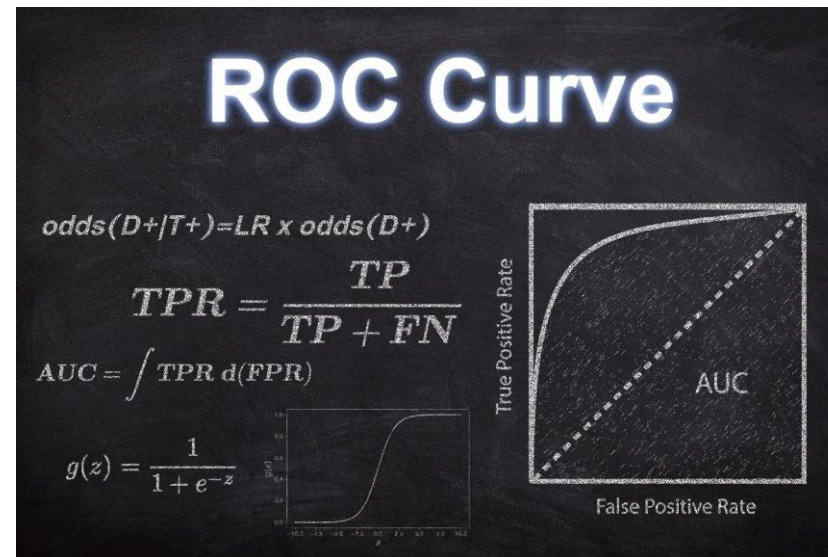# ROC AUC Curve

•**What is ROC AUC Curve?**

- ROC: Receiver Operating Characteristic

- AUC: Area Under the Curve

- Used to evaluate the performance of binary classification models

Key Terms

- **True Positive Rate (TPR):** Also known as Recall or Sensitivity

- **False Positive Rate (FPR):** The proportion of negative instances that are incorrectly classified as positive

- **Threshold:** The value at which the decision changes from negative to positive

ROC Curve

- **Definition:** A plot of TPR vs. FPR at various threshold settings

- **Purpose:** To visualize the trade-off between sensitivity and specificity

AUC - Area Under the Curve

- **Definition:** The area under the ROC curve

- **Interpretation:**

  - AUC = 1: Perfect model

  - AUC = 0.5: Model with no discrimination ability

  - Higher AUC indicates better model performance

How to Interpret ROC AUC

- **High AUC:** Indicates a good measure of separability

- **Low AUC:** Indicates poor model performance

- **Example:** AUC of 0.7 means there is a 70% chance that the model will distinguish between positive and negative classes correctly

Practical Example

- **Example Scenario:** Medical diagnosis model

  - **Objective:** To predict whether a patient has a particular disease (binary classification: disease vs. no disease)

  - **Dataset:** Contains features such as age, blood pressure, cholesterol levels, etc.

- **ROC Curve Plot:**

  - **True Positive Rate (TPR):** Proportion of actual positives correctly identified (e.g., patients with the disease correctly diagnosed)

  - **False Positive Rate (FPR):** Proportion of actual negatives incorrectly identified as positive (e.g., healthy patients incorrectly diagnosed with the disease)

- **Plot Explanation:**
  - **X-Axis:** False Positive Rate (FPR)
  - **Y-Axis:** True Positive Rate (TPR)
  - **Curve:** Shows the performance of the model at different threshold levels
  - **Diagonal Line:** Represents a random classifier (AUC = 0.5)
- **Interpretation:**
  - **Point A:** High TPR and low FPR, indicating good model performance
  - **Point B:** High FPR, indicating many false positives
  - **AUC Value:** The area under the ROC curve, which quantifies the overall ability of the model to discriminate between positive and negative classes

Graph
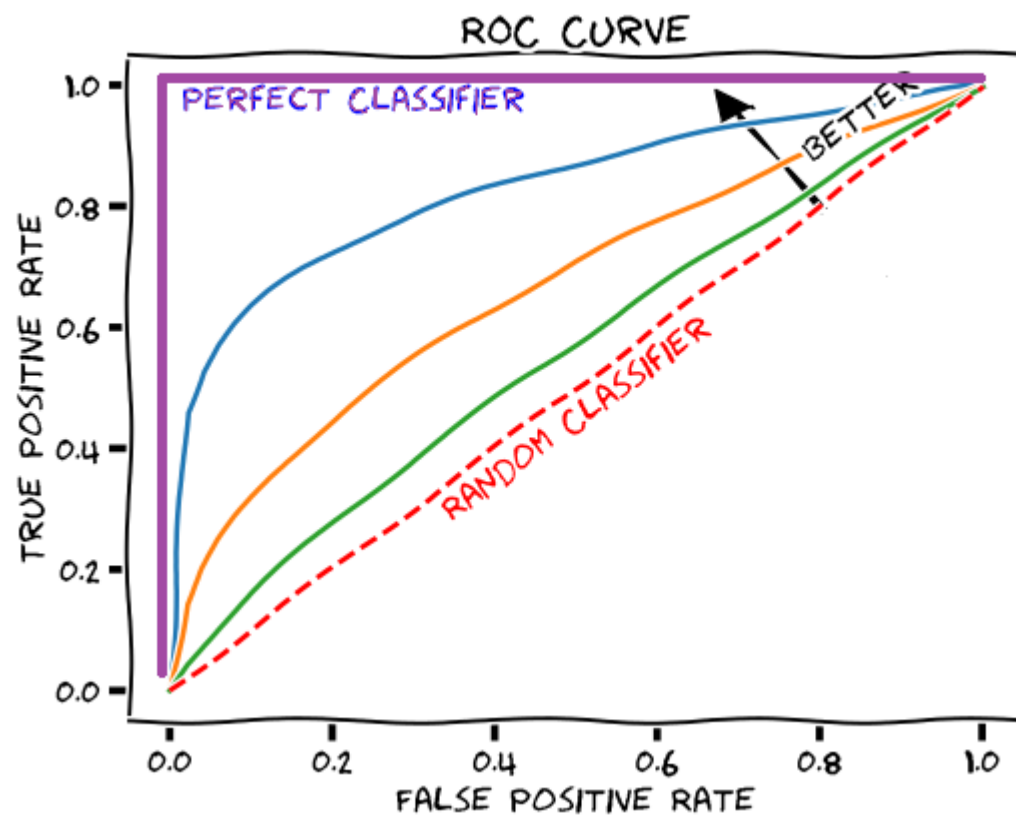
Advantages of ROC AUC

- **Threshold Invariance:** Measures the quality of the model's predictions irrespective of the classification threshold

- **Scale Invariance:** Measures how well predictions are ranked, not their absolute values