SVM vs Neural Network - Classification Report

# Team Members

1. Zyad Wael Mohamed (23011276) – Implemented and evaluated the Support Vector Machine (SVM) models using sklearn. Also worked on the exploratory data analysis and confusion matrix plotting.  
2. Steven Daniel Labib (23011281) – Developed and trained the Neural Network using Keras. Responsible for generating training curves and evaluating metrics.  
3. Mohamed Ahmed Anter (23011457) – Compared the models, analyzed performance metrics, and generated the ROC curve and final insights.

# Objective

The goal of this project is to understand and implement two machine learning models: Support Vector Machines (SVM) and Neural Networks, for a classification problem using the Breast Cancer Wisconsin dataset. The models are evaluated, compared, and analyzed using various performance metrics.

# Dataset and Preprocessing

We used the Breast Cancer Wisconsin dataset available in sklearn. It contains 569 samples with 30 numeric features. The target is binary: malignant (0) or benign (1). We handled preprocessing by scaling features using StandardScaler and splitting the dataset into 70% training and 30% testing data.

# Exploratory Data Analysis

We performed class distribution analysis and pair plots to understand feature relationships and class separability. These visualizations helped guide the model selection and parameter tuning.

# Support Vector Machine (SVM)

Three kernels were tested: linear, polynomial, and RBF. The RBF kernel performed the best. We used sklearn's SVC class with proper training, predictions, and evaluation using accuracy, confusion matrix, and classification report.

# Neural Network

We built a neural network with two hidden layers using Keras. Activation functions used included ReLU and softmax. The model was compiled with categorical crossentropy and the Adam optimizer. It was trained for 50 epochs and evaluated on the test set.

# Model Comparison

Both models achieved high accuracy. The SVM with RBF kernel slightly outperformed the neural network. Performance metrics used include accuracy, precision, recall, F1-score, and ROC curve.

# Conclusion

Both SVM and Neural Networks are powerful classifiers. SVM performed slightly better on this dataset due to its robustness and simplicity. The neural network provided comparable results and can be enhanced with more tuning and data.