Assignment 3: Transfer Learning
CSL7590: Deep Learning
AY 2023-24, Semester II

March 11, 2024

[Maximum Marks: 150]

1 General Instructions

1. Clearly mention any assumptions made.

2. Report all resources used.

3. Submissions in other formats or after the deadline will not be evaluated.

4. Add references to used resources.

5. Plagiarism will result in zero marks.

6. Select the dataset correctly.

7. Late submission incurs a 20% deduction per day.

2 Submission Guidelines

1. Prepare a Python code file named YourRollNo.py.

2. Submit a single report with methods, results, and observations.

3. Name your report as YourRollNo.pdf. Include a sharable Colab file link.

4. Directly upload code and report to Google Classroom.

5. Do not upload in any other format.

6. Do not convert .ipynb files to .py and upload. Use the .py format from Colab.

7. Do not include code snippets or screenshots in the report.

3 Objective

In this assignment, the objective is to train a segmentation model using a MobileNet pre-trained on the ImageNet dataset as an encoder and design a decoder that predicts segmented masks.

4 Dataset

Download the ISIC 2016 dataset from the provided link: here
    The dataset includes:

- **train:** 900 training images.

- **train_masks:** Segmented masks for training images.

- **test:** 379 test images.

- **test_masks:** Segmented masks for test images.

5 Pre-Processing   [10 marks]

Pre-process the dataset, design the custom dataloader for this dataset. Make sure the images should be resized to 128x128. You are free to opt for any kind of pre-processing varying from normalization to augmentations.

6 Experiments   [2 × 35 = 70 marks]

6.1 Feature Extraction

Use a pre-trained MobileNet encoder trained on ImageNetV1. Design a custom decoder atop this encoder for the segmentation task. Train the decoder while keeping the encoder frozen. You are free to choose whether to take input for the decoder from the last layer of the encoder or from multiple layers for potentially better results.

6.2 Finetuning

Keep the same architecture as in 6.1. Train the segmentation model while fine-tuning encoder weights.

7 Tasks   [50 marks]

Do the following tasks for both the experiments:

1. Calculate and report the Intersection over Union (IoU) and Dice score.

2. Plot the following:
   - Training Loss
   - Validation/Testing Loss

3. Analyze the results and provide observations.

4. Visualize several samples alongside their generated masks and ground truth.

5. Conduct a comparative analysis for both experiments.

8 Report Writing   [20 marks]

Prepare a detailed report containing all the results, graphs, plots, methodology, and observations. The report should contain a comparative table containing results for both the experiments.

9 Demonstration

Evaluation of the assignment will accompany a demonstration of the working model.