IEEE TRANSACTIONS ON MEDICAL IMAGING

Deep Learning-Based for Automatic Multi-Landmark Localization in Medical Images

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Motivations

The motivations behind this project are based on the improvement of a simplistic and effective technique for detecting landmarks in medical images. Landmarks are very important in orthodontics and maxillo-facial surgery.

NEXT →

2D Cephalometric X-rays

Data

What ?

- Cephalometric radiographs (lateral) of 400 patients
- Folder with images and csv files for all 19 landmarks

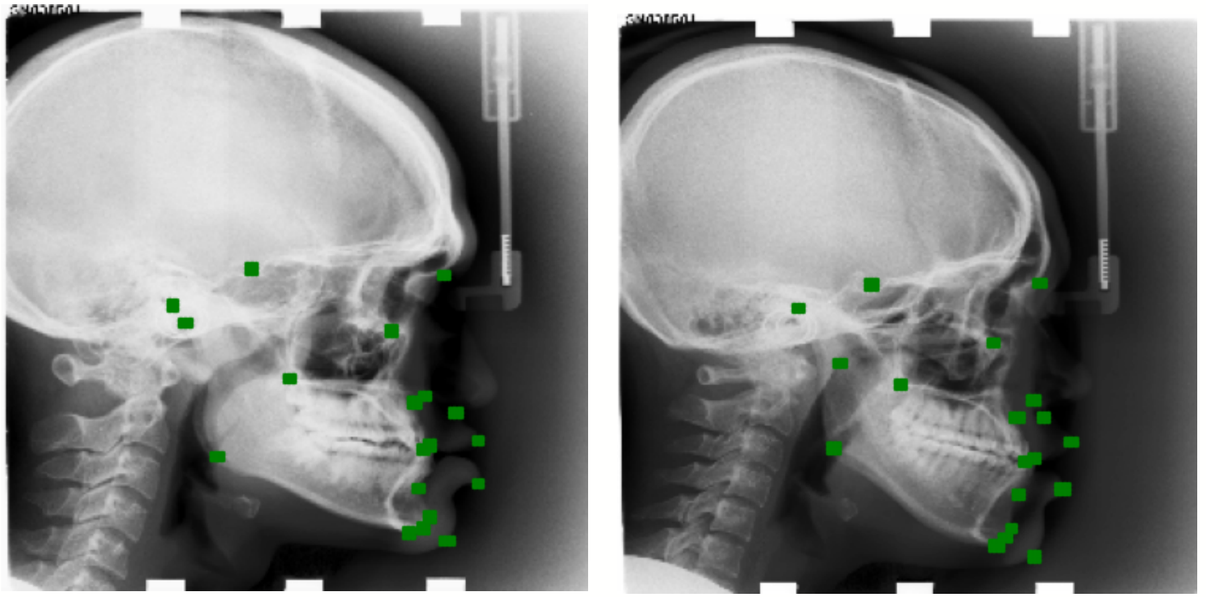
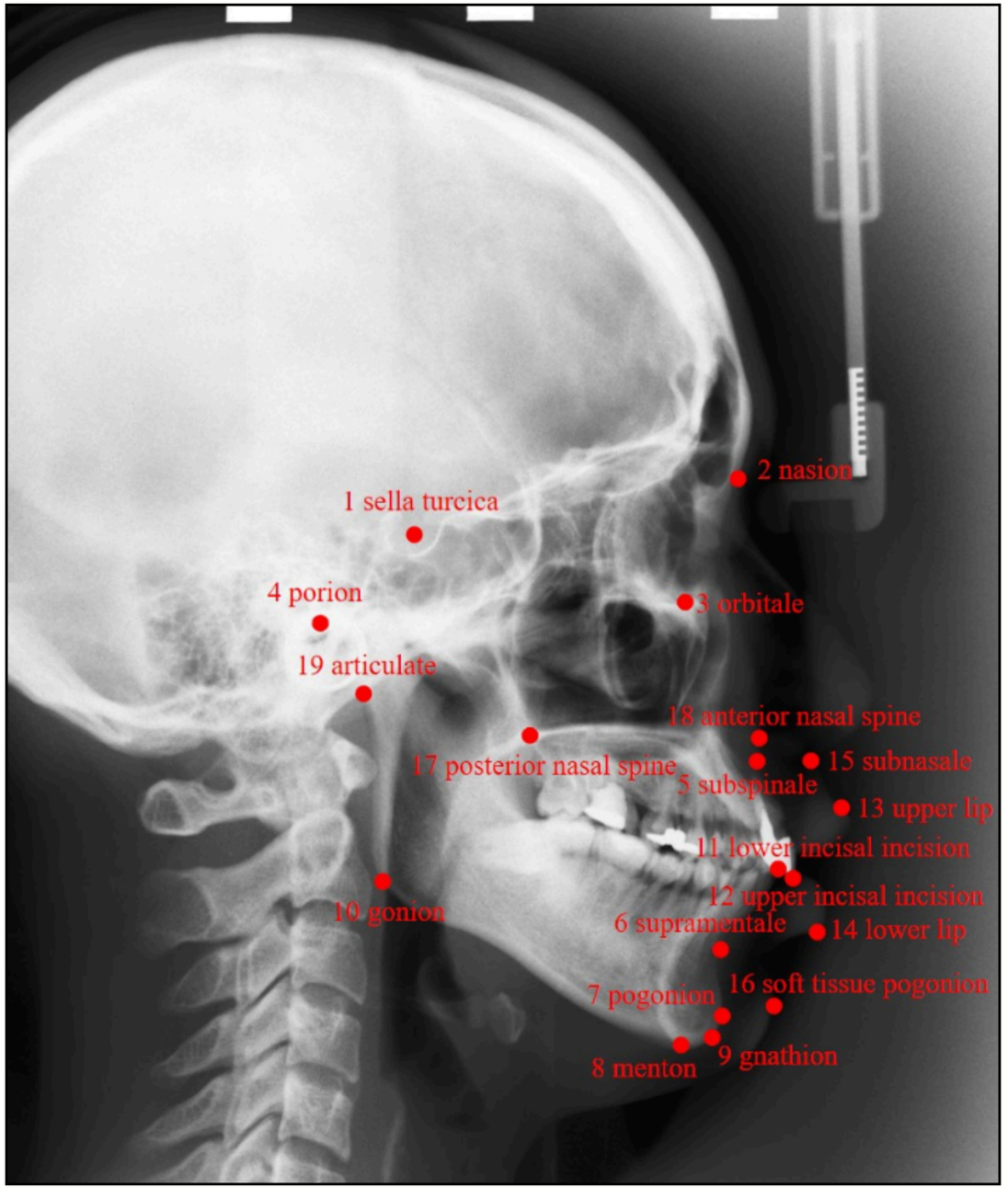


Fig : Cephalometric X-ray of two different patients, in which 19 different landmarks are indicated by a red cross.


2 nasion
1 sella turcica
4 porion
3 orbitale
19 articulate
18 anterior nasal spine
17 posterior nasal spine
15 subnasale
5 subspinale
13 upper lip
11 lower incisal incision
12 upper incisal incision
10 gonion
6 supramentale
14 lower lip
16 soft tissue pogonion
7 pogonion
9 gnathion
8 menton

METHOD

Pre-processing :

- Resizing images : from 2400 x 1935 to 256 x 256
- Normalization

U-Net :

- Input : Images 256 x 256
- 4 Downsampling block : 64, 128, 256 and 512 filters
- Bottleneck : Conv2D with 1024 filters using ReLu + BatchNormalization + Conv2D and BatchNormalization
- 4 Upsampling block with 512, 256, 128 and 64 filters
- Output : Convolution 2D with 1 filter using Sigmoid

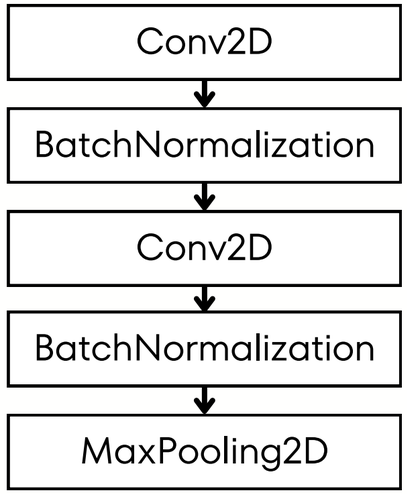


Fig : Downsampling block

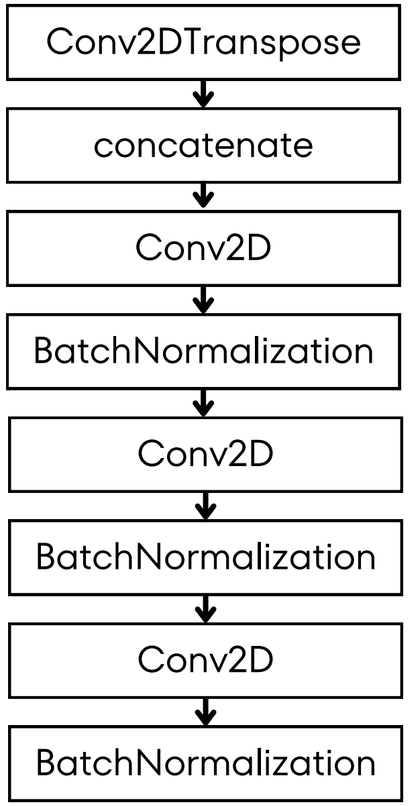


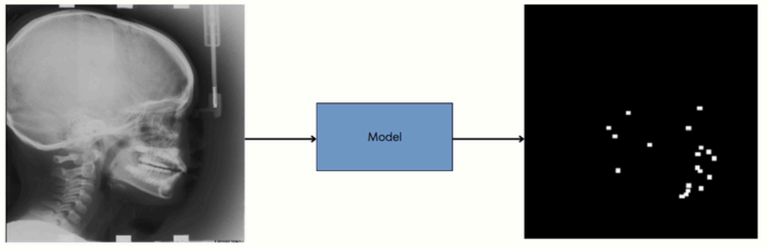
Fig : Upsampling block

Language
Python

Librairies
tensorflow and keras

About training :

- Loss function : dice_loss to avoid imbalanced class
- Optimizer : Adam to converge faster and don't need to try lot of parameters



Results

Evaluation

- Median Euclidean distance to compare with SOTA

Experiments

- Randomly splits of each dataset in training, validation and test set

	1 Training	2 Validation	3 Test
2D Cephalometric X-rays	300 images	50 images	50 images

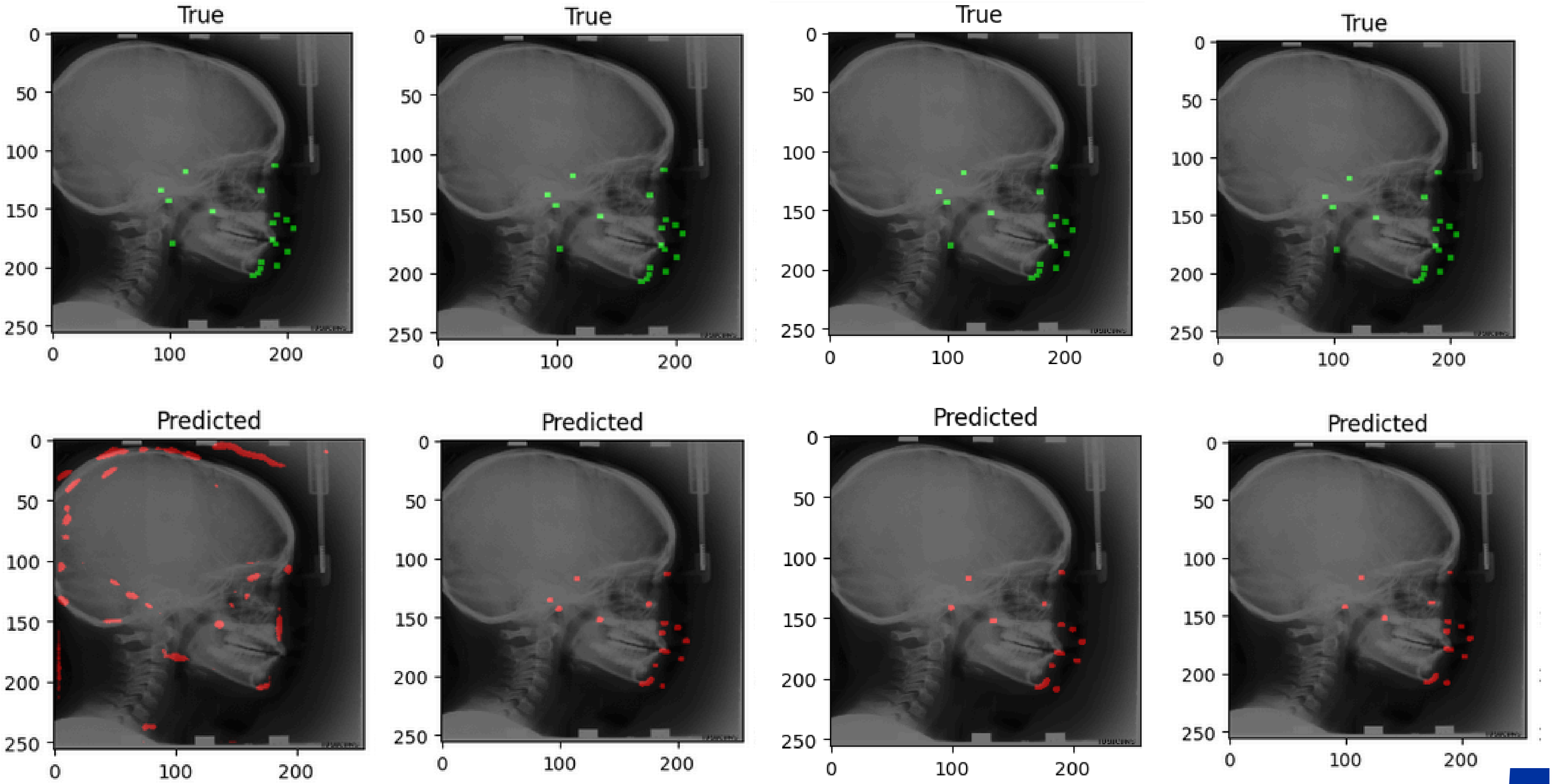
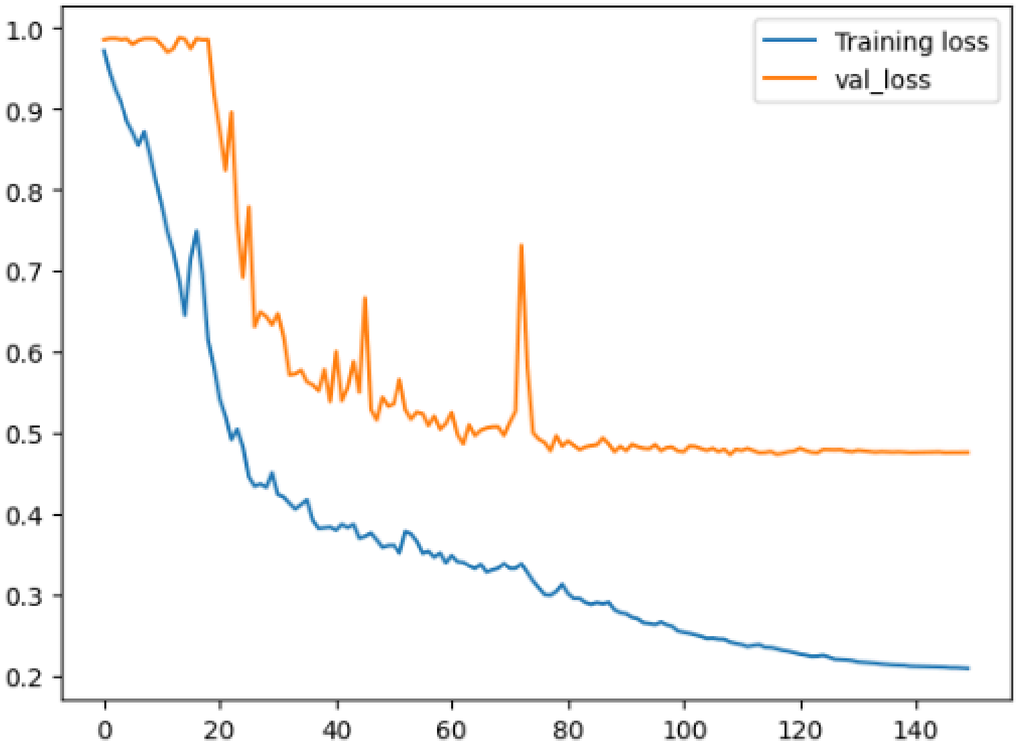


Fig : Predictions with 20, 75, 100 and 150 epochs



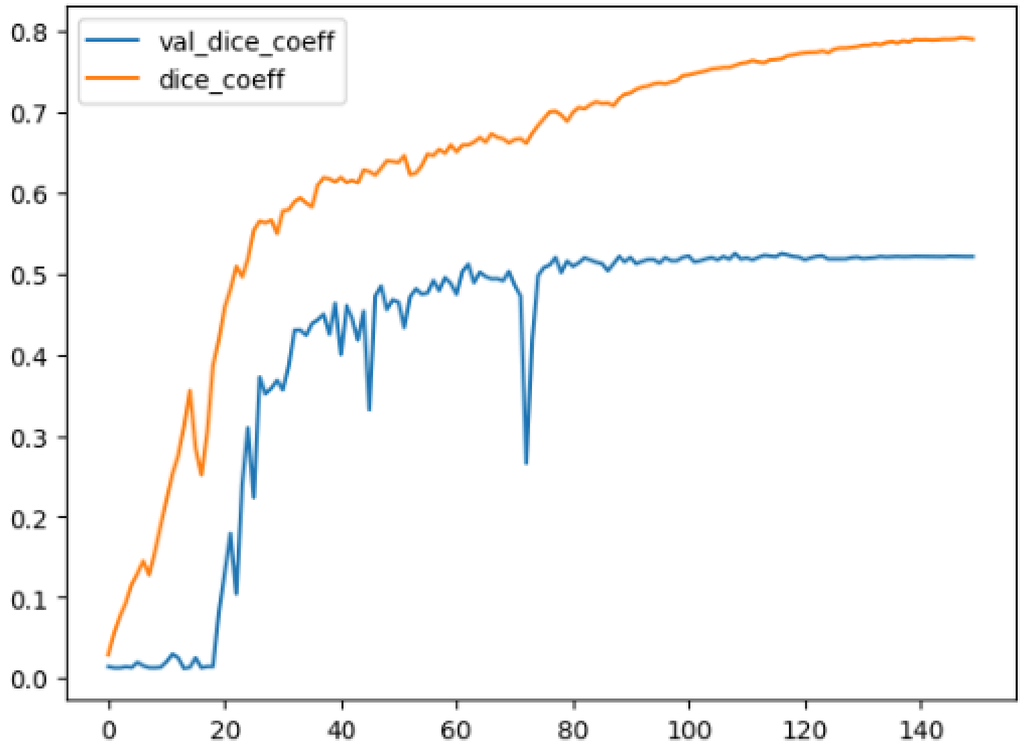


Fig : Loss with 150 epochs

2D Cephalometric X-rays

Comparison with SOTA

Method	Errors range
Julia M. H. Noothout et al.	0.46 to 2.12 mm
Lindner and Cootes	0.89 to 0.9 mm
Proposed methd	0.97 to 1.32 mm

Conclusion

- Compare on different dataset like CCTA or Olfactory MR
- Locates landmarks quickly and easily
- Simple model to localize landmarks

Thank you for your attention !

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The Kernel crashed while executing code in the current cell or a previous cell.
Please review the code in the cell(s) to identify a possible cause of the failure.
Click here for more info.
View Jupyter log for further details.
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