ML Lab Week 14: CNN Image Classification

1. Problem Statement

The goal of this lab is to design, build, and train a Convolutional Neural Network (CNN) using PyTorch. This model must be able to accurately classify images of hand gestures into one of three categories: 'rock', 'paper', or 'scissors'.

You will be given a boilerplate Jupyter Notebook. Your task is to complete the missing code, train the model, evaluate its performance, and write a report on your findings.

2. Dataset Description

You will be using the "Rock Paper Scissors" dataset, which is automatically downloaded from Kaggle in the provided notebook.

- **Content:** The dataset contains over 2,000 images of hands making the 'rock', 'paper', or 'scissors' gesture.
- **Structure:** The data is organized into three sub-folders (`rock/`, `paper/`, `scissors/`), one for each class. This structure is ideal for use with PyTorch's `ImageFolder` utility, which will automatically label the images based on their folder.
- **Access:** The notebook `boilerplate.ipynb` already includes the code to download and set up this dataset for you.

3. What Needs to Be Done

You are provided with the `boilerplate.ipynb` notebook. Your main task is to find all the comments marked `#TODO:` and fill in the corresponding code.

Finally, run the entire notebook from top to bottom to ensure all cells execute without errors and your model trains successfully.

4. Deliverables

You must submit two files:

1. **Completed Jupyter Notebook:** The SRN_Week14_Lab.ipynb file with all TODO sections completed. Please ensure you have run all the cells so the output is visible.
2. **Lab Report:** A report in .pdf format that summarizes your work.

5. Report Contents

Your lab report must include the following sections:

1. **Introduction:** A brief one-paragraph summary of the lab's objective.
2. **Model Architecture:**
   ○ Describe the CNN architecture you built.
   ○ Mention key parameters like kernel size, number of channels, and the use of Max Pooling.
   ○ Describe the fully-connected classifier.
3. **Training and Performance:**
   ○ State the key hyperparameters used for training: optimizer, loss function, learning rate, and number of epochs.
   ○ Report the **final Test Accuracy** your model achieved.
4. **Conclusion and Analysis:**
   ○ Briefly discuss your results. Did the model perform well?
   ○ Were there any challenges you faced?
   ○ Suggest one or two ways you could potentially improve the model's accuracy in the future.

6. Naming Convention

Please use the following format for your files that need to be submitted. Replace SRN with your actual SRN.

1. SRN_Week14_Lab.ipynb
2. SRN_Week14_Report.pdf