Corentin Giroud[1,2], Florian Dubost[2]

[1]Zelos Mediacorp, Rotterdam, Netherlands
[2]Ecole des Mines de Saint-Etienne, Saint-Etienne, France

Probabilistic Segmentation and Detection of Aneurysm from brain MRA with an Ensemble of 3D Convolutional Neural Networks and Monte Carlo Dropout

INTRODUCTION :

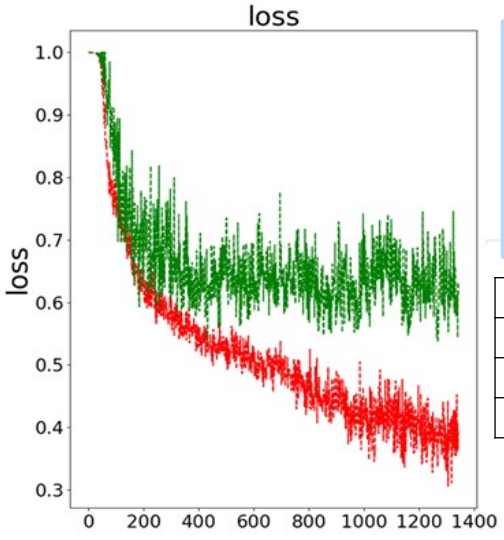
- Detection of aneurysm before rupture
- Patient monitoring to follow the evolution of the aneurysm

TASKS :

- Detection of intracranial aneurysms from TOF-MRA
- Segmentation in 3D of aneurysms

METHOD :

- Segmentation of the target brain region
- Resized image preprocessing
- CNN takes the segmented region as input
- U-Net architecture
- Optimized with data augmentation
- Dice simillarity Loss function
- Adadelta optimizer
- Prediction with Monte Carlo Dropout
- Average of 4 probability maps, with 4 splits



Dice similarity loss function (in red) and its adjusted value (in green)

RESULTS :

Team: zelosmediacorp

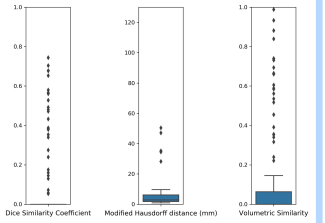
Task 1 Rank: 0.36
Task 2 Rank: 0.52

Task 1 Place: 7 th
Task 2 Place: 6 th

Task 1	False Positives	Sensitivity
Average	0.05	0.21
Rank	0	0.73

Task 2	Dice Coefficient	Modified Hausdorff Distance (mm)	Volumetric Similarity
Average	0.09	9.79	0.13
Rank	0.79	0.02	0.76

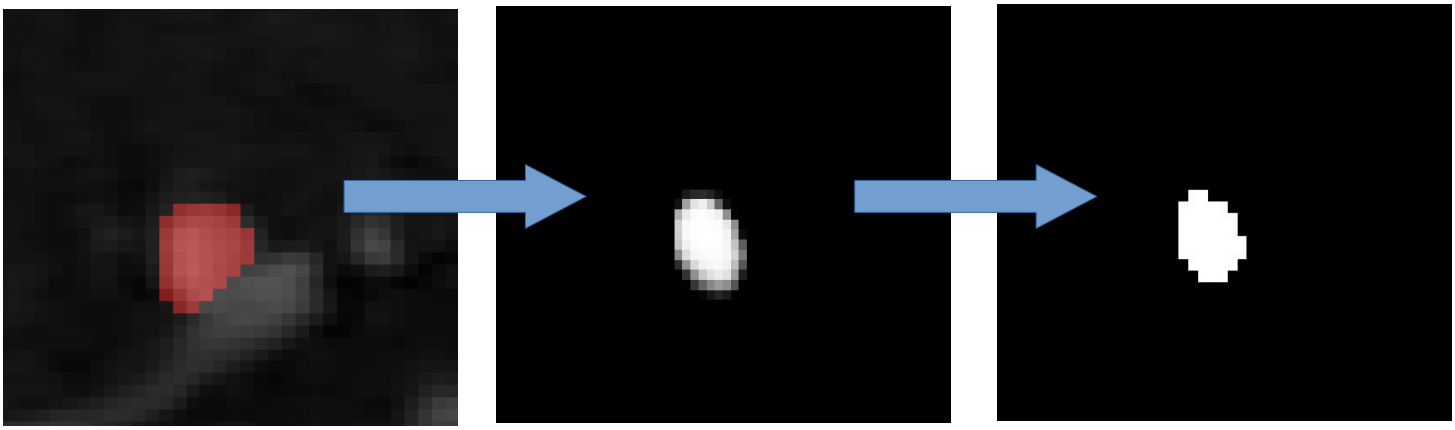
(lower rank is better)



	Split 1			Split 2			Split 3			Split 4		
Sensitivity (in%)	68	68	63	74	52	57	48	48	62	66	47	50
Falses Positives	6	9	19	7	6	9	7	7	4	3	5	3
Score	192	288	703	182	288	387	364	364	152	102	265	150

$$Score = (100 - sensitivity) * falses\ positives$$

Networks trained on 4 random splits with 91 images in training set and 22 images in validation set. Falses positives and sensitivity are calculated on the validation set. Each column represents a different neural network



Original TOF-MRA and ground thruth (in red)

Monte-Carlo prediction

Segmentation

Contact information

Corentin Giroud
cgiroud@zmediacorp.org

Florian Dubost
floriandubost1@gmail.com