Regression	Classification
Supervised Machine Learning	Supervised Machine Learning
Predictions of Labels OR Target Variables Which are Continuous	Predictions of Labels OR Target Variables Which are Discrete
Examples are Salaries, Housing Price	Classification of disease OR Classification of Animals
Housing Price = 952340.98076	Yes/No, Cat/Dog

Model Evaluation
(Confusion Matrix)

Model Evaluation

After training a Logistic Regression model on training data, we evaluate the model on test data. One of the metric use for evaluate the classification problem is Confusion Matrix.

Confusion Matrix

N = 215	Predicted No	Predicted Yes
Actual No	50	10
Actual Yes	5	150

Confusion Matrix

N = 215	Predicted No	Predicted Yes
Actual No	50	10
Actual Yes	5	150

$$Accuracy = \frac{150 + 50}{150 + 10 + 5 + 50} = \frac{Total\ Correct\ Guesses}{Total\ Guesses}$$

$$Accuracy = 0.93$$

Confusion Matrix

N = 215	Predicted No	Predicted Yes
Actual No	TN = 50	FP = 10
Actual Yes	FN = 5	TP = 150

TP = True Positive
TN = True Negative
FN = False Negative
FP = False Positive

True Positive and True Negative

A true positive is an outcome where the model correctly predicts the positive class. Similarly, a true negative is an outcome where the model correctly predicts the negative class.

False Positive and False Negative

A false positive is when a model predicts positive when it is not positive OR it is negative. False positive also called a type I error.

A false negative is when a model predicts negative when it is positive. False negative is also called a type II error.

Accuracy, Precision, Recall and F_1 Score

Accuracy

Accuracy is the most intuitive performance measure and it is simply a ratio of correctly predicted observation to the total observations.

$$Accuracy = \frac{TP + TN}{TP + FP + FN + TN} = \frac{Total\ Correct\ Guesses}{Total\ Guesses}$$

Accuracy Issue with Biased dataset

- In accuracy we count total number of correctly classified labels whether positive or negative.
- Suppose we have a dataset with only 1% positive labels so in this case if model decides to predict everything negative, it will have 99% accuracy.
- Thus, we need another metric that can precisely represents the performance of biased data.

Precision

Precision is the ratio of correctly predicted positive observations to the total predicted positive observations.

$$Precision = \frac{TP}{TP + FP} = \frac{Correct\ Positive\ Guesses}{Total\ Positive\ Guesses}$$

Precision solve the issues of accuracy with biased data. So if your model is classifying everything to negative, its precision is zero.

Recall

Recall is the ratio of correctly predicted positive observations to the all observations in actual class

$$Recall = \frac{TP}{TP + FN} = \frac{Correct\ Positive\ Guesses}{Total\ Positive\ Labels}$$

F_1 Score

$$F_1 Score = \frac{2 * (Recall * Precision)}{Precision + Recall}$$