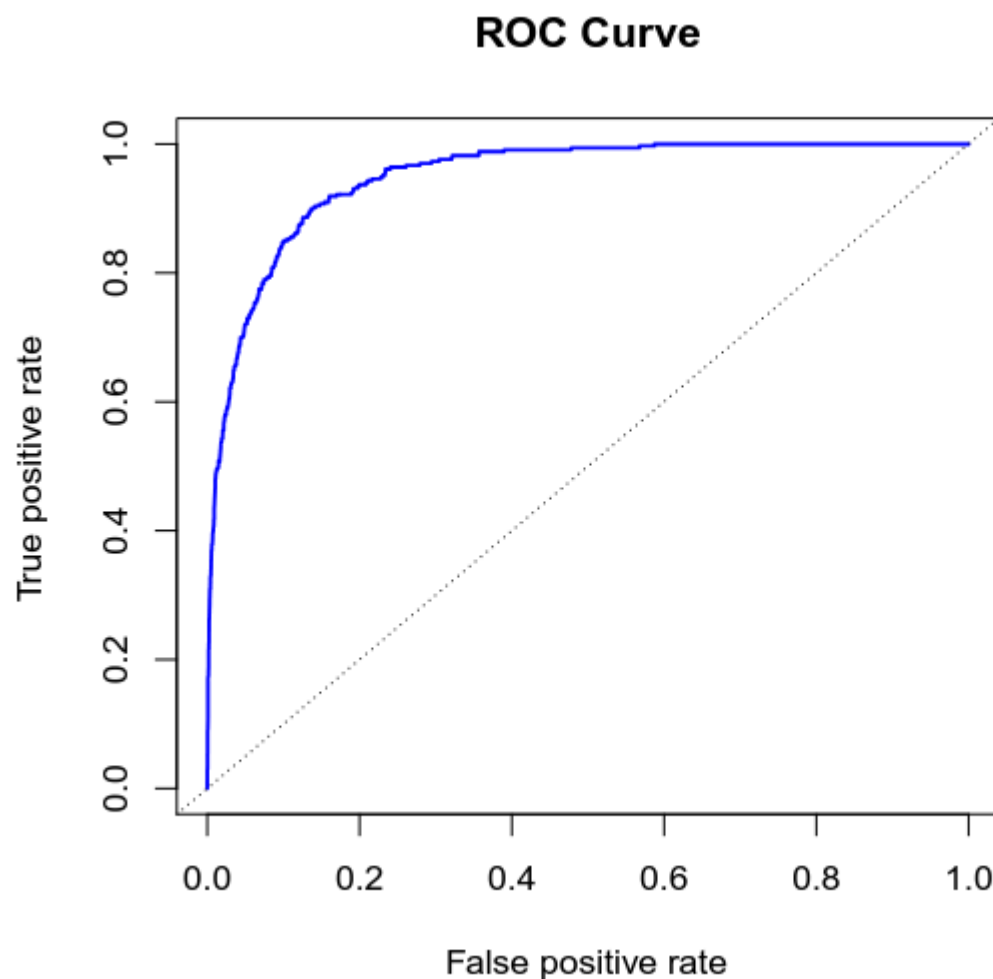


# ROC Curve

Receiver Operating Characteristic Curve also known as **ROC Curve**, its a visual representation of classification model performance across all thresholds.

- **True positive rate** → sensitivity
- **False positive rate** → 1 – Specificity



- The **Top-left** corner where the **TPR** is near 1 and **FPR** is near 0 → a very good classifier where the rate of **False Positive** is low
- The **Diagonal Line** random guessing
  - Above the diagonal line its a better model than random
  - Below the diagonal line its a worse model than random

To draw the **ROC** curve we:

- Calculate The **True Positive rate TPR** and **False Positive rate FPR** at every possible threshold of classifying and plot them(TPR,FPR)

$$FPR = \frac{FP}{FP + TN}$$

- This measures how often the model classifies negatives as positives : The lower *FPR* the better
- **False Positive** is predicted to be **positive** while its **negative** : A real email classed as spam
- **True Negative** is predicted to be **negative** while its **negative** :spam email classes as spam

$$TPR = \frac{TP}{TP + FN}$$

- This Measures how well model classifies correctly : The higher *TPR* the better

## Area under the curve AUC

Calculating the Area under the curve known as **AUC** indicate:

- above 0.7 its good
- below 0.6 very poor performance
- Its also a way to compare two different classification models to each other by comparing their **AUC**

*Why use ROC curve?*

- Threshold selection : Trade off between **Sensitivity** TPR and **1-Specificity** FPR, Simply if the False Positive is costly of False Negative which depends on the problem at hand
- Model Comparison