Artificial Intelligence

2023/2024 – 2nd Semester

PROJECT – IMAGE CLASSIFICATION

1. Objectives

In this work, students should:

- Use an image dataset thought for a classification task;
- Train models based on convolutional neural networks for the task;
- Write a report using notebook markdown annotations. The report should contain:
  - All the steps taken to build the models;
  - The description of all the experiments and obtained results. This should be accompanied by metrics analysis (e.g. confusion matrices, accuracy, precision, recall and F1 score), appropriate charts and results analysis.

2. Dataset

The data set available in Moodle is divided into 6 folders: 5 train# folders and the test folders. All groups use the same test folder. Each group must use 4 of the train# folders as a training set and the remaining train# folder as a validation set. The folder to be used by each group as a validation set is determined as follows: calculate the sum of the last digit of the student number of each element of the group and then do the rest of the division by 5 and finally add 1. For example:

Student number 1: 2200783
Student number 2: 2243929
12 % 5 + 1 = 2 + 1 = 3
Validation set: *train3*
Train set composed of the images from folders *train1*, *train2*, *train4* and *train5*

3. Requirements

The project has the following requirements:

- Train, validation and test datasets should be used and described;
- RGB images should be used (three channels);
- At least one model architecture (let us call it model S) should be designed from scratch. At least one of these models should be different from the model developed in the classes;
- At least two distinct optimizers should be tried;
- S models should be trained both with and without data augmentation;
- Transfer learning should be tried with both feature extraction and fine-tuning. Let us call T models to these models;
- T models should also be trained both with and without data augmentation.

4. Assessment

05% - Dataset processing
35% - S models
30% - T models
20% - Report
10% - Extras

The project assessment will favour the students' ability to innovate, that is, of going beyond the contents learned in the classes (worksheets and hands-ons).

Examples of extras:
- Usage of regularization methods;
- Deployment of the developed models in an application (standalone or web);
- Develop custom data augmentation operations.

5. Deadlines, dates, rules, and instructions

1. Project delivery deadline: **June 22nd 2024, 23:59**.

2. The project should be developed in groups of 2 students. Groups with more than 2 students are not allowed. Students who want to develop the project alone should ask for permission through email to the theoretical classes' teacher. Only in well-grounded situations, this will be allowed.

3. The project should be delivered as a zip file following the format dl_project_#1_#2.zip, where #1 and #2 should be replaced by the student numbers of the group elements. The zip file should contain:

- the notebook files (.ipynb file) after being executed;

- the notebook files (.ipynb file) without markdown content and before being executed;

- pdf files with the notebooks with the run outputs;

- the models;

- computed features (for models built using transfer learning without data augmentation) .

4. An oral exam may be carried out in cases where teachers consider it necessary. The oral exam grade (from 0 to 100%) is multiplied by the project grade. The list of students taking the oral exam will be published on Moodle after delivery.