🧠 Machine Learning Assignment

EEG Eye State Classification using Random Forest & Neural Network

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📌 Objective

Build and evaluate two machine learning models —
Random Forest and **Neural Network** — to predict whether a person's **eyes are open or closed** using EEG brain signals.

This assignment helps you understand:

- Real-world biological data
- Feature preprocessing
- Model training & evaluation
- Comparison of ML vs Deep Learning

🧬 Dataset Description

Dataset Name: EEG Eye State Dataset
Features: 14 EEG signal values (continuous numeric)
Target Column: `eyeDetection`

Value	Meaning
0	Eyes Open
1	Eyes Closed

Each row represents one moment of recorded brain activity.

🛠️ Tasks

🔹 **Step 1: Data Loading & Exploration**

- Load the dataset into Python (Pandas).
- Display first 5 rows.
- Check for missing values.
- Print dataset shape.
- Plot class distribution.

- ◆ **Step 2: Preprocessing**

  - Separate features X and target y.
  - Apply **Standard Scaling** to features.
  - Split data into **Training (80%)** and **Testing (20%)**.

🌲 Model 1: Random Forest

Train a **Random Forest Classifier**.

Required steps:

- Initialize model.
- Train on training data.
- Predict on test data.
- Print:
  - Accuracy
  - Confusion Matrix
  - Classification Report

🧠 Model 2: Neural Network

Build a **feedforward neural network** using Keras / TensorFlow.

Requirements:

- Input layer → 14 neurons
- At least **2 hidden layers**
- Output layer → 1 neuron with sigmoid activation
- Compile with:
  - Loss: Binary Crossentropy
  - Optimizer: Adam
  - Metric: Accuracy

Train and evaluate the model:

- Plot training & validation accuracy.
- Evaluate on test data.
- Print confusion matrix.

📊 Comparison & Analysis

Answer the following questions in your report:

1. Which model performed better? Why?
2. Which model was faster to train?
3. How does feature scaling affect model performance?
4. What challenges did you face?