Applied Machine Learning Systems ELEC0134 (19/20)

Assignment

General Overview

The AMLS assignment comprises individual implementation of machine learning models along with associated code writing, training and testing on data, and an individual report in the form of a conference paper and (optionally) supplementary material. You are allowed to discuss ideas with peers, but your code, experiments and report must be done solely based on your own work.

Assignment summary

1. The assignment leverages elements covered in:
    a. The AMLS lectures,
    b. The AMLS lab sessions, and
    c. Relevant research literature associated with machine learning systems.

    The assignment involves the realisation of various machine learning tasks on a provided dataset. You are expected to go through the data, analyse it and/or pre-process it as necessary.
2. Using your ML knowledge acquired in the lectures and the labs, design solutions for each task described in the section *Assignment Description* below. You should also search the relevant literature for additional information, e.g., papers on state-of-the-art methods in machine learning.
3. Implement your solution in your preferred programming language, e.g., MATLAB, Python, C/C++, Java, etc. However, please note that the labs of the module will be based on Python, so you are encouraged to use this programming language too.
4. Write a report summarising all steps taken to solve the tasks, including a rational for the model and design choices. In addition, in the report, you should also describe and analyse the results obtained via your experiments and provide accuracy prediction scores on unseen data. Please refer to Report and Code Format, and Marking Criteria sections for more details about the report.

Goal of the assignment

- To further develop your programming skills.
- To further develop your skills and understanding of machine learning systems.
- To acquire experience in dealing with real-world data.
- To develop good practice in model training, validation and testing.
- To read state-of-the-art research papers on machine learning systems and understand the current challenges and limitations.
- To develop your writing skills by presenting your solutions and findings in the form of a conference paper.

Assignment Description

Datasets

We provide two datasets which are designed specifically for this assignment and contain pre-processed subsets from the following datasets:

1. **CelebFaces Attributes Dataset (CelebA)**, a celebrity image dataset (S. Yang, P. Luo, C. C. Loy, and X. Tang, "From facial parts responses to face detection: A Deep Learning Approach", in *IEEE International Conference on Computer Vision (ICCV)*, 2015)
2. **Cartoon Set**, an image dataset of random cartoons/avatars (source: https://google.github.io/cartoonset/).

The datasets you are going to use in this assignment are:

1. **celeba**: A sub-set of CelebA dataset. This dataset contains 5000 images. It is going to be used for tasks A1 and A2.
2. **cartoon_set**: A subset of Cartoon Set. This dataset contains 10000 images. It is going to be used for tasks B1 and B2.

The datasets can be downloaded via following link:

https://drive.google.com/file/d/1zCCpWhDfXVh4dEQoMB09nKSfLNJi-HyT/view?usp=sharing

Tasks

The machine learning tasks include:

A. **Binary tasks (celeba dataset)**
   - A1: Gender detection: male or female.
   - A2: Emotion detection: smiling or not smiling.

B. **Multiclass tasks (cartoon_set dataset)**
   - B1: Face shape recognition: 5 types of face shapes.
   - B2: Eye color recognition: 5 types of eye colors.

You should design separate modes for each task and report training errors, validation errors, testing errors, along with any hyper-parameter tuning procedures.

Report and Code Format, and Marking Criteria

Report format and template

We provide both latex and MS word templates in ***AMLS_assignment_kit***. The criteria for each part are detailed in the template. For beginners in latex, we recommend overleaf.com, which is a free online latex editor.

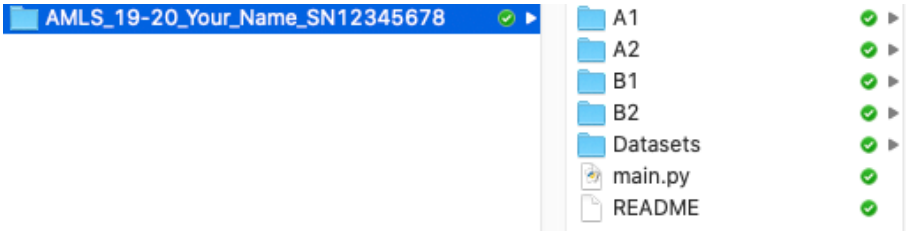
Your report should be no longer than **8 pages** (including the reference). You are allowed to append an additional supplementation material to your report with no longer than **4 pages**.

Once you finish your report, please export it into a PDF document and name it with the following format:

Report_AMLS_19-20 _SN12345678.pdf

Code criteria

You should write your code in modules and organize them in the following fashion:



- We will first run your code with a script. Therefore, please make sure your project is named properly as demonstrated in the figure above.
- The '**Datasets**' folder does not have to contain the raw dataset we provided. You can use it to save the datasets you generated (pre-processing, augmentation etc.).
- The '**A1**', '**A2**', '**B1**' and '**B2**' folders should contain the code files for each task.
- The **README** file should contain:
    - a brief description of the organization of your project;
    - the role of each file;
    - the packages required to run your code (e.g. numpy, scipy, etc.).

  The recommend format for **README** file is markdown (**.md**). **.txt** is acceptable too.
- We should be able to run your project via '**main.py**'. The structure of '**main.py**' has been provided.
- You are NOT going to upload your code and dataset to Moodle. Please refer to Submission session for more details.

Marking scheme

The mark will be decided based on both the **report** and **corresponding code**. In particular, we will mark based on following scheme:

REPORT		60%	CORRESPONDING CODE	40%
Abstract		5%		
Introduction		7%		
Literature survey		15%		
Description of models (Use flow charts, figures, equations etc. to explain your models and justify your choices)	Task A1	2%		
	Task A2	2%		
	Task B1	2%		
	Task B2	2%		
Implementation (the details of your implementation, explain key modules in your code.)	Task A1	3%	Correct implementation	7%
	Task A2	3%	Correct implementation	7%
	Task B1	3%	Correct implementation	7%
	Task B2	3%	Correct implementation	7%
	Task A1	2%	Reasonable results	3%

Experimental Results and Analysis	Task A2	2%	Reasonable results	3%
	Task B1	2%	Reasonable results	3%
	Task B2	2%	Reasonable results	3%
Conclusion		5%		

It should be noted that – whereas we expect students to develop machine learning models delivering reasonable performance on tasks A1, A2, B1 and B2 – the assessment will not be based on the exact performance of the models. Instead, the assessment will predominantly concentrate on how you articulate about the choice of models, how you develop/train/validate these models, and how you report/discuss/analyse the results.

Submission

- **Deadline**: 23:59, Jan 10th, 2020
- **Report submission**: you should only submit your report on Moodle Turnitin link under the Assignment tab of this module.
- **Code submission**: You must include a link to your code in a repository that is publicly accessible in your report (e.g., public Dropbox or Google Drive link, or similar).

  You are also encouraged to use GitHub to save and track your project. Use your UCL github account (or create an account) to start a git repository named **AMLSassignment19_20/**. Make sure to backup your code on the git repository regularly and keep your repository private so it is not viewable by other students. Changes made after the assignment deadline will not be taken into account. The code should be well documented (i.e., each class and function should be commented) and an additional README.md file containing instructions on how to compile and use your code should be created in the repository. We intend to test the code as well as ask you to provide us with your GitHub commit history evidencing how you gradually built and tested your solution.