CS412 - Machine Learning: Homework 4

Due: May 5, 2025 23:55
Late Accepted Until: May 8 23:55

Colab Notebook Link

Goal

Gain hands-on experience with transfer learning using pretrained deep neural networks.

Task Description

The task in this homework is to perform binary gender classification on a subset of the CelebA dataset using transfer learning.

A pretrained VGG-16 model will be adapted to the task, and its performance will be evaluated with different settings. You should experiment with two different learning rates (0.001 and 0.0001) and two different fine-tuning strategies: (1) freezing all convolutional layers and training only the classifier head, and (2) freezing all weights, but fine-tuning the last convolutional block along with the classifier head. The number of training epochs must be fixed to 10.

Dataset

You will use a subset of the CelebA dataset, which contains over 30,000 celebrity face images annotated with 40 attributes `CelebA30k.zip`, with an accompanying CSV file named `CelebA30k.csv`. This CSV file contains the image file names and attributes including the corresponding gender label under the `Male`. You are expected to split the dataset into 80% training, 10% validation, and 10% test sets. The test set should only be used for final evaluation and must not be involved in model selection or hyperparameter tuning.

Report Guidelines

- Write a report that reads like a project report. Include a cover page with your name, ID number, the course name, HW No., etc.

- Include an introduction section where you state the problem, a method section where you describe approaches evaluated, a results section and a separate discussion section.

- Use structured headers, and specify which section corresponds to the starter notebook.

- Include visualizations, confusion matrices and loss curves under the results section.

- Discuss which model is better etc. in a few lines.

Submission Guideline

- **Jupyter Notebook**: Include all code cells and outputs. (Outputs must remain in the notebook; it will not be rerun during grading.)

- **Notebook Link**: Include the shareable link to your notebook at the top of your PDF report.

- **Submission Files**:

    - CS412-HW4-YourName.ipynb
    - CS412-HW4-YourName.pdf

- **Late Submissions**: Accepted up to two days late, with a 10-point penalty per day.