Faculty of Engineering and Information Technology
School of Computer Science

42028: Deep Learning and Convolutional Neural Networks

Autumn 2022

ASSIGNMENT-1 SPECIFICATION

Due date	Friday 11:59pm, **25th March 2022**
Demonstrations	If required.
Marks	30% of the total marks for this subject
Submission	1. A report in PDF (5-pages max) (5%) 2. Google Colab/iPython notebooks (25%)
Submit to	Canvas assignment submission

Note: This assignment is individual work.

Summary

This assessment requires you to develop three different classifiers namely, KNN, SVM and Neural network, for handwritten digit classification. The features to be used for classification can be either Histogram-Of-Oriented-Gradients (HoG) or Local Binary Pattern (LBP), etc. and raw images/pixels.

Students need to provide the code (Colab/ipython Notebook) and a final report for the assignment, which will outline a brief comparative study of the classifier's performance.

Assignment Objectives

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

- To ensure firm understanding of basic machine learning basics. This will facilitate understanding of advanced topics.
- To ensure that students understand the basics of image classification, feature extraction using the traditional machine learning techniques.

Tasks:

Description:

1. Implement a simple kNN classifier for digit classification
2. Implement a Linear classifier using SVM for digit classification
3. Implement a Linear classifier using Neural Network for digit classification
4. Compare the three implementations in terms of classification accuracy.

Write a short report on the implementation, linking the concepts and methods learned in class, and also provide comparative study on the accuracies obtained from the combination of different classifiers and features.

IMPORTANT: Features to be used: At least one from the list given below:

a. HoG
b. LBP
c. Any other feature of your choice

and Raw image/pixels values.

Dataset to be used: MNIST (English handwritten numerals).

Report Structure:

The report should include the following sections:

1. **Introduction:** Provide a brief outline of the report and also briefly explain the features and classifier combination used for experiments.
2. **Dataset:** Provide a brief description of the dataset used with some sample images of each class.
3. **Experimental results and discussion:**
   a. **Experimental settings:** Provide information on the classifier settings (e.g: **KNN**: value of k for kNN classifier; **SVM**: kernel and other parameters used in SVM classifier; **ANN**: number of input neurons/nodes, activation function, loss function, output layer information etc.)
   b. **Experimental Results:**
      i. **Confusion matrix** for the highest accuracy achieved, with a very short description, with some result image sample.

      ii. Comparative study: sample table format

Classifier/Feature	HOG	LBP	Raw Input
KNN			
SVM			
ANN			

      iii. **Discussion:** Provide your understanding on why there was an error in the accuracy, and difference in the performance of the classifiers. You may also include some image samples which were wrongly classified.

4. **Conclusion:** Provide a short paragraph detailing your understanding on the experiments and results.

Deliverables:

5. Project Report (around 5 pages)
6. Google Colab (preferred) or IPython notebook, with the code. The code should run on Google Colab. The submitted notebook should also have the output visible after running each code cell.

Additional Information:

Assessment Submission

Submission of your assignment is in two parts. You must upload a zip file of the Ipython/Colab notebooks and the Report separately on 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/tested, 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 session.

Return of Assessed Assignment

It is expected that marks will be made available 2 weeks after the submission via Canvas.

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 discussion forum for this subject so that everyone can see the response.

If serious problems are discovered, the class will be informed via an announcement 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 page
- 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.