CSC 180-01 Intelligent Systems (Fall 2022)

Project 3: Computer Vision using GPU and Transfer Learning

Due at 10:00 am, Friday, October 28, 2022

Peer Review: class time, Friday, October 28, 2022

1. Problem Formulation

In this project, you practice with image classification using Google GPU and transfer learning.

- Google Colaboratory is a cloud-based Jupyter notebook environment that is free to use and requires no setup. When you go to *colab.research.google.com*, TensorFlow is pre-installed. Just *import tensorflow as tf*, and start coding.
- Transfer learning is a machine learning technique where pre-trained models are used as the starting point on computer vision and natural language processing tasks. Transfer learning is an optimization that allows rapid progress or improved performance when modeling the second task.

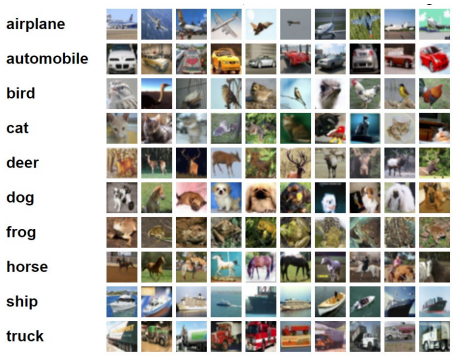
The project is twofold:

1. You train and test a CNN model on GPU **without** transfer learning
2. You train and test a CNN model on GPU **using** transfer learning

2. Dataset

We work with the CIFAR-10 dataset, which is preinstalled with Tensorflow.

https://keras.io/datasets/



For more details, go to https://www.cs.toronto.edu/~kriz/cifar.html

The CIFAR-10 dataset consists of 60000 32x32 color images in 10 classes, with 6000 images per class. There are 50000 training images and 10000 test images.

3. Notebook

Write your code to complete the provided notebook on the same Canvas page. The notebook must be opened using Google Colab.

How to launch notebooks using Google Colab:

- To start working with Colab, you first need to log in to your google account, then go to this link https://colab.research.google.com
- Go to the folder "Colab Notebooks" under "My Drive" and upload the notebook file there. Right click your notebook and open with "Google Colab".
- (Optional) If you want to access your data in Google Drive from Google Colab, check this: https://www.marktechpost.com/2019/06/07/how-to-connect-google-colab-with-google-drive/

4. Grading breakdown

You may feel this project is described with some certain degree of vagueness, which is left on purpose. In other words, **creativity is strongly encouraged**. Your grade for this project will be based on the soundness of your design, the novelty of your work, and the effort you put into the project.

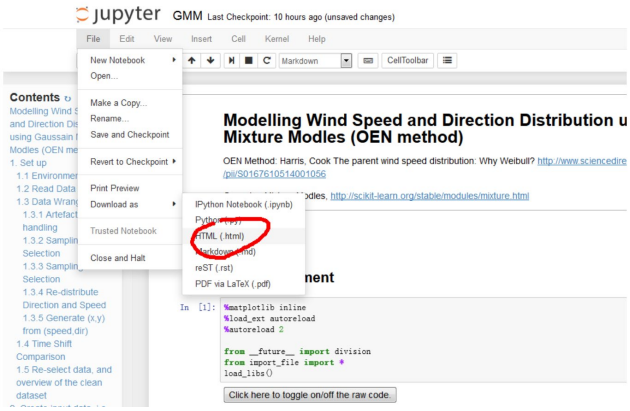
Use the evaluation form on Canvas as a checklist to make sure your work meets all the requirements.

5. Teaming:

Students must work in teams with no more than 3 people. Think clearly about who will do what on the project. Normally people in the same group will receive the same grade. However, the instructor reserve the right to assign different grades to team members depending on their contributions. So you should choose partner carefully! You are welcome to work on your own.

6. Deliverables:

(1) The HTML version of your notebook that includes all your source code. Go to "File" and then "Download as". Click "HTML" to convert the notebook to HTML.



5 pts will be deducted for the incorrect file format.

(2) Your report in PDF format, with your name, your id, course title, assignment id, and due date on the first page. As for length, I would expect a report with more than one page. Your report should include the following sections (but not limited to):

- Problem Statement
- Methodology
- Experimental Results and Analysis
- Task Division and Project Reflection

In the section "Task Division and Project Reflection", describe the following:

- who is responsible for which part,
- challenges your group encountered and how you solved them
- and what you have learned from the project as a team.

10 pts will be deducted for missing the section of task division and project reflection.

To submit your notebook and the report, go to Canvas "Assignments" and use "Project X (submit your code and report here)". Use the evaluation form on Canvas as a checklist to make sure your work meet all the requirements.

(3) **Link to your video presentation shared to the discussion board.** Each team have **three minutes** to demo your work. Failure to submit the video presentation will result in **zero** point for the project. The following is how you should allocate your time:

- Model/code design (1 minute)
- Findings/results (1 minute)
- Task division, challenges encountered, and what you learned from the project (1 minutes)

To submit the link to your video presentation, go to Canvas "Discussions" and use "Post Your Presentation for Project X Here". Share your link by replying directly to my main discussion post.

All the deliverables must be submitted **by team leader** on Canvas before

10:00 am, Friday, October 28, 2022

NO late submissions will be accepted.

7. Peer Review:

During the class after the deadline, please review and comment on the presentations from other teams by replying to their posts. It is a great chance for you to learn from other people's work. Please be nice, and provide constructive, specific feedbacks. You will become a better, more effective learner when you found yourself in a community of active learners!

8. Hint and Code Efficiency.

To finish this project, there is absolutely NO need to purchase Google Colab Pro (Google asks for $10 per month). If you code smartly (e.g., for up-sampling, you may initialize an all-zero numpy array with desirable size and then assign each resized image into it), you should be able to handle the whole CIFAR-10 dataset using the FREE memory provided by Google Colab. Using the FREE GPU provided by Google Colab, each epoch of VGG16 takes approximately one minute to finish (the exact training time cost depends on your concrete model implementation). Therefore, hyperparameter running is not required in this project although you are more than welcome to do that.