**Project Title: CIFAR-10 Image Classification Using Neural Networks**

**Overview**

This project involves using the CIFAR-10 dataset to train a neural network for image classification. It's designed to teach fundamental concepts in deep learning like data handling, model design, and model evaluation.

**Objectives**

- Learn data preprocessing techniques and neural network construction.
- Understand model compilation and training.
- Evaluate model performance and analyze training outcomes.

**Tools and Libraries**

- Python
- Keras
- Matplotlib
- Numpy

**Project Outline**

1. **Introduction to CIFAR-10 Dataset (5 Points)**
   - Load and describe the dataset.
   - Explain the significance of using CIFAR-10 for learning image classification.
2. **Data Preprocessing (15 Points)**
   - Visualize and display images from the dataset.
   - Normalize the image pixel values.
   - Reshape and flatten the data if necessary.
   - Convert class vectors to binary class matrices (one-hot encoding).
3. **Building the Neural Network (20 Points)**
   - Construct a neural network using the Sequential model.
   - Add appropriate layers (Dense, Activation, Flatten) with explanations for choices.
   - Explain the choice of activation function, particularly **softmax** for the output layer.
4. **Compiling the Model (10 Points)**
   - Set the loss function, optimizer, and metrics.
   - Discuss the chosen configurations and their impact on training.
5. **Training the Model (20 Points)**
   - Train the model with defined epochs and batch size.
   - Implement and justify the use of a validation split.
   - Provide detailed observations from the training output.
6. **Evaluating the Model (10 Points)**
   - Evaluate the model using the test dataset.
   - Report and interpret the test loss and accuracy.

7. **Visualization of Training Progress (10 Points)**
   - Plot training and validation accuracy and loss.
   - Analyze and discuss what these metrics suggest about the model's performance over time.
8. **Making Predictions (5 Points)**
   - Use the model to make predictions on new data.
   - Visualize and discuss the accuracy of predictions versus actual labels.
9. **Conclusion (5 Points)**
   - Summarize key learnings.
   - Discuss potential improvements and real-world applicability of the model.

**Assessment Criteria**

- Completeness and accuracy of each task (according to points).
- Ability to interpret results and technical choices.
- Code quality, including comments and readability.
- Engagement in discussions and problem-solving activities during the project.

Output

Your output should be inline with the following. No other layout, format, or non- **CIFAR-10 images are expected.**