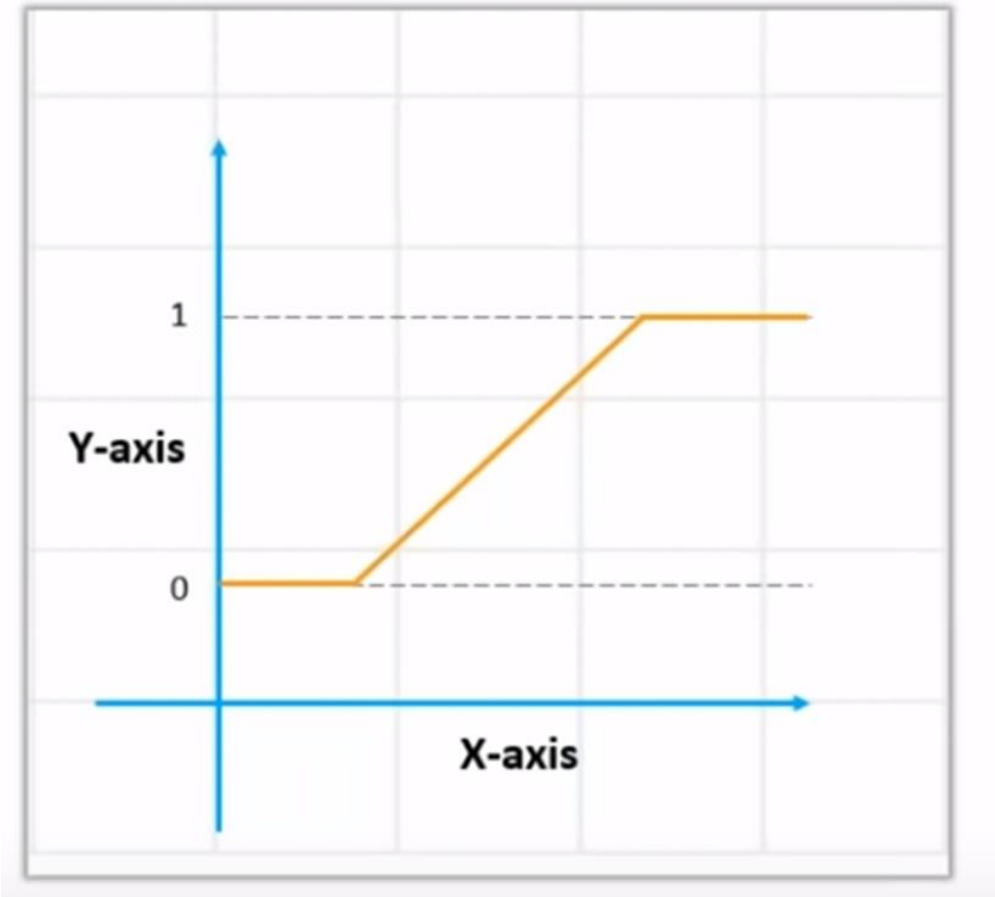
Since our value of Y will be between 0 and 1, the linear line has to be clipped at 0 and 1.

Value of Y – between 0 and 1



Since our value of Y will be between 0 and 1, the linear line has to be clipped at 0 and 1.

How to get the value of 0 and 1



How to get the value of 0 and 1?
Use Sigmoid

- We Apply sigmoid function on the linear regression equation to get the S-curve so that it lies between 0 and 1

Sigmoid function: $p = 1 / 1 + e^{-y}$

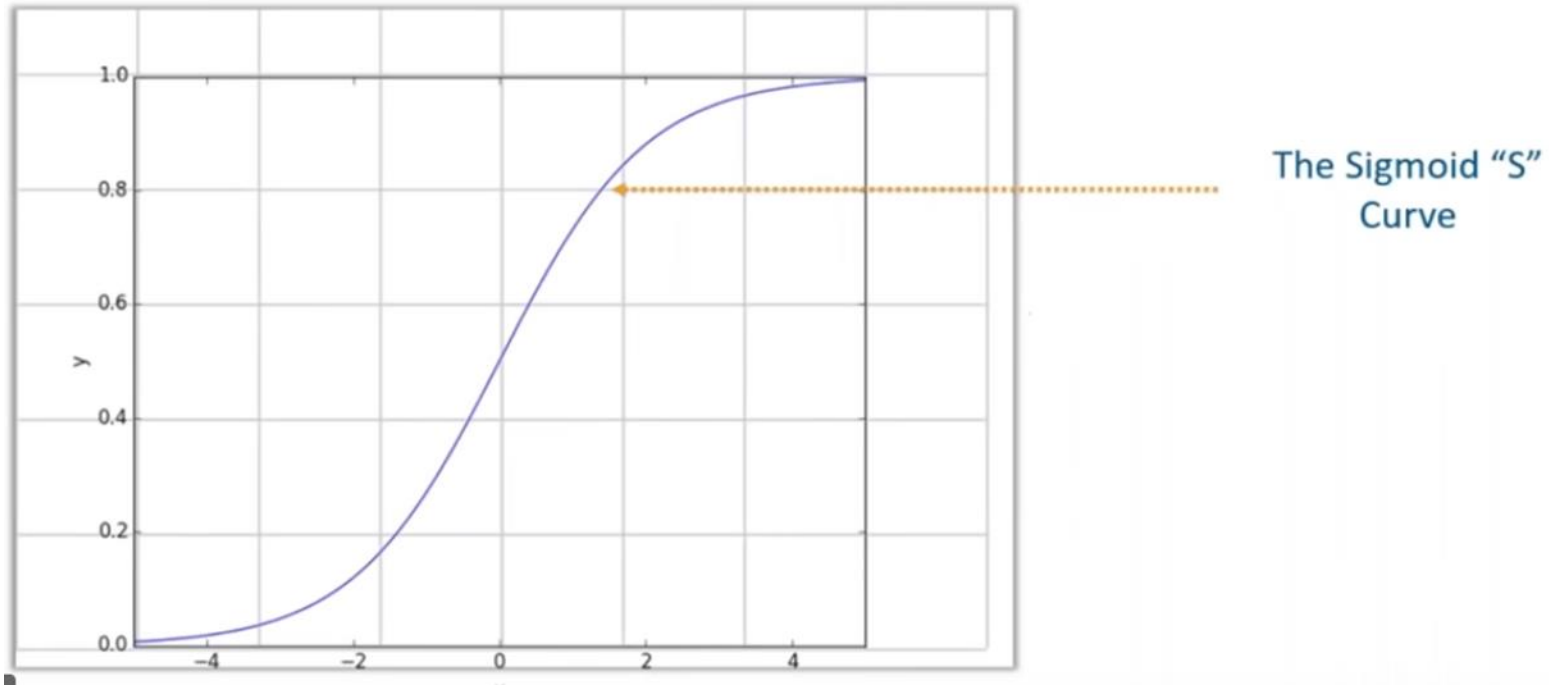
- A sigmoid function is a mathematical function/equation having a characteristic "S"-shaped curve or sigmoid curve.

Convert Linear to Logistics

- Linear regression equation: $y = \beta 0 + \beta 1X1 + \beta 2X2 \ldots. + \beta nXn$
- Sigmoid function: $p = 1 / 1 + e^{-y}$

  e^{-y} y is replaced
- Logistic Regression equation: $p = 1 / 1 + e^{-(\beta 0 + \beta 1X1 + \beta 2X2 \ldots. + \beta nXn)}$

Sigmoid – S-curve



Sigmoid

- Sigmoid curve converts any value from

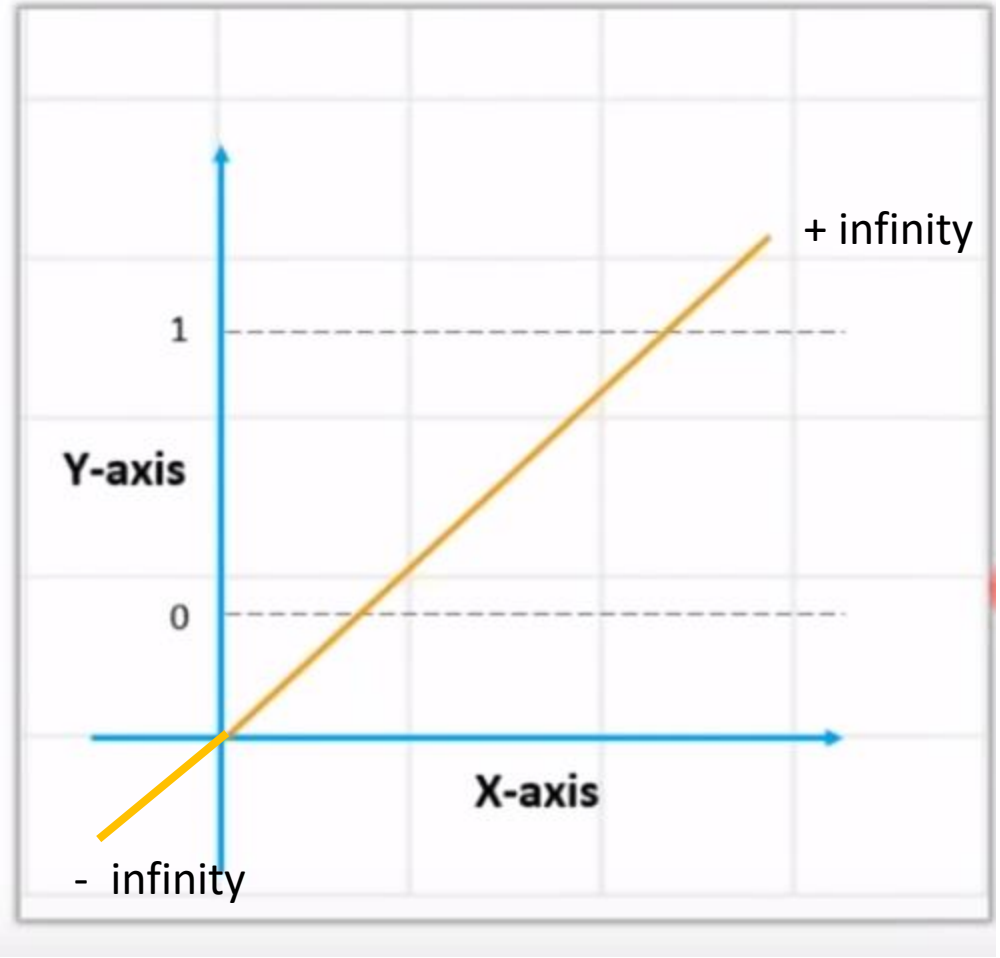
-infinity to +infinity to (0 to 1)

- Sigmoid will output:

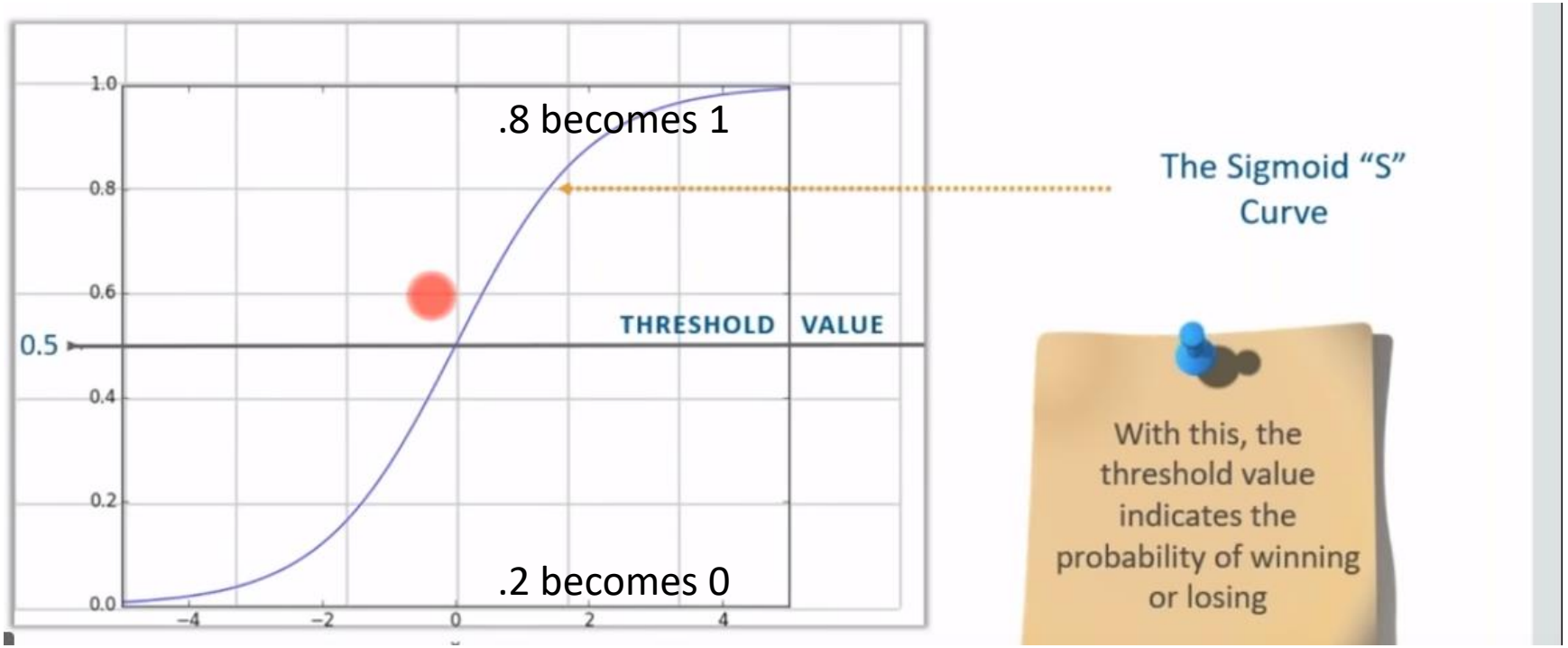
‘0’ as x approaches $-\infty$

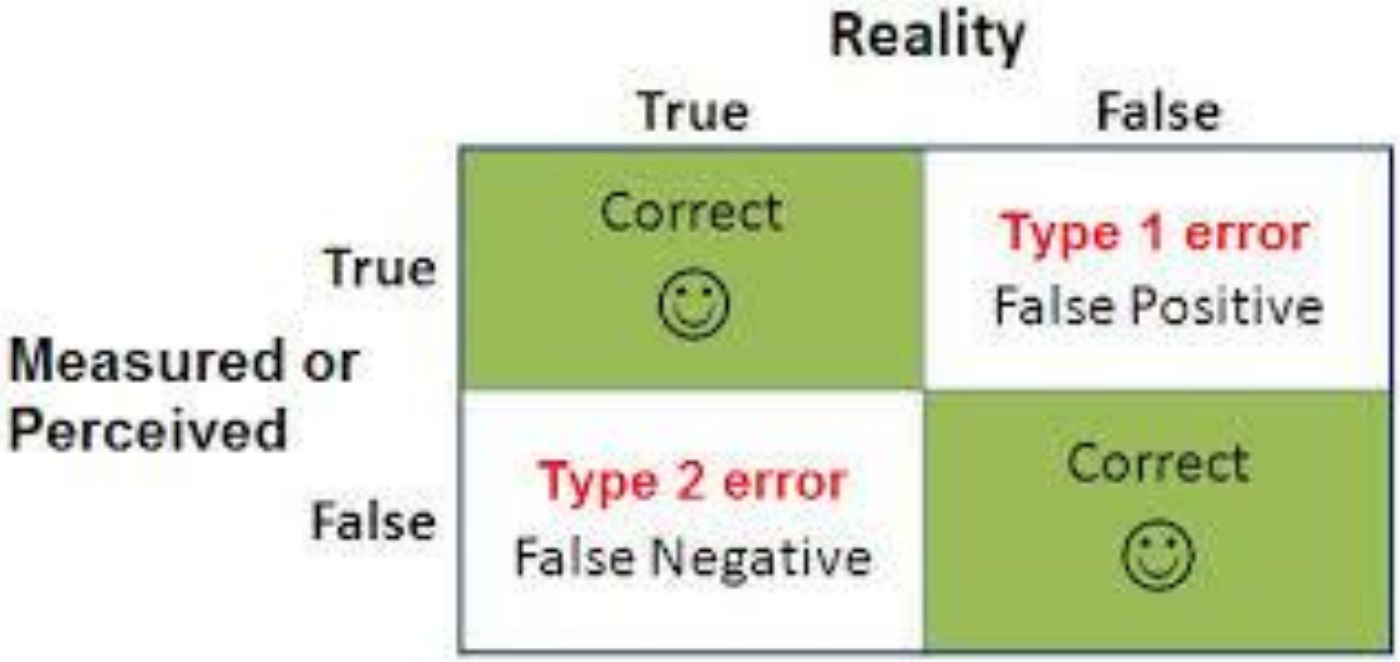
‘1’ as x approaches $+\infty$

Linear Regression



Probability values for the answers

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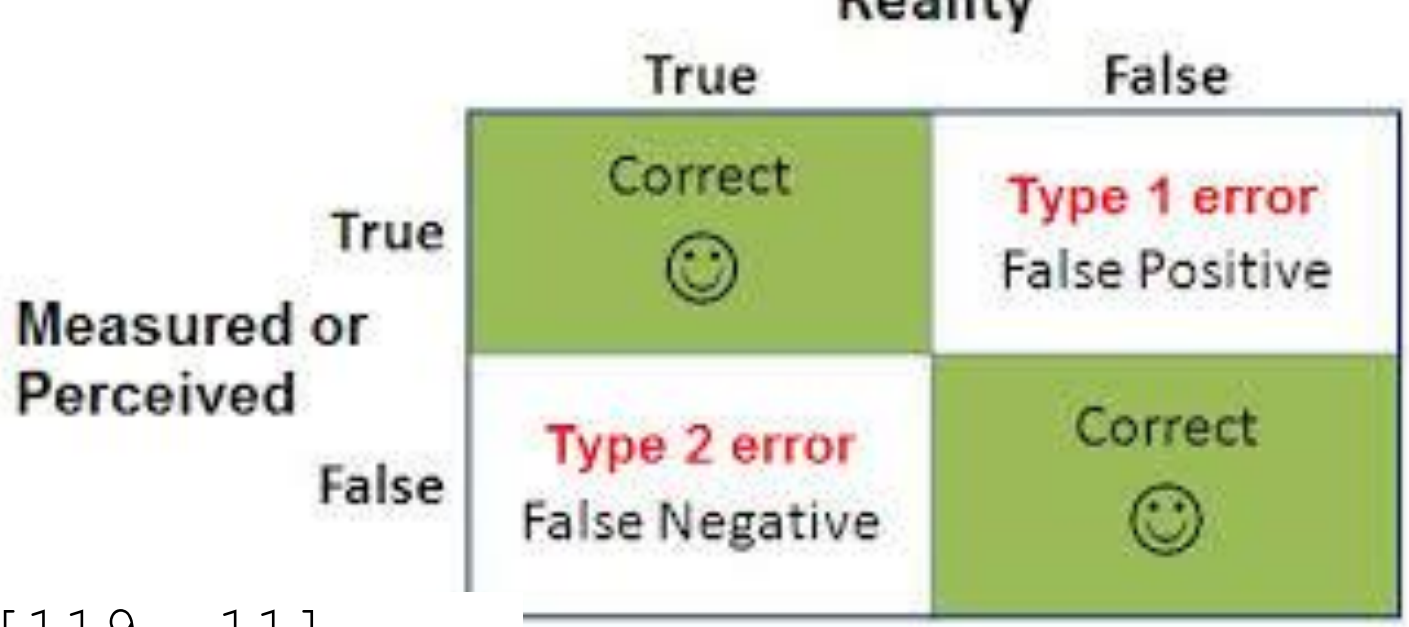
True
False
Measured or Perceived
True
False
Correct
Type 1 error
False Positive
Type 2 error
False Negative
Correct


Reality
True
False
Measured or Perceived
True
False
Correct
Type 1 error
False Positive
Type 2 error
False Negative
Correct

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[[119, 11],
 [ 26, 36]
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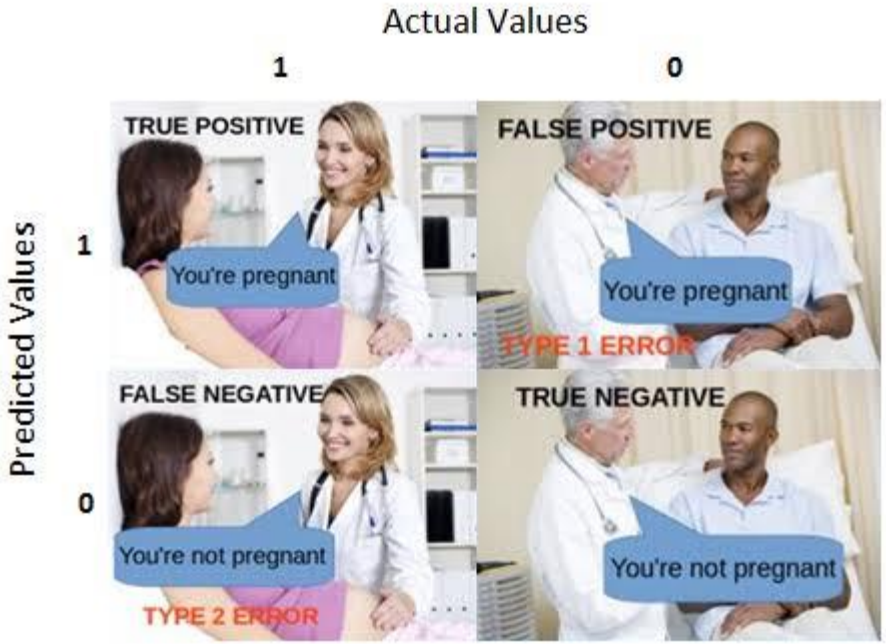
Actual Values
1
0
Predicted Values
1
0
TRUE POSITIVE
You're pregnant
FALSE POSITIVE
You're pregnant
TYPE 1 ERROR
FALSE NEGATIVE
You're not pregnant
TYPE 2 ERROR
TRUE NEGATIVE
You're not pregnant

Thanks

End