Segmentation of ischemic stroke lesion

CM2003 Deep Learning Methods for Medical Image Analysis

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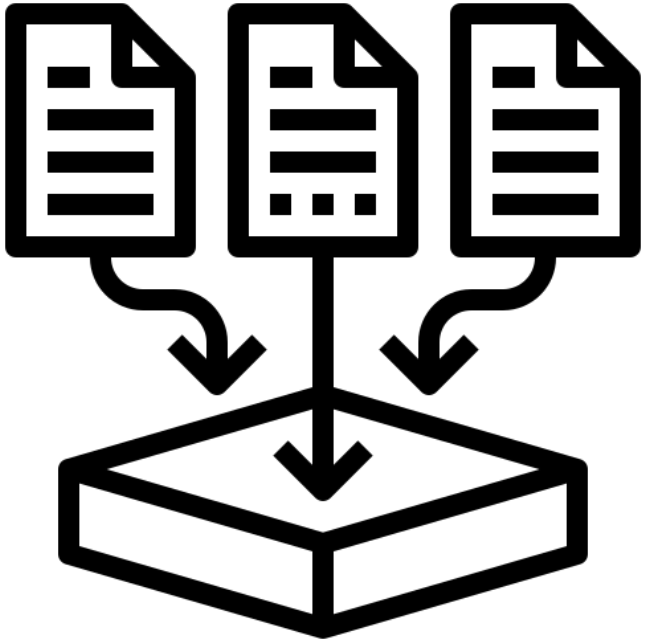
2022

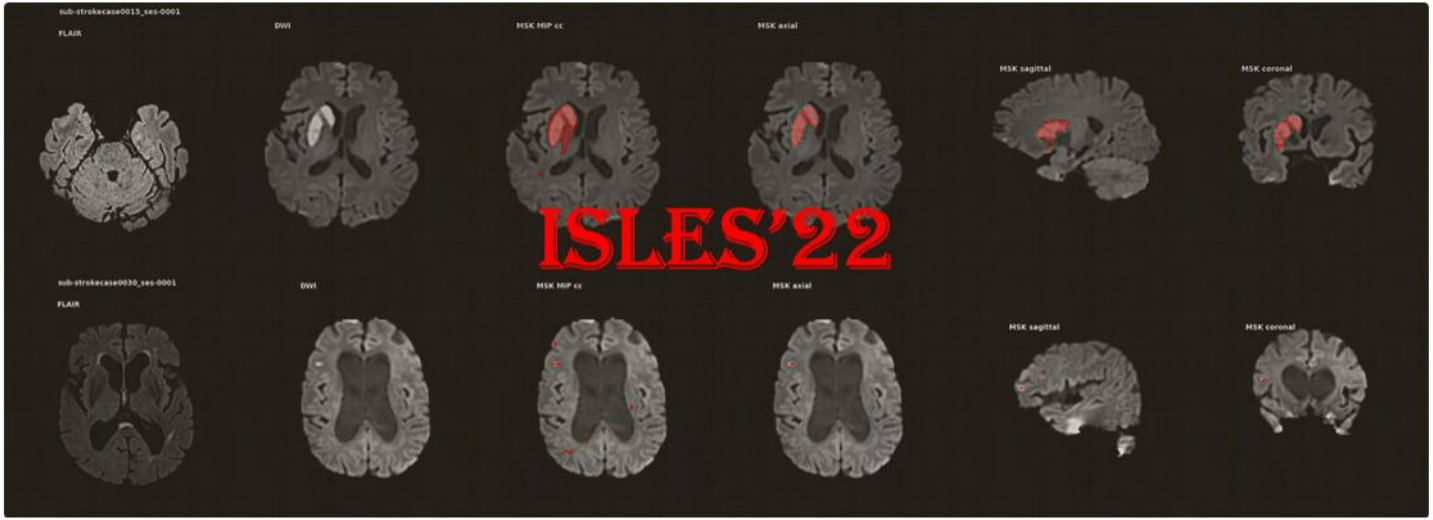
Summary

I. Dataset



I.1) Source

Comes from **Ischemic Stroke Lesion Segmentation Challenge - ISLES'22**
Found on **grand-challenge.org**



https://isles22.grand-challenge.org/

I.2) Description

250 participants

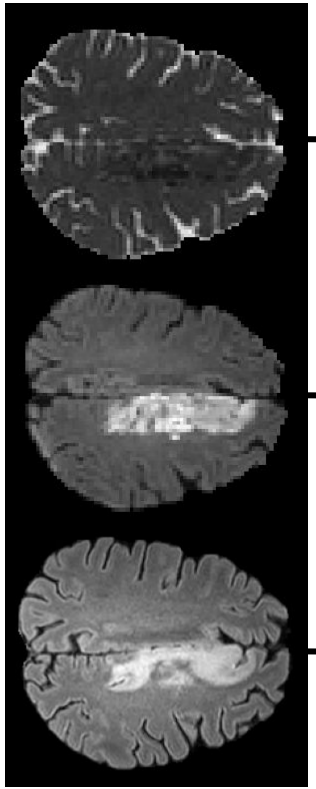
3 different modalities

1 mask

ADC
112 x 112 x 72

DWI
112 x 112 x 72

FLAIR
281 x 352 x 352

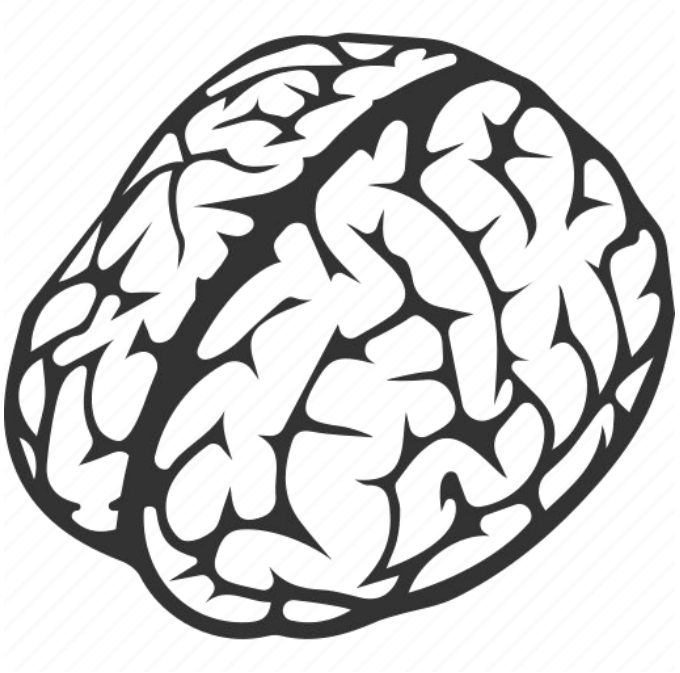


Segmentation

Mask

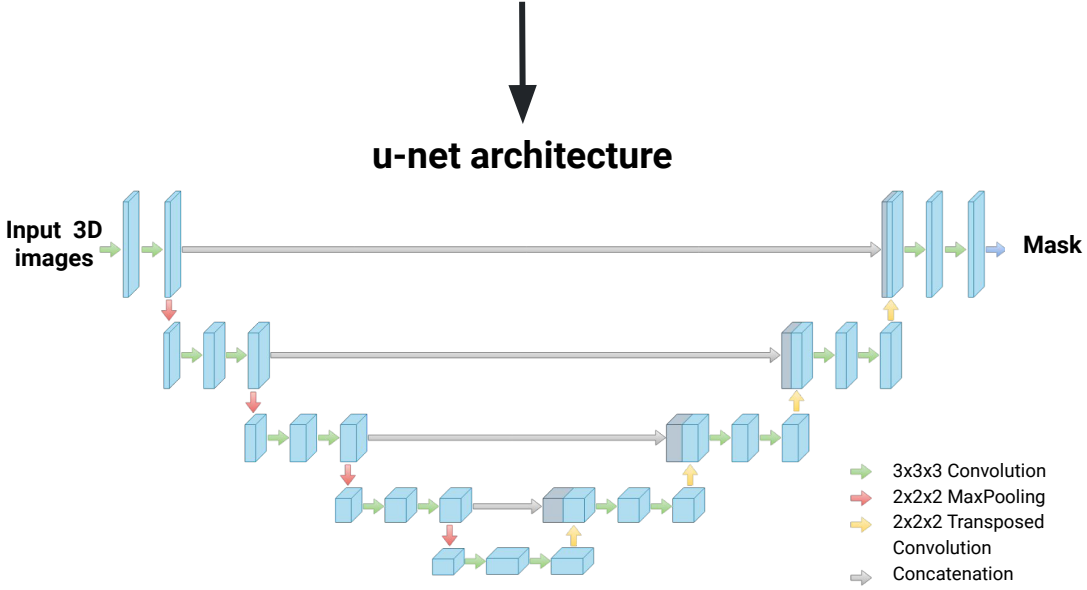
112 x 112 x 72

II. 3D Study



II.1) Methods

Segmentation task



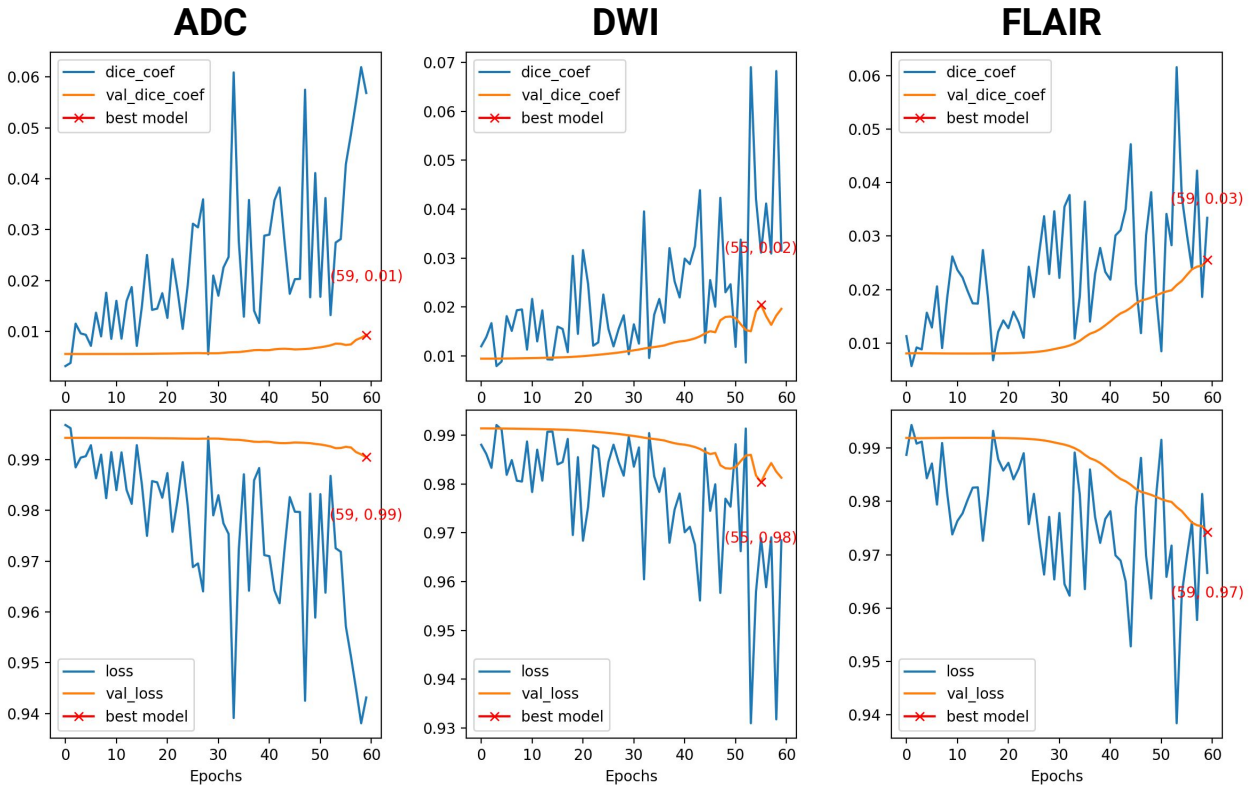
Memory problem

→ impossible to load the whole dataset to train the model

use the modalities separately

II.2) Results

Parameters :
number of base = 8
learning rate = 1e-4
batch size = 8
batch normalization = True



II.3) Limitation

Where do these bad results come from ?

→ **Resizing** of the images : loss of information
→ **Few data** : only 250 participants
→ **One modality** at a time instead of using them all
→ **Not enough epochs** due to too high computation time
→ **Non optimized parameters**

How to solve them ?

→ data augmentation
→ use all modality
→ use more epochs

→ test different parameters

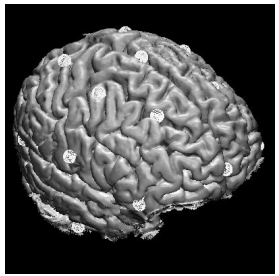
need more memory

select only some slices

III. 2D Study

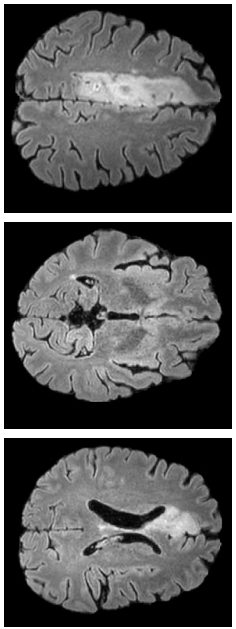
III.1) Methods

3D



Selection of slices

2D



1. **Train u-net model with this selection**
2. **Save the trained model**
3. **Reconstruct the mask slice by slice by passing them through the saved model**

Reduction of the needed memory and computation time

Can use all modalities
Can use more epochs
Easier to tune the parameters

III.2) Results

Overall results

	1 slice	5 slices	10 slices
Mean Dice Coefficient	0,4	0,52	0,59
Median Dice Coefficient	0,39	0,57	0,66
Minimum Dice Coefficient	0	0	0
Maximum Dice Coefficient	0,93	0,94	0,96

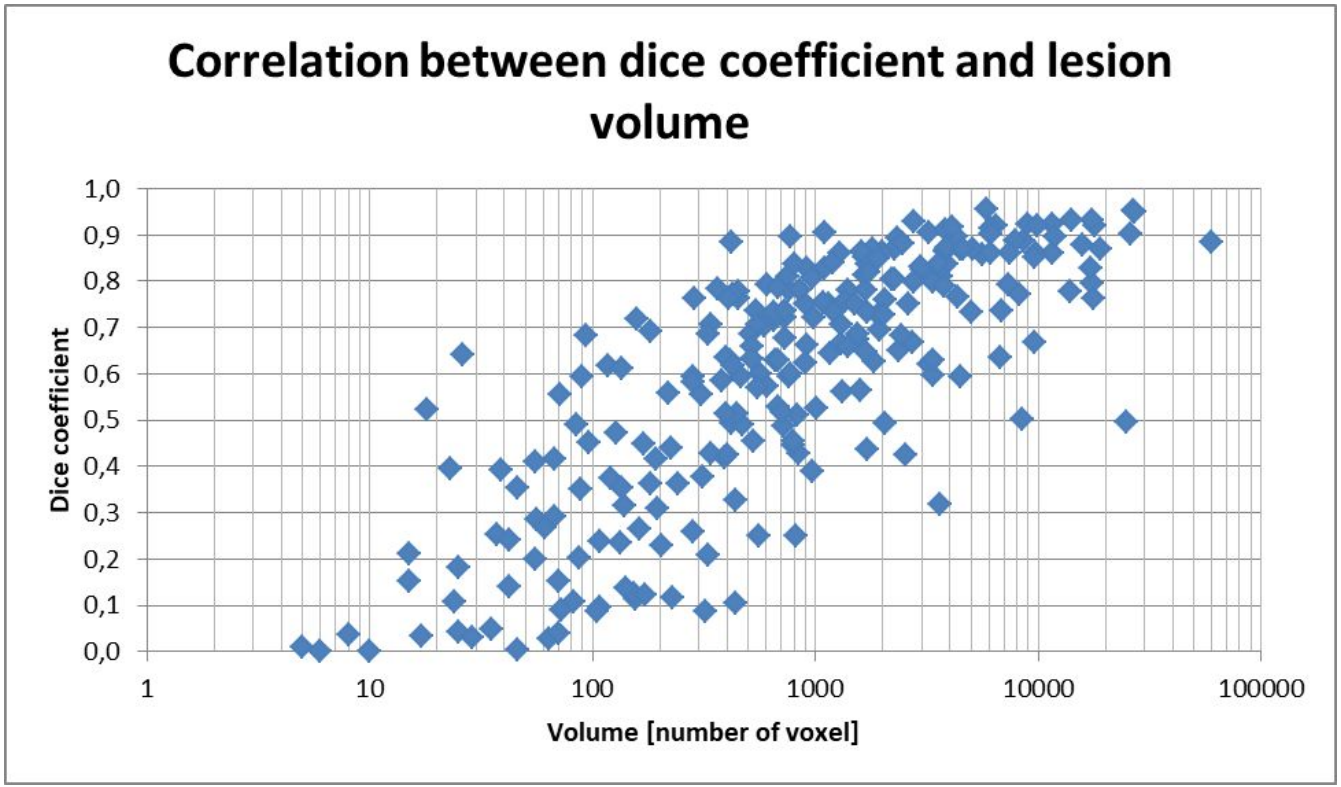
data augmentation

What about the challenge ?

The highest ranked team has a median dice coefficient of **0.821**

The lowest ranked team has a median dice coefficient of **0.397**

III.2) Results



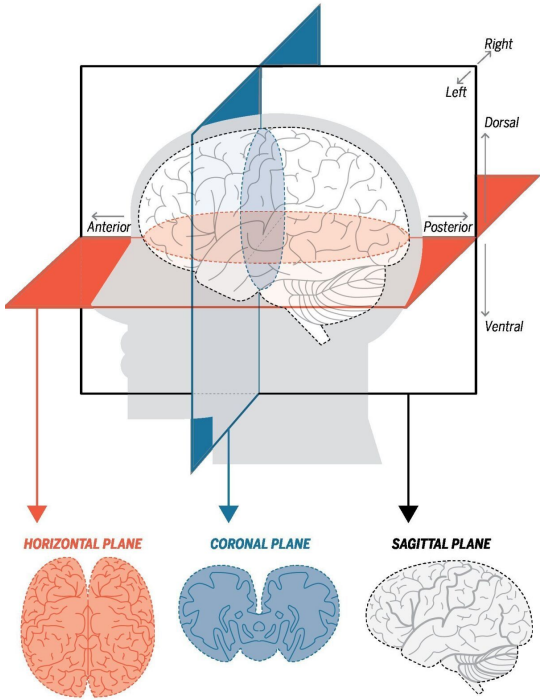
By computing the dice coefficient between each layer of the mask and the prediction, the same correlation is observed :

→ **the lowest accuracy occur in the layers where there is almost no lesion**

III.3) Areas for improvement

→ Increase the **number of slice** used in the training
→ Use the **three different planes** instead of using only the horizontal one
→ **Autocontext**

→ Using the **3D images** with an efficient model should work better because 3D convolutions keep the information of the neighbors present in the adjacent layers



Conclusion

→ **The 3D model is not convincing**
↳ it should be the best performing model because it is the one that best suits the problem
↳ it suffers mainly from a need for excessive resources

→ **The 2D model obtains reasonable results**
↳ it seems to be able to be improved by different methods