Faculty of Engineering and Information Technology
School of Software

42028: Deep Learning and Convolutional Neural Networks

Autumn 2024

ASSIGNMENT-2 SPECIFICATION

Due date	Friday 11:59pm, **10 May 2024**
Demonstrations	Optional, if required.
Marks	30% of the total marks for this subject
Submission	1. A report in PDF or MS Word document (~10-pages) (Part-B submission) 2. Google Colab/iPython notebooks (Part-A submission)
Submit to	Canvas assignment submission

Note: This assignment is an individual work. Your assignment is incomplete without the Report and Code submission. If you just submit either code or the report, it will be considered incomplete and will not be marked. Please make sure to submit both the report and code using the appropriate links/pages on Canvas.

Summary

This assessment requires you to customize the standard CNN architectures for image classification. Standard CNNs such as AlexNet, GoogleNet, ResNet, etc. should be used to create customized version of the architectures. Students are also required to implement a CNN architecture for object detection and localization. Both the customized CNNs (image classification and object detection) should be trained and tested using the dataset provided.

Students need to provide the code (iPython/Colab Notebook) and a final report for the assignment, which will outline a brief assumptions/intuitions considered to create the customized CNNs and discuss the performance.

Assignment Objectives

The purpose of this assignment is to demonstrate competence in the following skills.

- To ensure that the student has a firm understanding of CNNs and object detections algorithms. This will facilitate the learning of advanced topics for research and also assist in completing the project.

- To ensure that the student can develop custom CNN architectures for different computer vision related tasks.

Tasks:

Description:

1. Customize AlexNet/GoogleNet/ResNet etc. and reduce/increase the layers, Train, and Test for image classification.
2. Implement the Faster-RCNN and SDD/YOLO architectures for object detection/localization. (Use of existing implementation such as Google Object detection API is permitted).
3. Train and test on the given dataset for object detection, using Faster-RCNN and SSD/YOLO object detection methods.

Datasets for each task can be downloaded using the link available on Canvas.

Write a short report on the implementation, linking the concepts and methods learned in class, and also provide assumptions/intuitions considered to create the custom CNNs for image classification. Provide diagrams for the CNNs architecture where required for better illustrations. Provide the model summary, such as input and output parameters, etc. Discuss the results clearly and explain the different situations/constraints for the better understanding of the results obtained.

Dataset to be used: Provided separately (Check Canvas under Assignment--> Assignment-2).

Report Structure (suggestion only):

The report may include the following sections:

1. **Introduction:** Provide a brief outline of the report and also briefly explain the baseline CNN architectures used to create the custom CNNs for image classification. Also, mention about the object detection methods used.
2. **Dataset:** Provide a brief description of the dataset used with some sample images of each class.
3. **Proposed CNN architecture for Image classification:**
    a. Baseline architecture used.
    b. Customized architecture
    c. Assumptions/intuitions
    d. Model summary
4. **CNN architecture for Object Detection/localization:**
    a. Faster-RCNN.
    b. SSD (Single Shot Detector)/YOLO (You Only Look Once)
    c. Assumptions/intuitions
    d. Model summary
5. **Experimental results and discussion:**
    a. Experimental settings:
        i. Image classification
        ii. Object detection
    b. Experimental Results:
        i. Image classification
            1. Performance on baseline/standard architecture
            2. Performance on customized architecture

ii. **Object detection**
    1. Performance on Faster-RCNN
    2. Performance on SSD or YOLO or customized architecture.

iii. **Discussion:** Provide your understanding of the performance and accuracy obtained. You may also include some image samples which were wrongly classified.

6. **Conclusion:** Provide a short paragraph summarizing your understanding of the experiments and results.

Deliverables:

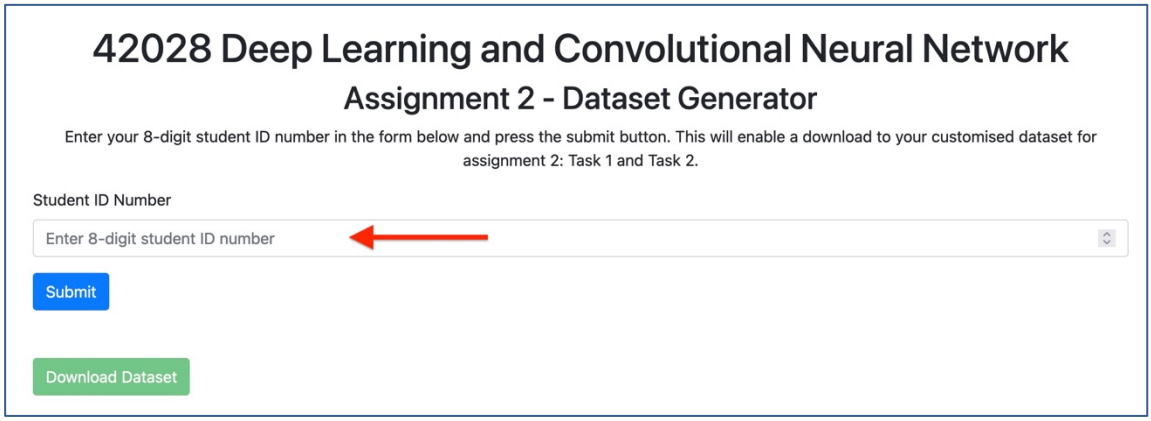
a. Project Report (10 pages max)
b. Google Colab or iPython notebook, with the code, and **output of each code cell should be visible.**

Note: You are welcome to report accuracy on custom CNNs designed for Object detection, instead of SSD/YOLO. Use of transfer learning is permitted. Students must only use the dataset provided to them based on their student ID through the link available on Canvas.

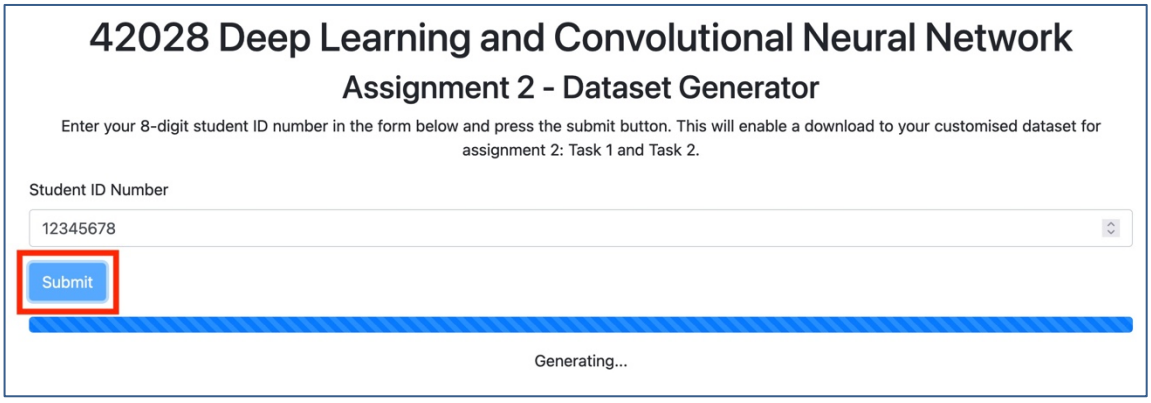
Additional Information:

Dataset Generation

1. Use the link provided on Canvas (use a web browser on a laptop/computer device, avoid mobile/tablet devices)
2. A webpage, similar to the following screenshot will open:

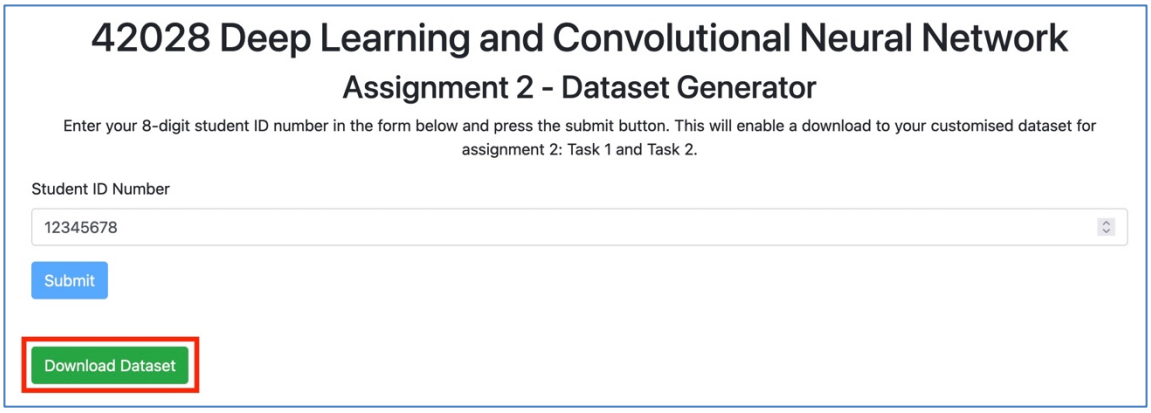


3. Enter your student ID in the box provided and click submit (please click only ONCE).

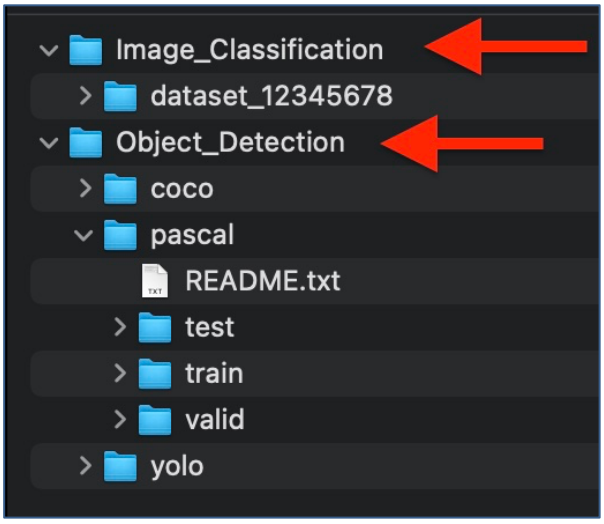


4. Wait until the processing ends.

5. Once complete, the download button appears, click the button.



6. This will download the dataset specific to your student ID.



Please note:

For Image Classification: Every student will get one set of 20 unique classes with a set of images inside each class folder for Image classification task. The classes might vary depending on your student ID. This dataset is not split into train, test, validation sets, and students are required to perform the dataset split. *Make sure to use your student ID as a random seed for randomly splitting it into train, test and validation sets respectively.*

For Object Detection: Every student will get one of the few datasets with a unique training, testing and validation set (pre-segregated for you based on your student ID) along with three different annotation formats: (a) COCO JSON, (b) Pascal VOC XML, (c) YOLO.

Dataset: For a specific student ID, the system will generate the same set of data every time. Make sure to use your set of data for your assignment. This will be cross verified. Any discrepancy will result in a 0 (zero) mark for the whole assignment.

Assessment Submission

Submission of your assignment is in two parts. You must upload the iPython/Colab notebooks (zip-file in case of multiple notebooks) and Report to Canvas. This must be done by the Due Date. You may submit as many times as you like until the due date. The final submission you make is the one that will be marked. If you have not uploaded your zip file within 7 days of the Due Date, or it cannot be run in the lab, then your assignment will receive a zero mark. Additionally, the result achieved and shown in the iPython/Colab notebooks should match the report. Penalties apply if there are inconsistencies in the experimental results and the report.

PLEASE NOTE 1: It is your responsibility to make sure you have thoroughly tested your program to make sure it is working correctly.

PLEASE NOTE 2: Your final submission to Canvas is the one that is marked. It does not matter if earlier submissions were working; they will be ignored. Download your submission from Canvas and test it thoroughly in your assigned laboratory.

Return of Assessed Assignment

It is expected that marks will be made available 2 weeks after the submission via Canvas. You will be given a copy of the marking sheet showing a breakdown of the marks.

Queries

If you have a problem such as illness which will affect your assignment submission, contact the subject coordinator as soon as possible.

Dr. Nabin Sharma
Room: CB11.07.124
Phone: 9514 1835
Email: Nabin.Sharma@uts.edu.au

If you have a question about the assignment, please post it to the Canvas forum for this subject so that everyone can see the response.

If serious problems are discovered the class will be informed via an announcement/FAQs on Canvas. It is your responsibility to make sure you frequently check Canvas.

PLEASE NOTE: If the answer to your questions can be found directly in any of the following.

- Subject outline
- Assignment specification
- Canvas FAQ
- Canvas discussion board

You will be directed to these locations rather than given a direct answer.

Extensions and Special Consideration

Please refer to subject outline.

Academic Standards and Late Penalties

Please refer to subject outline.