Deep Learning basics

1 Context

In this lab, we will quickely review deep learning basic concepts. Then, you will use a deep learning framework to solve a classification problem.

2 Quizz

First, just a quick informal quizz to remind you some deep learning basic concepts. Are you able to answer all the following questions:

1. What is a neural network?
2. What is a neuron definition?
3. What does it mean to train a neural network?
4. How do you train a neural network?
5. What do we call "parameters" and "hyperparameters"?
6. What is the difference between a classification problem and a regression problem?
7. Which loss function do we tend to use for classification problems?
8. What is a convolutional neural network (CNN)?
9. What are the advantages of CNN over regular neural networks?
10. Which well-known CNN architectures do you know?
11. How do we split the data during training and why?
12. What is overfitting ?
13. How do we fight overfitting?
14. What is transfer learning?

3 Image classification

Here, we will use pretrained ResNet to classify architectural styles of Mexican buildings

3.1 MexCulture142 dataset

We will use the MexCulture142 dataset. This dataset contains 284 images of 142 Mexican monuments. They are classified in 3 styles: Prehispanic, Colonial and Modern. The images are in different resolutions.

The dataset is available at CREMI in: */net/ens/DeepLearning/DLCV2024/MexCulture142*. Images are already split in train and validation sets. The filenames contain the building style as prefix.

3.2 Transfer learning

Use a ResNet, pretrained on ImageNet, and apply transfer learning to classify the images of MexCulture142 according to the 3 styles.

You can use pytorch or tensorflow/keras.

At CREMI, you will have to activate a virtual python environment to access these frameworks:

```
source /net/ens/DeepLearning/python3/tensorflow2/bin/activate
```

Once activated, your prompt should change and indicate: “(tensorflow2)”.
In this environment, you should be able to launch pytorch and tensorflow2/keras python code.

4 Work

You should submit an archive with your work on Moodle. This archive should contain your python code and a small report. It may be a (clean) jupyter notebook. You should explain: which model(s) you used, the final accuracy you obtained, plots of the loss function and accuracy obtained during training on train and validation sets, and the 10 worst classified images (with the obtained category and probability, and the actual category).