Data Analysis Core

Paris Brain Institute

Exercises for the position of:

Engineer to develop deep learning algorithms for MRI segmentation

Introduction

The exercises are based on material from this online tutorial[1]. Some of the exercises might be complex: just give it your best shot and don't be discouraged! As your time might be limited, consider quality as much as quantity. We will only consider responses (the hyperlink to the online repository or notebook) returned to us **before April 3rd,** by email to: stephen.whitmarsh@icm-institute.org. Please use the subject title: **[Exercises MRI segmentation]** to make sure your response is not lost.

Good luck!

Exercise 1

- Write a training code for a similar training as in the tutorial, but without the pytorch_lightning library.
- Make one script with a command line for training.
- In the training loop use the automatic mixed precision from Pytorch (with autocast and GradScaler) in order to train with FP16 precision instead of the default FP32.

For the next exercise, you can either keep you code from exercise 1 or come back to the tutorial solution (i.e. with the pytorch_lightning library).

Exercise 2

- Implement an option to perform a fine-tuning strategy: load a previously saved model, or start from random weights, and freeze all layer parameters for the Unet model except the last classification layer.

Exercise 3

- Because we used a strong data augmentation strategy (thanks to Torchio), the dataset length does not need to be equal to the real length. Indeed, in the nnUnet paper they proposed to train always with the same scheme : 1000 epoch of 250 iterations.
- Make the necessary changes so that the training epoch is always Nit iterations (i.e. Nit*batch size training volumes).
- Make sure that all training samples are equiprobably chosen, whatever the chosen Nit value.

[1] https://colab.research.google.com/github/fepegar/torchio-notebooks/blob/main/notebooks/TorchIO_MONAI_PyTorch_Lightning.ipynb