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 feature extraction / average pooling / logistic regression are then applied as follow :
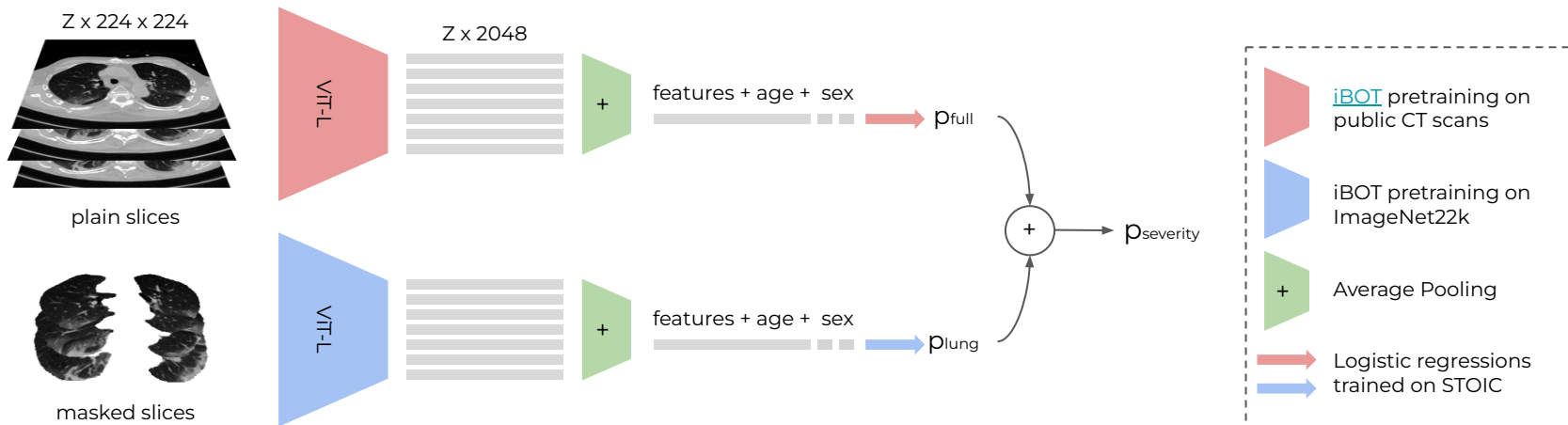
➔ The STOIC database was used only to train the logistic regressions (pytorch feature extraction + sklearn → very fast to train)
➔ For the severity model, only COVID patients are used to train the logistic regression (_i.e._ 60% of the data)
➔ For the COVID model, age and sex are not used

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 - X$_{full}$	79.01 +- 2.63	80.65 +- 2.16
Training - X$_{lung}$	79.00 +- 3.30	82.63 +- 1.99
Training	80.36 +- 2.80	82.98 +- 2.01
Qualification LB	**80.44**	**83.22**
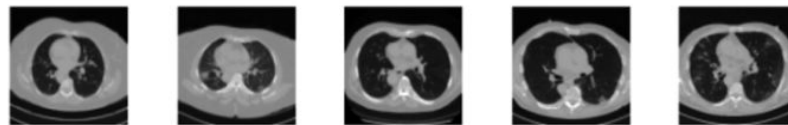
False negatives for severity : low lung lesion burden
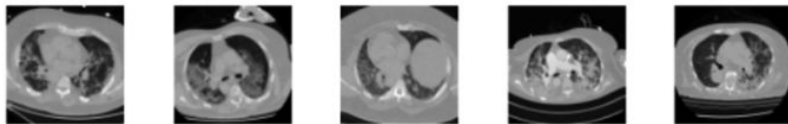
False positives for severity : high lung lesion burden

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 (TBC on final leaderboard)
➜ Using sagittal and coronal views brought +1% AUC in cross-validation but not on the first qualification leaderboard (however there was a very high variance on this leaderboard, see forum post)
➜ Finetuning the feature extractor(s) or adding a learnable slice pooler did not bring significant gains

Balaïtous access

The model submitted to *the qualification (last submission)* leaderboard has been open-sourced on GitHub (https://github.com/SimJeg/balaitous) and pushed on 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)
```


Balaitous

Missing : model calibration and validation on an independant test set (*i.e.* not from APHP)