Machine Learning
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Extra Practical Project

Deep Learning

This project aims at replacing the written test, that was scheduled to June 2nd, and due to the extraordinary CODIV-19 situation, had to be cancelled. Instead, students are invited to develop one extra practical project (corresponding to 10/20 points in the final mark), in the **Deep Learning** subject.

The required steps for the project are:

1. Select and describe one practical problem where a Deep Learning classifier (in particular a **CNN: Convolutional Neural Network**) could be used to distinguish elements of different classes, based on images (instances) of those elements;

2. Send a small description of your problem proposal to the teacher, describing the number of classes of your problem and (ideally) providing some visual examples of the elements you will be attempting to discriminate. This small description should have at most 1 page, and should be sent by email, up to May 12th, 23:59.

3. Manually acquire a data set (composed of as many instances as you can, but no less than 1.000), using a smartphone or camera device.

    a. All images should have the same dimensions;
    b. All images should be represented in the same color space (either RGB, or grayscale);
    c. Each image should contain only one instance of the elements that the network should discriminate.
    d. Images should be captured under as much variability factors as possible (e.g., different distances, different lighting conditions, blurred, shadowed, partially occluded, …)
    e. Each instance will correspond to an image, represented either in ".jpg" or ".png" formats.

4. Use the "scr_deep_learning_classification.py" file available at the course web page, or download an appropriate *Keras* or *TensorFlow* CNN model from the web. Carefully study the code to be used. Even if it was not developed by you, you should know every single line used as if it was.

5. Learn an appropriate CNN for your problem, using the data set chosen.

6. Perform an empirical validation of your model, using the (disjoint) test set. What are the typical success cases? What are the most problematic data degradation factors? What are the average error rates?

7. Write a complete report of all the work conducted in the scope of the project. This report should be sent by email, to the teacher, up to July 3rd, 23:59.

8. Prepare a 10 minutes presentation of the work carried out for this project. An individual presentation of the project (using Zoom) will be scheduled, where all the options taken will be discussed and validated.