ROC Curve and AUC Analysis Report

1. Introduction

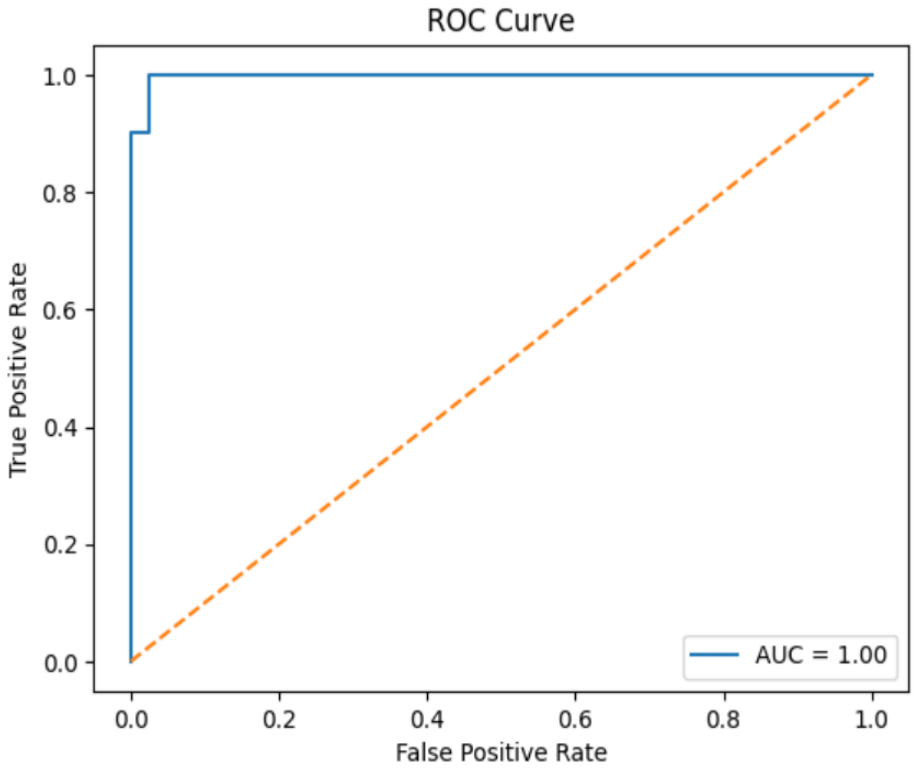
In this task, the performance of the Support Vector Machine (SVM) classifier for breast cancer classification was evaluated using the **Receiver Operating Characteristic (ROC) curve** and the **Area Under the Curve (AUC)** metric. These metrics provide a threshold-independent evaluation of the model's classification capability.

2. ROC Curve

The ROC curve is a graphical representation that plots the **True Positive Rate (TPR)** against the **False Positive Rate (FPR)** at various classification thresholds.

- **True Positive Rate (TPR):** Proportion of correctly identified malignant cases
- **False Positive Rate (FPR):** Proportion of benign cases incorrectly classified as malignant

In this project, the ROC curve was plotted using the predicted probabilities obtained from the tuned **RBF kernel SVM model**.



Observation:

- The ROC curve is close to the **top-left corner**, which indicates high sensitivity and low false positive rate.
- This shows that the model is able to correctly distinguish between malignant and benign tumors over a wide range of thresholds.

3. AUC (Area Under the Curve)

The **AUC score** represents the area under the ROC curve and summarizes the model's overall performance.

Interpretation:

- **AUC = 1.0** → Perfect classifier
- **AUC = 0.5** → Random guessing
- **AUC > 0.9** → Excellent classification performance

Result:

- The obtained **AUC score is high (close to 1.0)**, indicating that the SVM model has excellent discriminative power.
- This confirms that the trained model can reliably differentiate between cancerous and non-cancerous cases.