STOIC Challenge

Balaïtous model

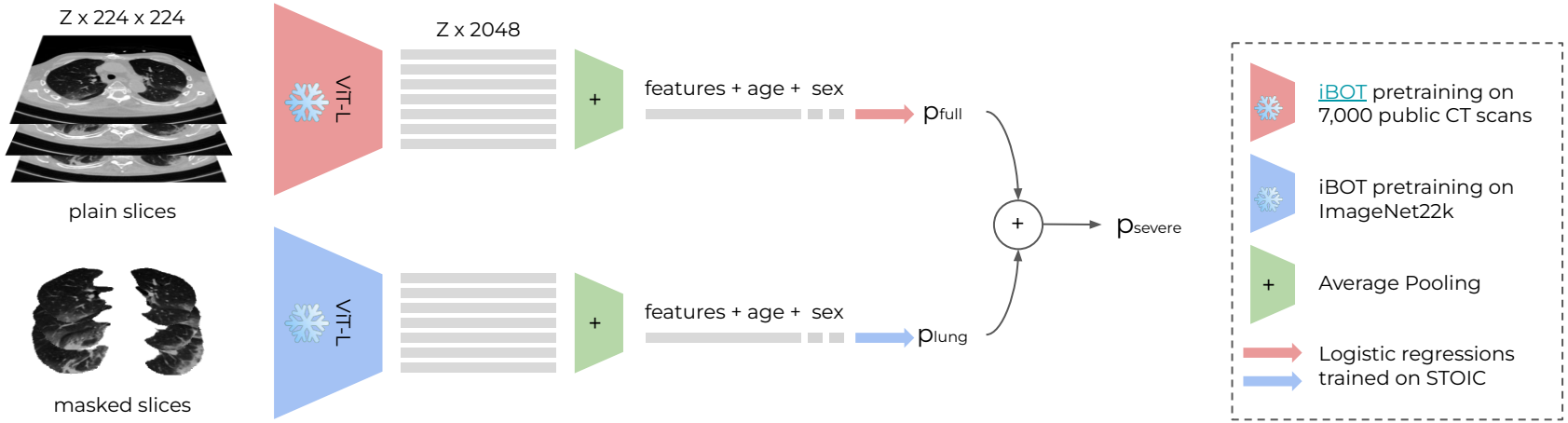
Simon Jégou - October 18th 2022

Mont Balaïtous, 3144 m, Pyrénées, France

Balaïtous overview

Balaïtous is an improved version of the **AI-Severity** model described in *Lassau et al., Nature Communications, 2021.*

The input scan is resized to (1.5mm, 1.5mm, 5mm) and cropped to the lung slices using an open-source 2D U-Net (lungmask).
Two pipelines **frozen feature encoder** / average pooling / **logistic regression** are then applied as follow :

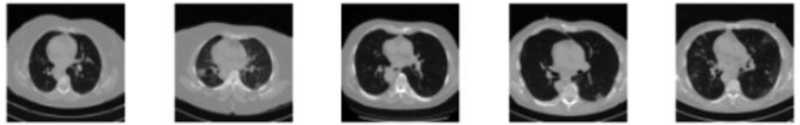


- ➔ The STOIC database is used only to train the logistic regressions (pytorch feature extraction + sklearn → fast to train)
- ➔ For the severity model, only COVID patients are used to train the logistic regression (*i.e.* 60% of the data)
- ➔ For the COVID model, age and sex are not used as they are not predictive of COVID disease

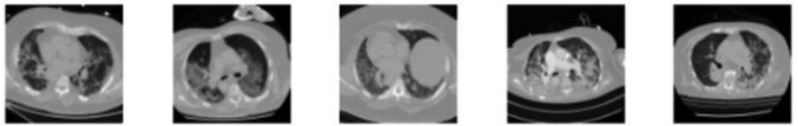
Balaïtous performances

- ➔ The ROC-AUC performances on the training set (cross validation 4x8 folds) generalized to the *qualification (last submission)* leaderboard
- ➔ Analysis of the errors indicates that the model relies on **lung lesion burden** for the severity prediction task

	AUC severity	AUC COVID
Training - Xfull	79.01 +- 2.63	80.65 +- 2.16
Training - Xlung	79.00 +- 3.30	82.63 +- 1.99
Training	80.36 +- 2.80	82.98 +- 2.01
Qualification LB	**80.44**	**83.22**



False negatives for severity : low lung lesion burden



False positives for severity : high lung lesion burden

Alternatives models were investigated:

- ➔ Feature extractors and preprocessing parameters were extensively benchmarked (DINO, SWAG, CLIP *etc.*)
- ➔ Finetuning iBOT on CT scans only brought modest gains
- ➔ Finetuning the feature extractor(s) or adding a learnable slice pooler did not bring significant gains
- ➔ Using sagittal and coronal views brought +0.6% AUC in cross-validation but not on the first qualification leaderboard (although a very high variance on this leaderboard, see forum post)

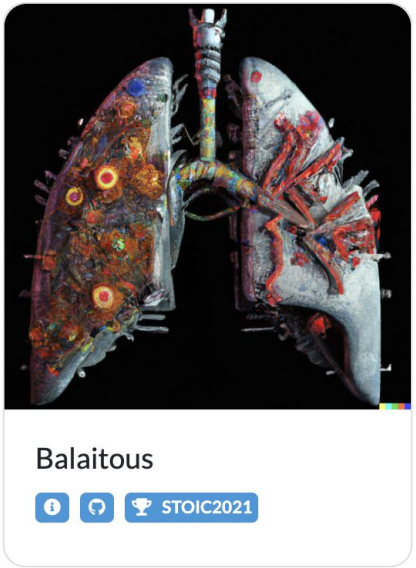
Balaïtous access

The model submitted to *the qualification (last submission)* leaderboard has been open-sourced on GitHub (https://github.com/SimJeg/balaitous) and pushed to PyPi, and is also available on the grand-challenge website (link)

```
pip install balaitous
```

```
from balaitous import Balaitous

model = Balaitous(device='cuda')
p_covid, p_severe = model('path/to/image', age=age, sex=sex)
```



- Model calibration could be performed if APHP releases model and predictions
- Validation on an independent test set (*i.e.* not from APHP) is required

Thanks to APHP for the amazing dataset and to the organizers of the challenge, especially Luuk Boulogne