Fundamentals of Machine Learning - 2022

Report 2 - Classifying with convnets
23 September 2022 - Due on 01 october 2022, 23:59

1. Instructions

This is the course's second deliverable. You will analyze the problem below and describe in detail the steps taken to solve it. You are expected to deliver:

1. A written report in a Jupyter notebook (or equivalently in pdf, in that case with the complete associated code in a separate file),
2. A five minute video (plus one extra minute if needed) explaining the main aspects of your Jupyter notebook.

This report is individual, not meant to be done in groups. We trust in your integrity to present your own material.

The report may be in Spanish or English, but privilege legibility. You will get an asssignment through Google Classroom with an associated personal space where you will be able to upload your material. Please sumbit before the due time (Saturday October 1 at 23:59). The deadline will have no extension. There will be two penalty points (-2) for submitting after the deadline.

The report is expected to reflect all stages of an end-end machine learning workflow (include all stages discussed in class), and you are expected also to analyze the performance of your models and the reasons of such performance. As before, it is mandatory that you include all the errors that you consider relevant. Which ones you include is considered a matter to be evaluated.

2. Problem

You will work with an image dataset (see below for details). Your task is two-fold:

1. Build a baseline classification pipeline with a classic machine learning algorithm (i.e. not based on a neural network) of your choosing, and estimate its classification error. There should be efforts to improve this error as much as possible.

2. Build a convolutional neural network to classify the same dataset. There should be efforts to improve its error over the baseline.

Both parts of the problem are mandatory and lacking one of them implies not passing the course. A bonus point will be given if a pretrained model is implemented. **This is in addition to the hand-crafted convnet, and not in place of it**.

3. Data

You will be working with the dataset associated to practice 03: `faces_dict.p`, which you can find in the `guias/Datasets/` folder in the repo.

The dataset is composed by 400 images of 10 different people, each image consisting of 64x64 pixels, each quantized to 256 grey levels and converted to floating point values on the interval [0, 1]. The `target` for this database is an integer from 0 to 39 indicating the identity of the person pictured.

A bonus point will be given if a data augmentation is implemented.

4. Video presentation and grading

We ask you to record a short video presentation, where you should explain the main aspects of your efforts regarding both the baseline model as well as the convnet model. Aim at recording your notebook while you explain it, as well as your image. The recorded presentation will have no more than 5 minutes with optionally one extra minute. **There will be a penalty point (-1 point) if the video has more than the (5+1 minute) estipulated time. Videos of over 8 minutes will not be considered valid.**

In subsequent dates (03/10 and 04/10), there will be a short oral exam with questions over the details of the presented material.

The report (both the notebook and the presentation) will not be graded by the model's final performance, but by how much of the course content you were able to correctly apply (and clearly communicate). We can't overstate how important it is to be clear in order to achieve good enough grades.

Try to reflect as much as possible the stages described until this point (data analysis, feature engineering, correct error estimation, fine tuning, etc.). The more explicit you are about your modeling decisions and findings, the better, as you will give us the means to improve your grade. Good model performance is cool, but will not warrant a good report grade. Good presentation and correct modeling logic will.

Finally, we urge you to read again and carefully these instructions, as this is considered the final examination and there is no room for logistic mistakes. If you have any doubts, feel free to ask any one of us for clarifications.