White Matter Hyperintensities Segmentation

MICCAI Challendge 2017

Выборка

http://wmh.isi.uu.nl/data/

- Обучение: 60 наборов МРТ снимков головного мозга
- Для каждого пациента: две модальности 3D T1-weighted image and a 2D multi-slice FLAIR image

INSTITUTE	SCANNER	#TRAINING	#TEST
UMC Utrecht	3 T Philips Achieva	20	30
NUHS Singapore	3 T Siemens TrioTim	20	30
VU Amsterdam	3 T GE Signa HDxt	20	30
	3 T Philips Ingenuity	0	10
	1.5 T GE Signa HDxt	0	10

Данные

- Структура папок одинаковая:

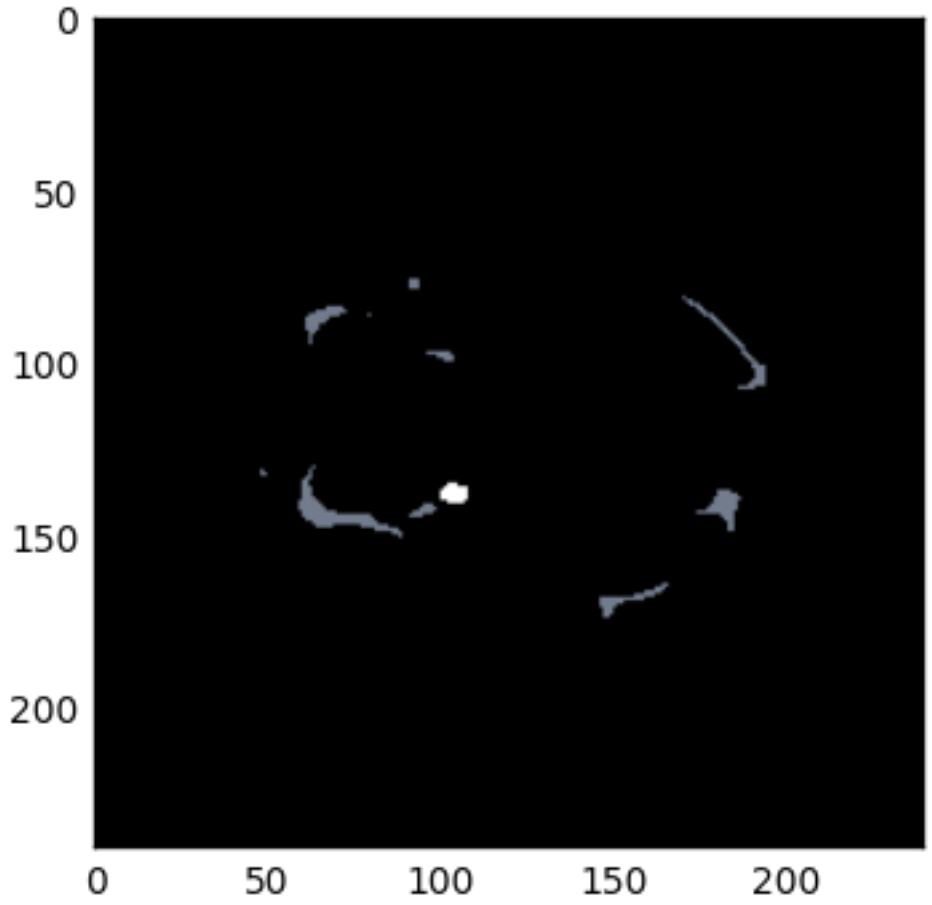
Папка пациента
- wmh.nii.gz

- orig: (маска для удаления лица, 3DT1, FLAIR, T1 (aligned with FLAIR), параметры конвертирования к FLAIR)
- pre: (3DT1, FLAIR, T1 (выровненная с FLAIR))
- Параметры: reg_3DT1_to_FLAIR.txt

Transformation parameters used to align the 3D T1 image with the FLAIR image. Participants can use this to do the transformation themselves, in case they use the 3D T1 for processing. Results will be evaluated in the FLAIR space. Call: transformix -in IMAGE.EXT -out /output -tp (elastix 4.8)

Данные

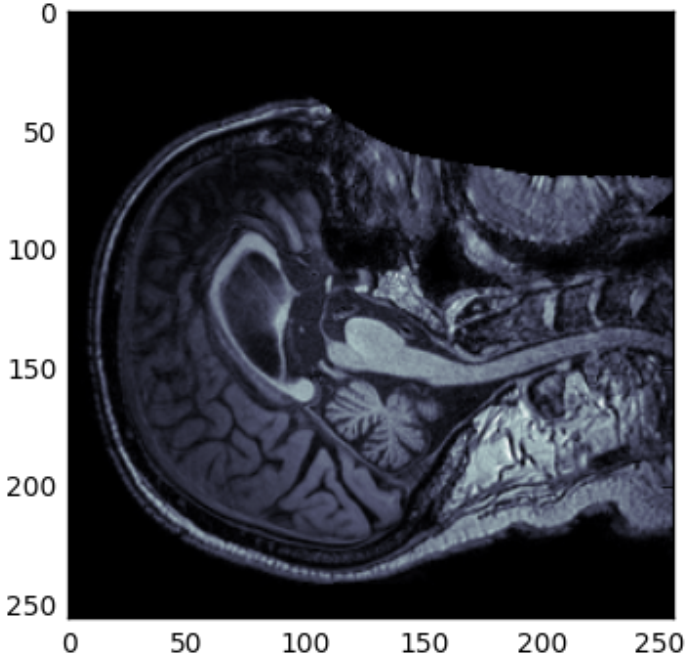
- Пример для Utrecht
- Разметка
  wmh.nii.gz (240, 240, 48)

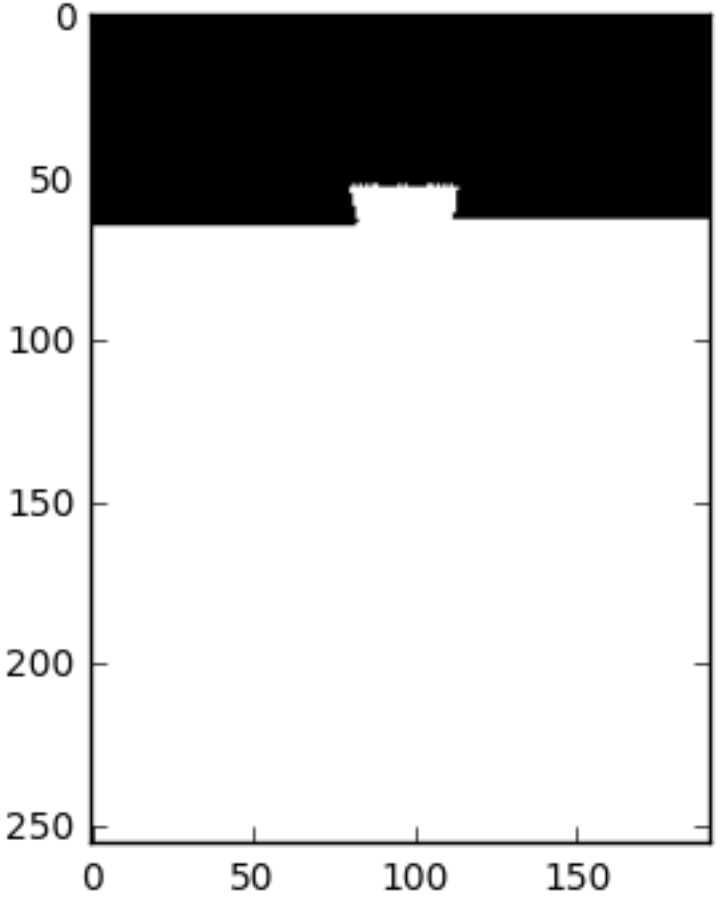


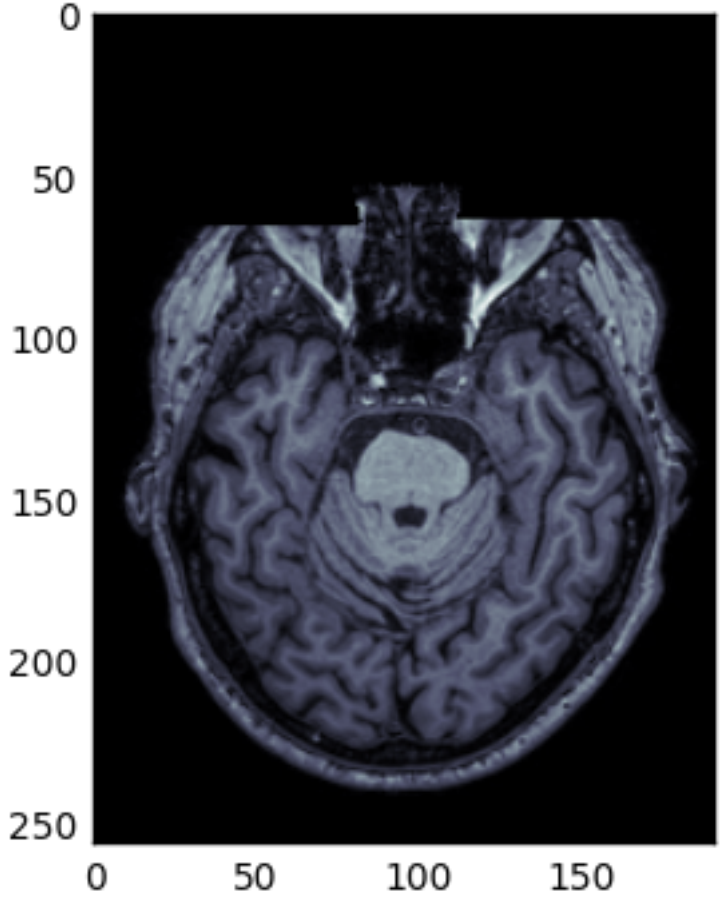
Данные

- 3DT1_mask.nii.gz
- orig/3DT1.nii.gz

(256, 256, 192)

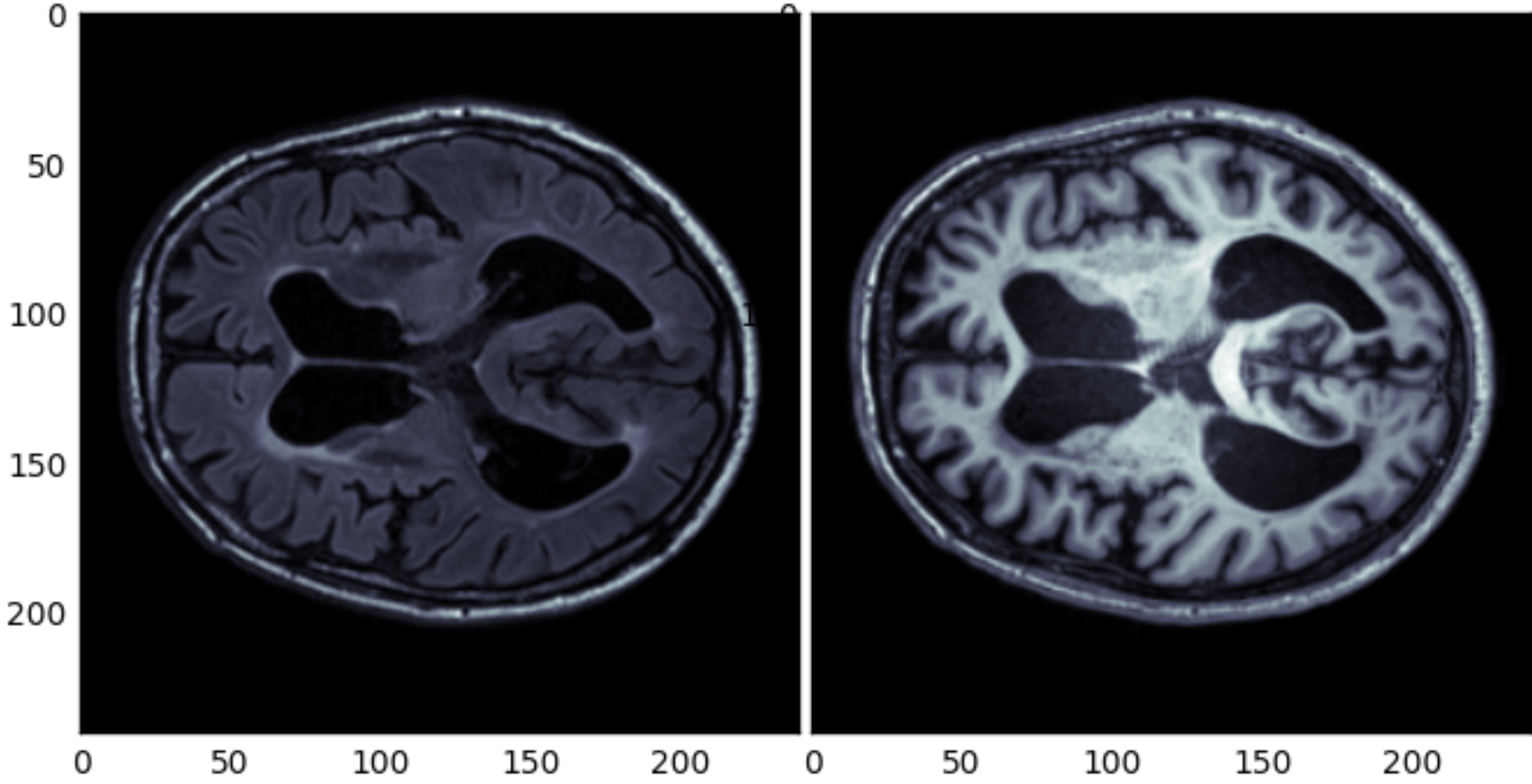






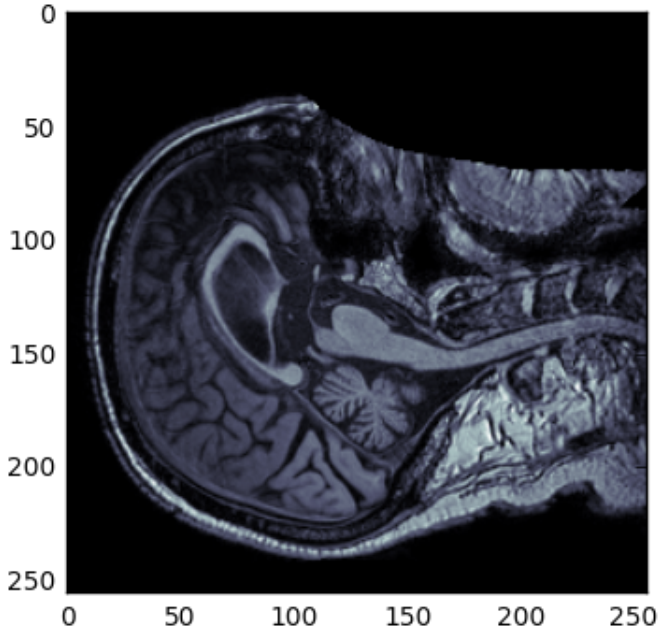
Данные

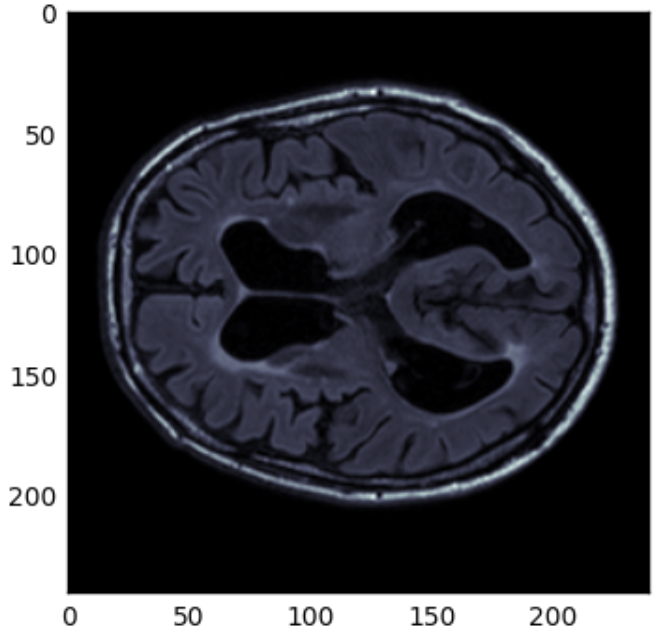
- orig/FLAIR.nii.gz
- orig/T1.nii.gz
- (240, 240, 48)

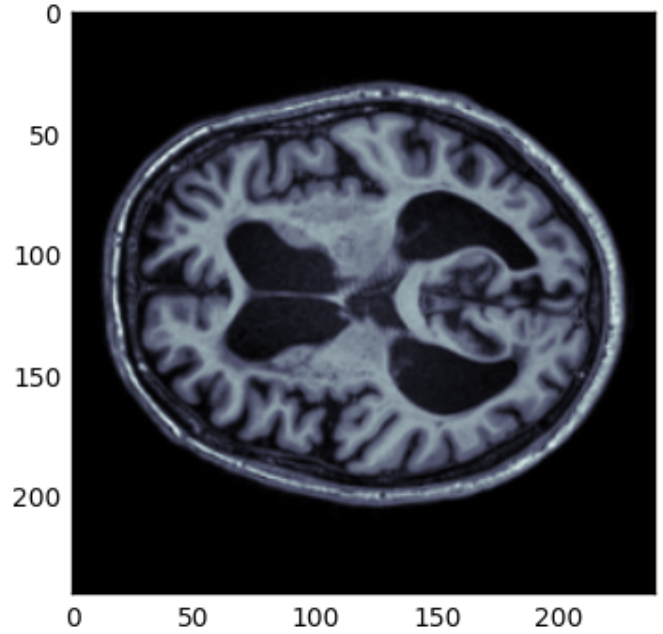


Данные

- pre/3DT1.nii.gz (256, 256, 192)
- pre/FLAIR.nii.gz (240, 240, 48)
- pre/T1.nii.gz (240, 240, 48)

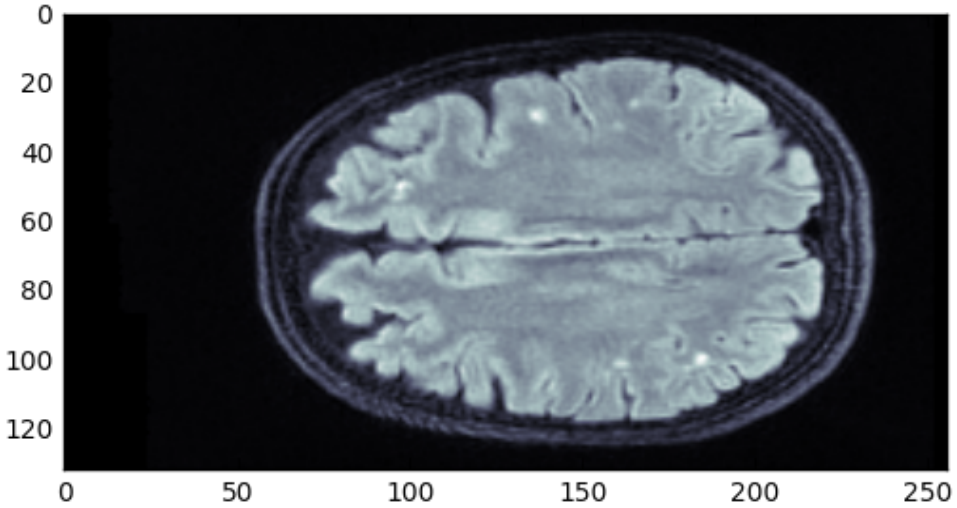


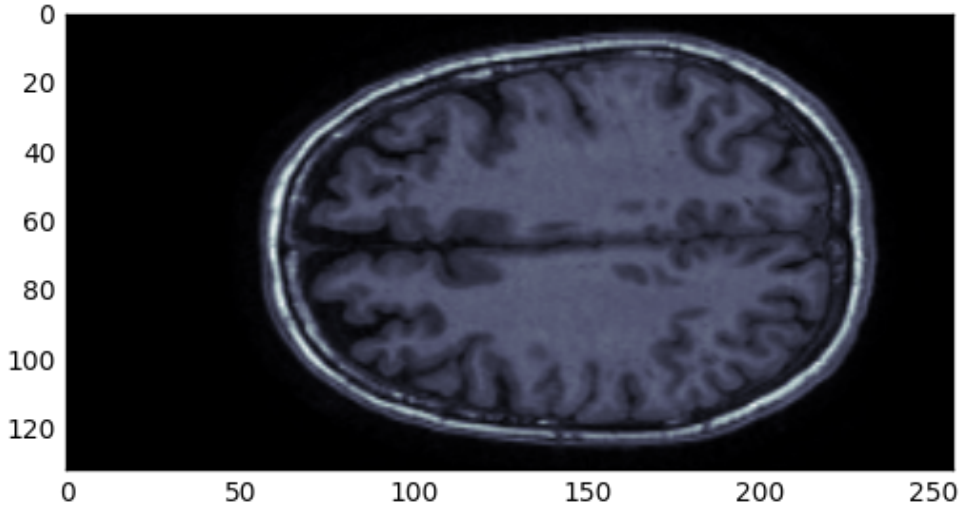




Данные

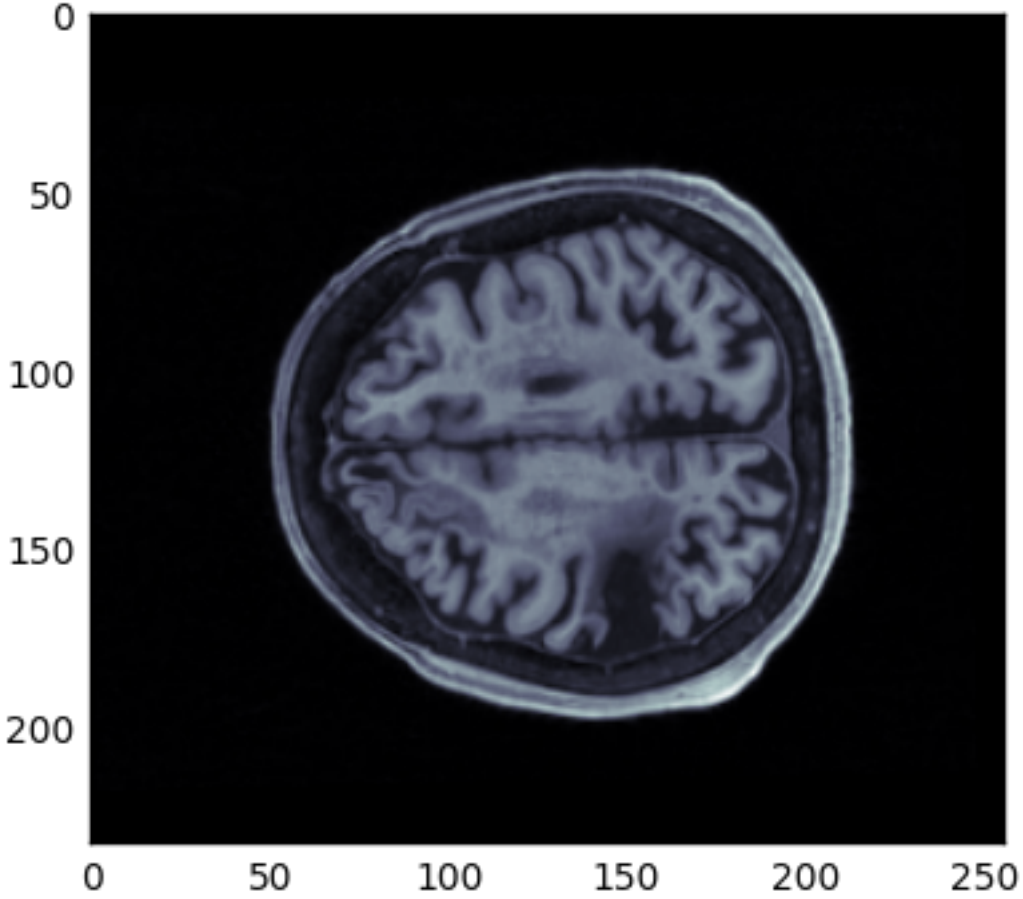
- Для Amsterdam другая размерность препроцешенных снимков (132, 256, 83)





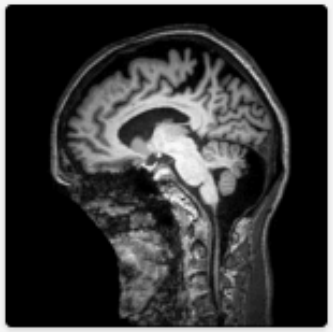
Данные

- Для Singapore в папке pre
  (256, 232, 48) либо (232, 256, 48)



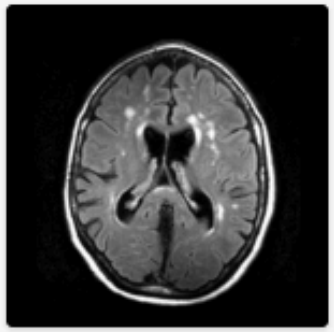
Данные

Example images



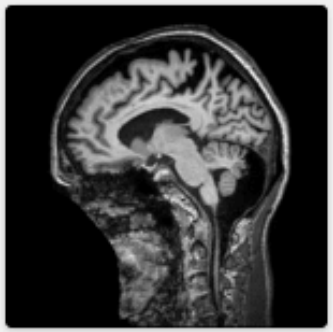
orig/3DT1

orig/3DT1 mask

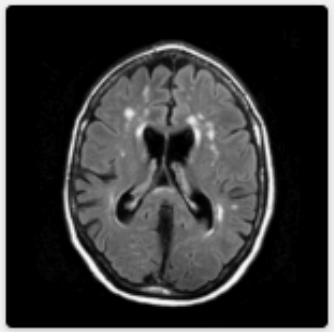


orig/FLAIR

orig/T1



pre/3DT1



pre/FLAIR

pre/T1

WMH

Препроцессинг

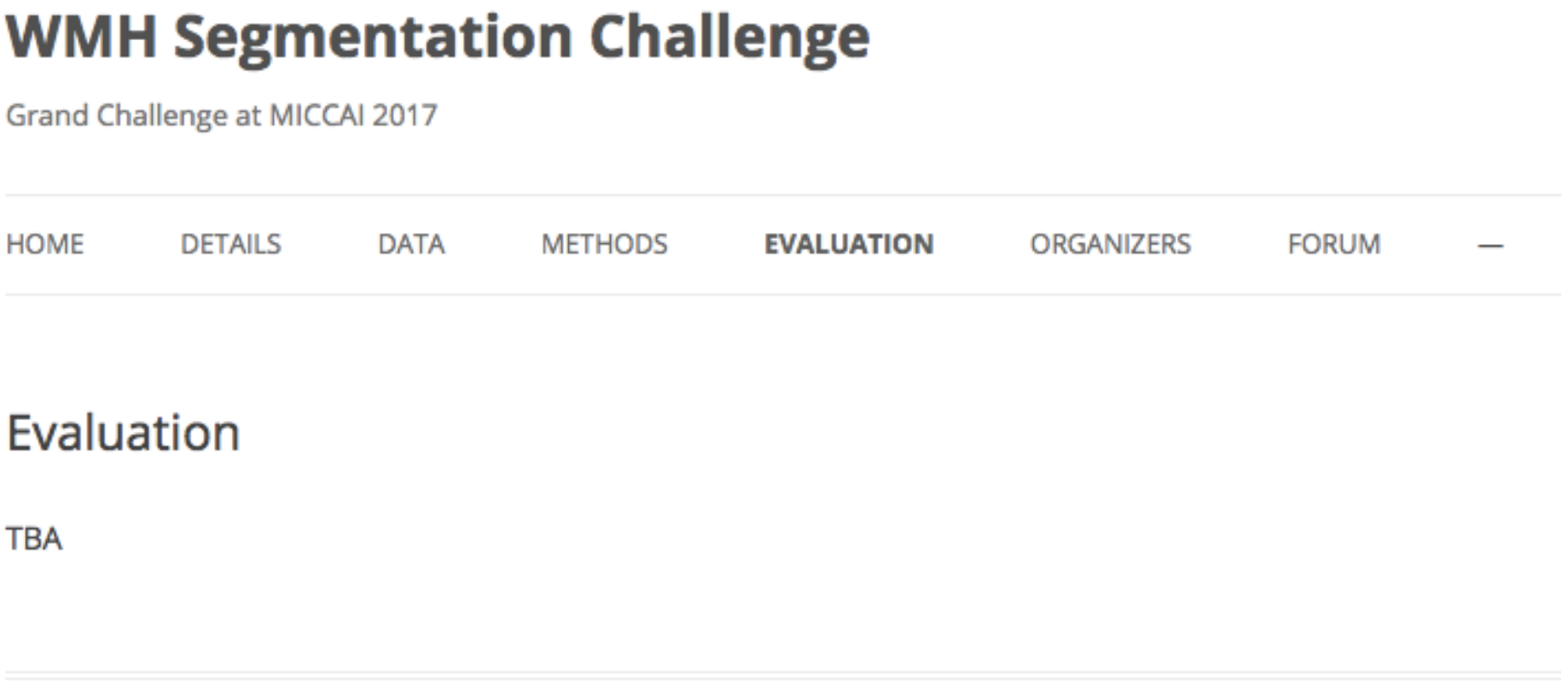
- All images were pre-processed with SPM12 r6685 to correct bias field inhomogeneities.

Задача

- This file is only provided for the training data. It contains the following three labels:
- 0. Background
- 1. White matter hyperintensities
- 2. Other pathology
- The objective of this challenge is to automatically segment WMH. Because we do not require methods to identify all other types of pathology, we provide a rough mask for them that will be ignored during evaluation.

Валидация, метрика качества

Отправка – в докере.



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Внешние данные

Participants are allowed to use additional data to train their method.

This must be mentioned in the description that is submitted with the method.

We encourage participants to use open data or make the additional data open access.

State-of-the-art

Location Sensitive Deep Convolutional Neural Networks for Segmentation of White Matter Hyperintensities

Mohsen Ghafoorian[1a,b], Nico Karssemeijer[b], Tom Heskes[a], Inge W.M. van Uden[c], Clara I. Sanchez[b], Geert Litjens[b], Frank-Erik de Leeuw[c], Bram van Ginneken[b], Elena Marchiori[a], Bram Platel[b]

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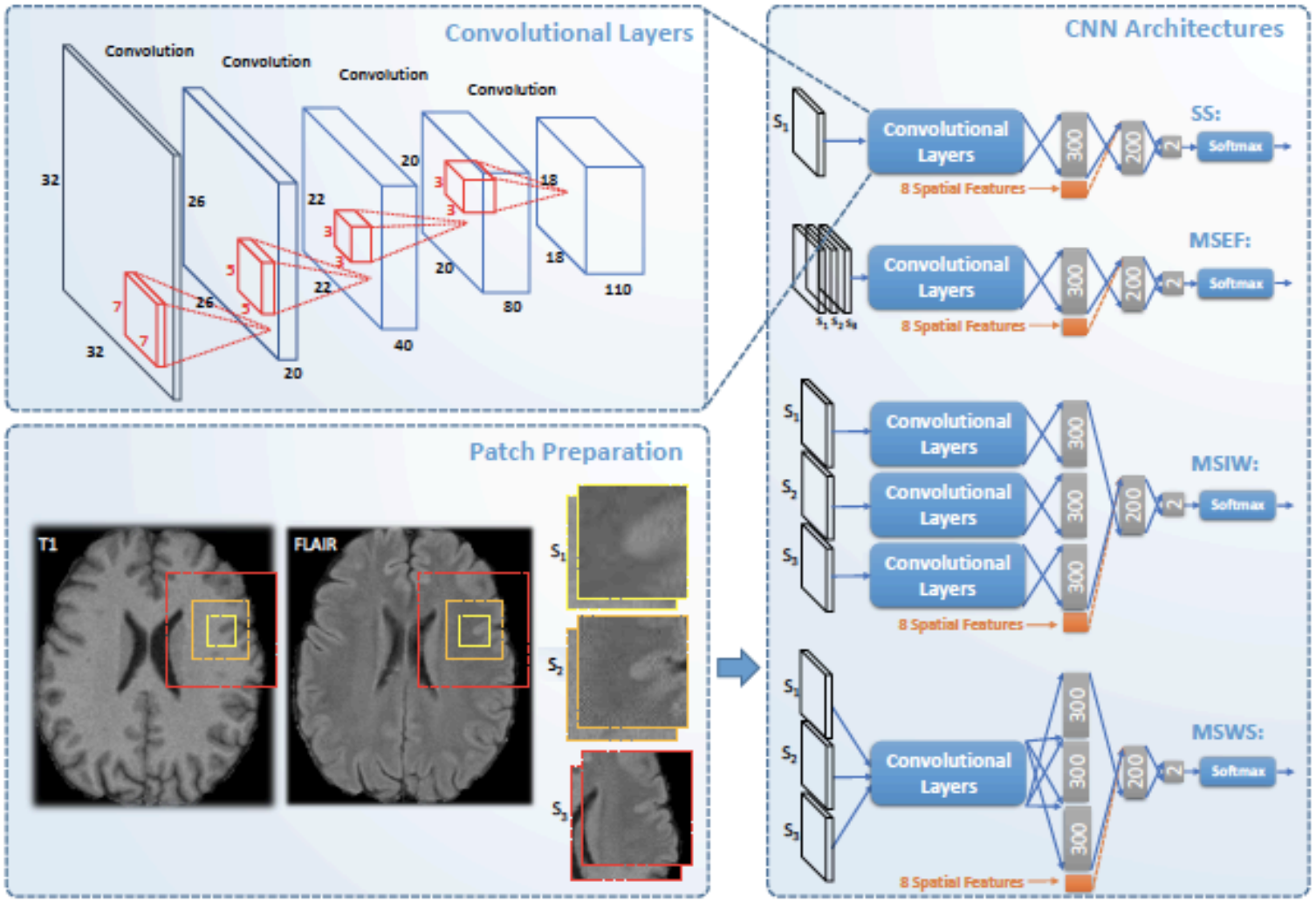

- Multi-modal registration
- Выделение мозга
- Bias field correction
- Intensity normalization

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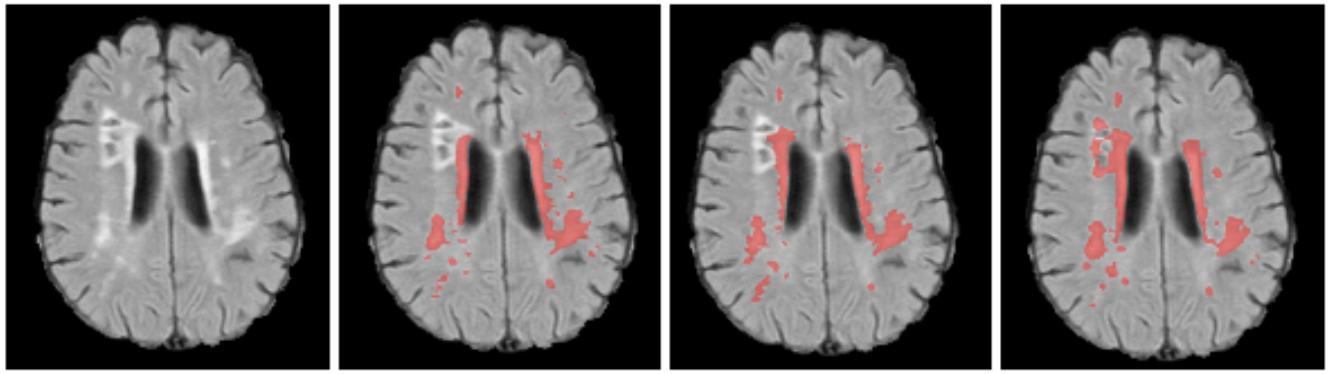

(a) FLAIR images without annotations. (b) Segmentation by human observer 1. (c) Segmentation by human observer 2. (d) Segmentation by MSWS+Loc method.

Figure 7: Gliosis around the lacunes is a prevalent type of false positive segmentation.

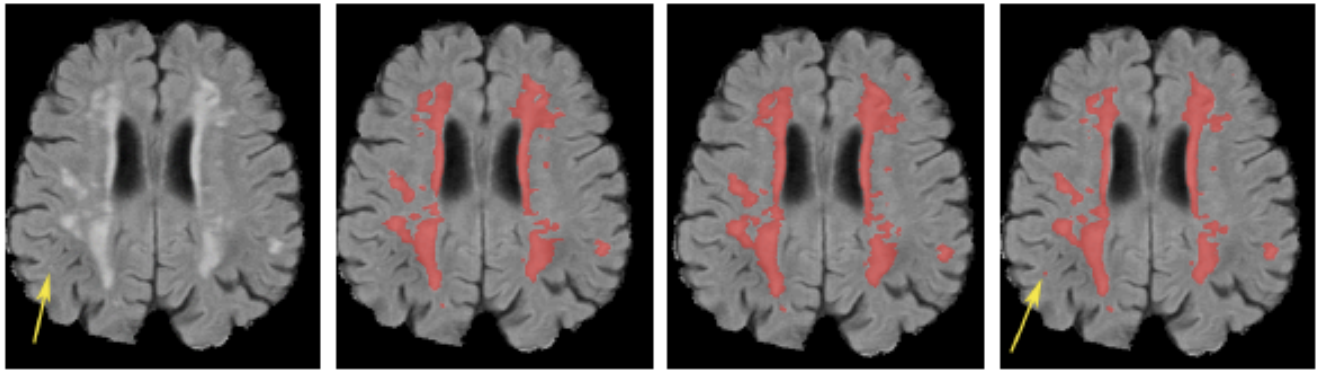

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Figure 8: A sample case with a small lesion missed by the two human observers.

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- Выделение мозга
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State-of-the-art

- MS-SEG Challenge (https://portal.fli-iam.irisa.fr/msseg-challenge/workshop-day)

Results comparison to experts

- Segmentation performance (Dice)
  - "Best" expert: 0.782
  - "Worst" expert: 0.669
  - "Best" pipeline: 0.591
- Detection performance (F1 score)
  - "Best" expert: 0.893
  - "Worst" expert: 0.656
  - "Best" pipeline: 0.490
- All pipelines rank below experts in both categories
  - What about a combination of those?

State-of-the-art

Segmentation ranking: Dice scores

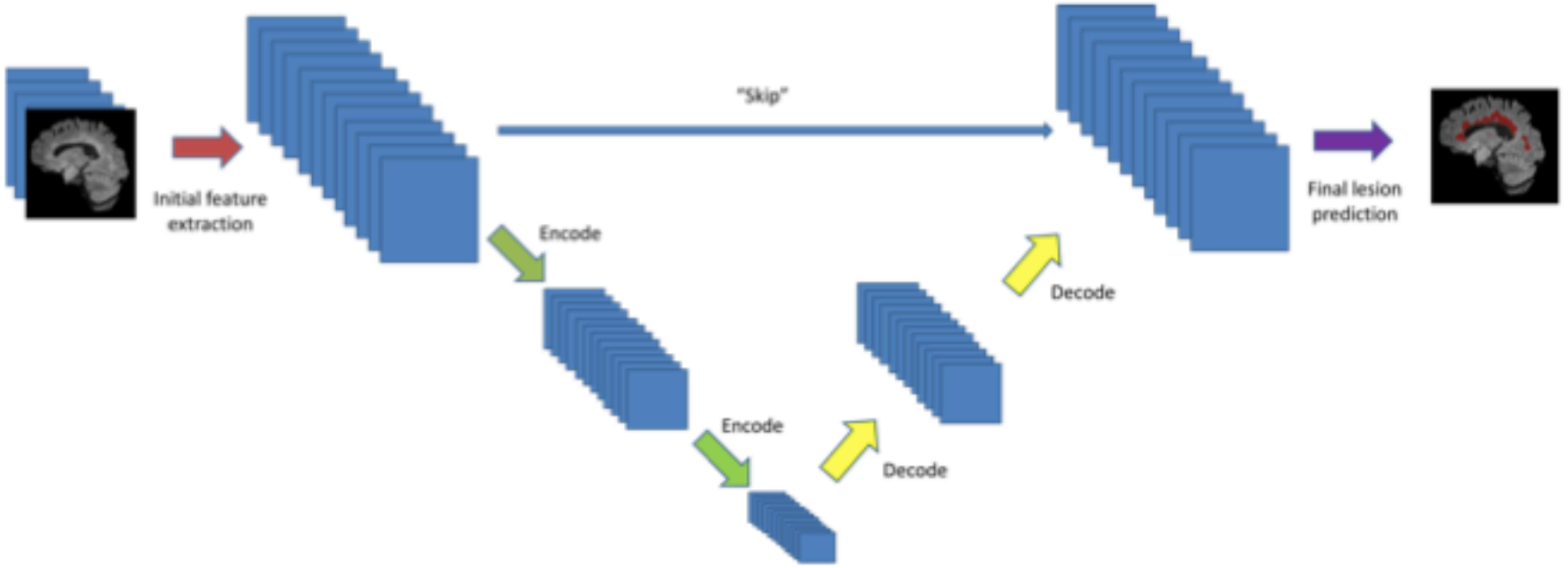
Evaluated method	Average Dice	Average ranking
Team 6	0.591	2.97
Team 8	0.572	4.03
Team 12	0.541	4.38
Team 13	0.521	4.95
Team 4	0.490	6.19

State-of-the-art

6 team

- Использовали FLAIR
- Resample to 1mm isovox
- 3 сетки для 3 проекций (axial, sagittal, coronal)
- На вход патч из 5 соседних слайсов
- Суммирование хитмапов
- Resample to original size
- Сегментация случайным блужданием

Nabla-net



Particulars :

- **Encode/Decode plus skip – combines long- and short-range features**
- **Sparse upscaling using tied unpooling and convolution**
- **Fully convolutional: network predicts lesion map slice by slice**
- **<1s per slice on GPU (GTX 980M)**

State-of-the-art

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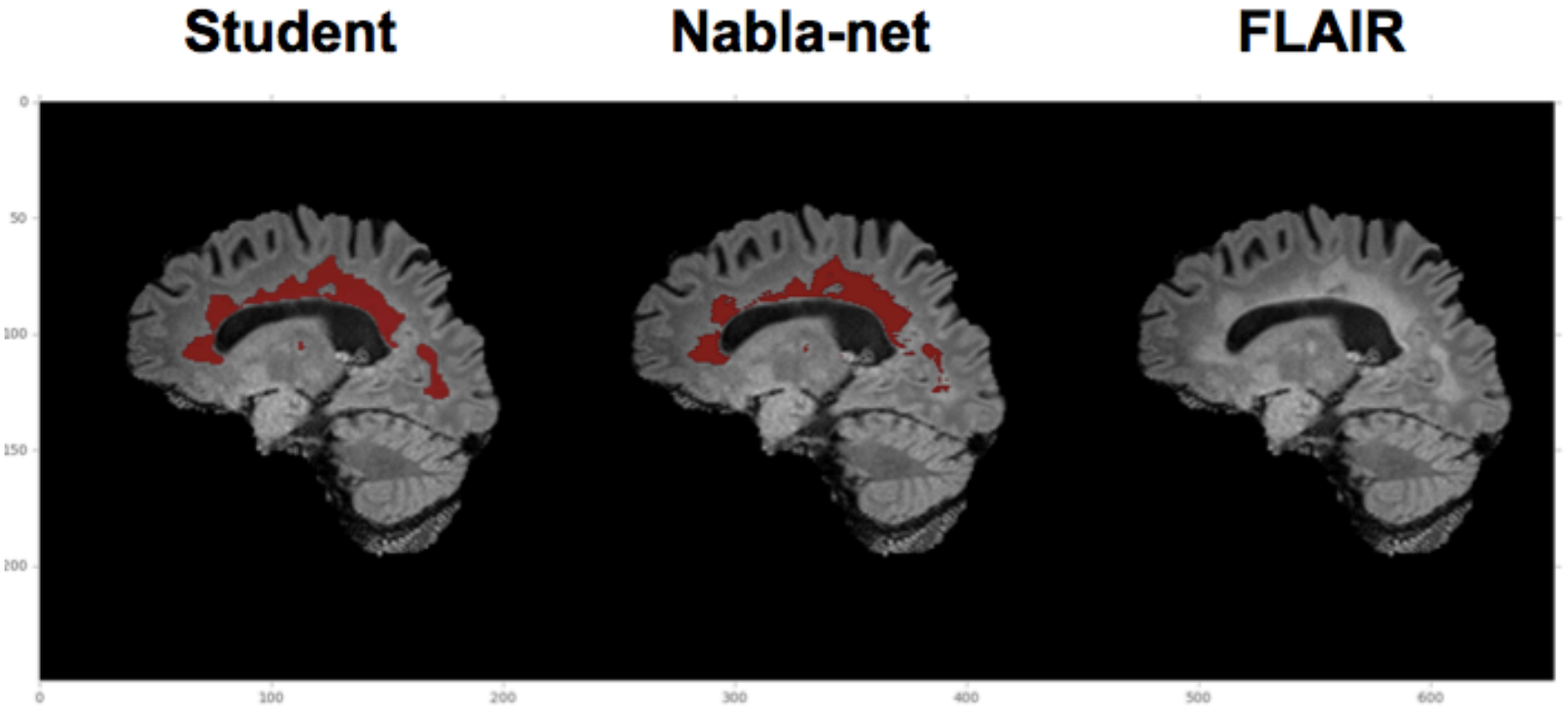
- Resample to 1mm isovox
- 3 сетки для 3 проекций
- На вход патч из 5 соседних слайсов
- Суммирование хитмапов
- Resample to original size
- Сегментация случайным блужданием

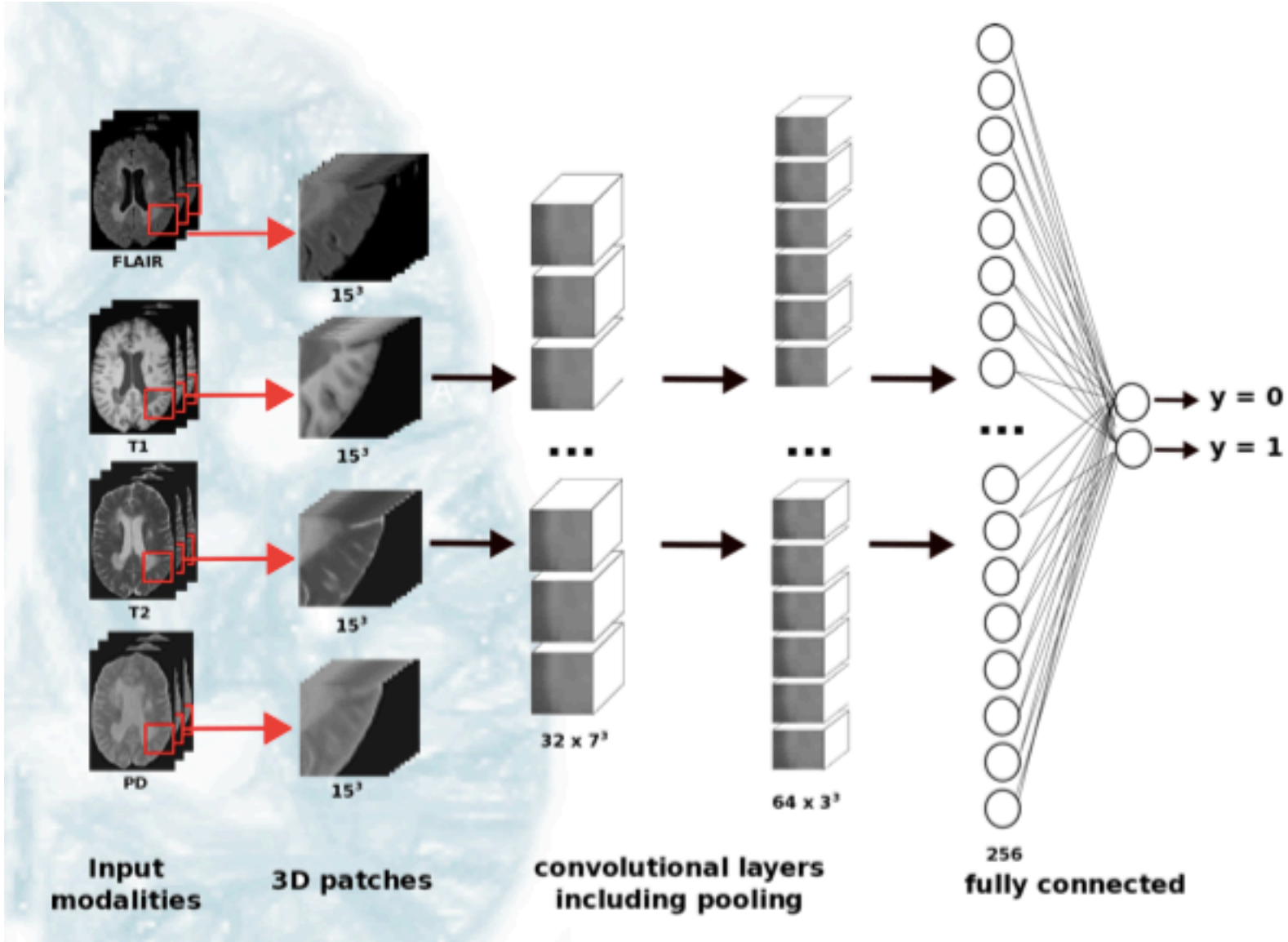
Evaluation on own data

129 cases, segmented axially by a supervised medical student.



State-of-the-art

- 12 team



State-of-the-art

8 team

- 3
- в