National Tsing Hua University
Fall 2023 11210IPT 553000
Deep Learning in Biomedical Optical Imaging
Homework 4 Description

1. Report (100 pts)

1.1 Task A: Model Selection (20 pts)

In this task, you will explore various pre-trained models available in *torchvision.models*, select two models, and justify their choices. The focus will be on understanding the architectures, their pre-trained performances, and predicting their adaptability to new tasks via transfer learning.

   • **Model Choice (5 pts)**:   List the two pre-trained models you have selected for the transfer learning tasks.
   • **Explanation (15 pts)**: The explanation should encompass a range of aspects including, but not limited to, the complexity of the architecture, the performance of the models when pre-trained, and their computation time for the transfer learning tasks.

1.2 Task B: Fine-tuning the ConvNet (30 pts)

You will fine-tune the selected pre-trained models on our 2 chest x-ray dataset. They need to modify the models to fit the new dataset and analyze the effectiveness of fine-tuning, considering the architecture and depth of the networks.

   • **Discussion (30 pts, 15 pts for each)**: Analyze the performances of the fine-tuned models. Include a comparative evaluation, focusing on how effectively fine-tuning facilitated their adaptation to the new task.

1.3 Task C: ConvNet as Fixed Feature Extractor (30 pts)

You will transform the selected models into fixed feature extractors by freezing all layers except the final one, and evaluate their performance.

   • **Discussion (30 pts, 15 pts for each)**: Similar to Task B, provide a comprehensive analysis of the models' performances. The focus should again be on a comparative evaluation of their effectiveness in the new task, though this time as fixed feature extractors.

1.4 Task D: Comparison and Analysis (10 pts)

After completing Tasks B and C, contrast the performance outcomes and adaptability of the models when subjected to the two distinct transfer learning approaches.

   • **Discussion (10 pts)**: Offer a succinct analysis that highlights the differences in performance and adaptability observed when the models are fine-tuned versus when used as fixed feature extractors.

1.5 Task E: Test Dataset Analysis (10 pts)

In the original Lab 5's code, you may have encountered challenges in enhancing the performance on the test dataset.

  • **Discussion (10 pts)**: Elucidate your perspective on this phenomenon. Provide a analysis explaining the reasons behind the difficulty in improving the test dataset performance.

1.6 Report Guidelines

• **Template**: Utilize the provided template for writing your analysis report.

• **Format**: The report should be submitted in PDF format, with the file named as "hw4.pdf".

• **Content**: Incorporate figures and tables to illustrate your findings (optional) and make your analysis comprehensive and understandable.

• **Page Limit**: Ensure your report is a minimum of 4 **pages** and does not exceed **6 pages**.

1.7 Grading Criteria

• **Analysis Depth**: This is our primary focus for grading. We seek a thorough and insightful analysis concerning the impact of changes on the model's performance. It is crucial to base your analysis on the empirical results obtained from your experiments, not on hypotheses or assumptions. Ensure your report express the outcomes of your experiments in a clear and concise manner. We are interested in your analytical skills and the ability to explain the results effectively. We are not grading based on the performance improvements attributed to the changes you made. As such, it is entirely acceptable if the modifications you make do not lead to performance enhancement or significant differences in the results.

• **Report Presentation**: Clarity and structure are paramount, and adherence to the provided template and style is mandatory. A deviation from the template will result in a 5-point deduction.

• **Code for Supporting Report**: The supporting code won't be a focal point during grading unless there is an apparent absence of evidence backing your findings. Clean, readable, and well-commented code is encouraged. If falsification or dishonesty is detected in your results, a 0-point penalty will be imposed for this report section.

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2. Submission Details

2.1 Deadline

Submit all components by **23:59, 6th Nov. (GMT+8)**, with timestamps on Github and EEclass being considered.

2.2 Github and EEclass

• **Github**: Create a "hw4" folder in your repository, "NTHU_2023_DLBOI_HW", containing "hw4_report.ipynb" and "hw4.pdf". Ensure that you run your code and all outputs are saved within the .ipynb files.

• **EEclass**: You are required to submit only the GitHub link of your Homework . Do not upload files directly to EEclass.