

Machine Learning Lab (UE22CS352A)



Introduction

A Convolutional Neural Network (CNN) is a specialized type of artificial neural network designed for processing grid-like data, particularly well-suited for tasks involving images and videos. CNNs have been pivotal in the field of computer vision, driving advancements in image classification, object detection, facial recognition, and more. At their core, CNNs employ convolutional layers that apply filters to localized regions of input data, enabling them to extract hierarchical features, starting from simple edges and textures and progressing to more complex shapes and objects.

These networks also incorporate pooling layers to down sample feature maps and introduce non-linearity through activation functions like ReLU. Typically, fully connected layers are used for final predictions. CNNs can have varying depths with many layers, facilitating the learning of intricate patterns.

PyTorch is a top choice for CNNs due to its simplicity, dynamic computation graph for flexible model design, strong community support, and GPU acceleration, making it ideal for efficient and effective development of CNN-based applications.

Task:

Complete the code for the functions whose skeleton has been provided.

You are provided with the following files:

1. CAMPUS_SECTION_SRN_Lab9.py
2. Test.py

CNN.py:

This file contains the following functions:

Function Name	Input	Output
<code>__init__</code>	self	Initializes the CNN layers
<code>forward</code>	x: tensor (image)	Output after passing through all layers

train	model: CNN object, train_loader: DataLoader	Trains the CNN and returns the train accuracy
evaluate	model: CNN object, test_loader: DataLoader	Evaluates the model and returns test accuracy and loss

You are expected to implement the architecture by completing the TODO sections in the CAMPUS_SECTION_SRN_Lab9.py file

Test.py:

1. This will help you check your code.
2. Rename the file appropriately
3. Run the command `python3 Test.py --ID CAMPUS_SECTION_SRN_Lab9`.

Dataset:

The dataset you will work with is the Satellite Image Classification dataset, which contains images of 4 different classes which includes cloudy areas, desert areas, green areas and water bodies. There are about 1500 images per class. The CNN will apply convolutional layers, pooling layers, and fully connected layers, and output the predicted class.

Important Points:

1. Do not make changes to the function definitions provided to you. Use the skeleton as it has been given.
2. Do not modify the test file. Run it as is.
3. The functions must be designed to be independent of the dataset schema. Avoid hardcoding values.
4. You may write additional helper functions.
5. You must use PyTorch to implement the CNN.

Submission Guidelines:

You are required to submit the following:

1. The Python solution file: CAMPUS_SECTION_SRN_Lab9.py
2. Screenshot of the test cases (all test cases in one screenshot):
CAMPUS_SECTION_SRN_Lab9.png

Please ensure that you remove all print statements before submission. Failing hidden test cases

will result in partial marks. The provided test cases are for reference only, and hidden test cases will be similar.