

MICCAI 2024
Marrakesh
MOROCCO

**27TH INTERNATIONAL CONFERENCE ON MEDICAL IMAGE COMPUTING
AND COMPUTER ASSISTED INTERVENTION**

6-10 OCTOBER 2024

PALMERAIE ROTANA RESORT

MARRAKESH / MOROCCO

PasteurDBC : Mednext adoption for fetal brain MRI segmentation
Robin CREMESE^{1,2,*}, Keïn SAM², Fleur GAUDFERNAU², Jean-Baptiste MASSON^{1,2}

1-Decision and Bayesian Computation - Épiméthée
Computational Biology & Neuroscience departments

Institut Pasteur - INRIA - CNRS UMR 3571 - Université de Paris

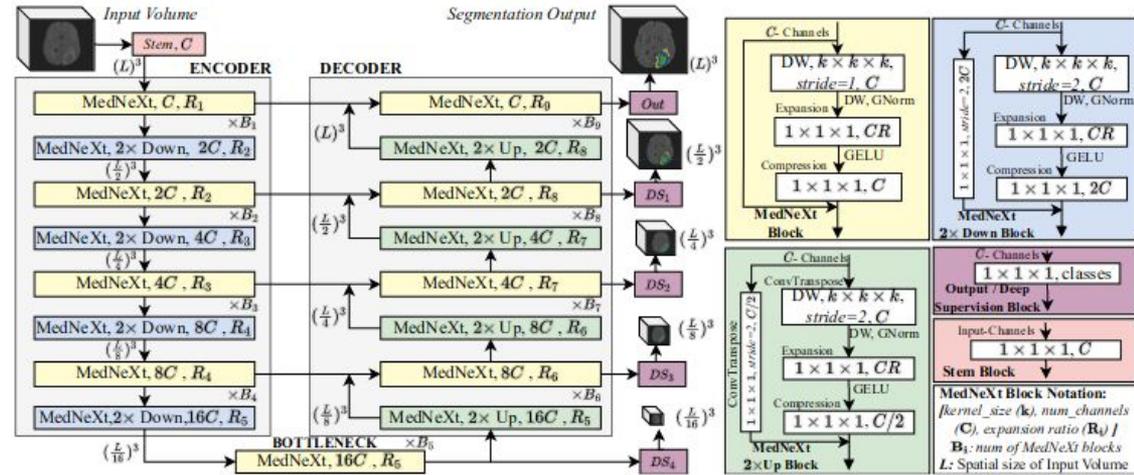
Institut Prairie

2-Université Paris Cité, Paris, France

★ robin.cremese@pasteur.fr

Segmentation task : MedNeXt Model presentation

- Keeps the inductive bias of the convolutional layers
- Compares favorably with SOTA architectures, including transformers, when trained from scratch
- Is *de facto* integrated in the nnUnet segmentation pipeline



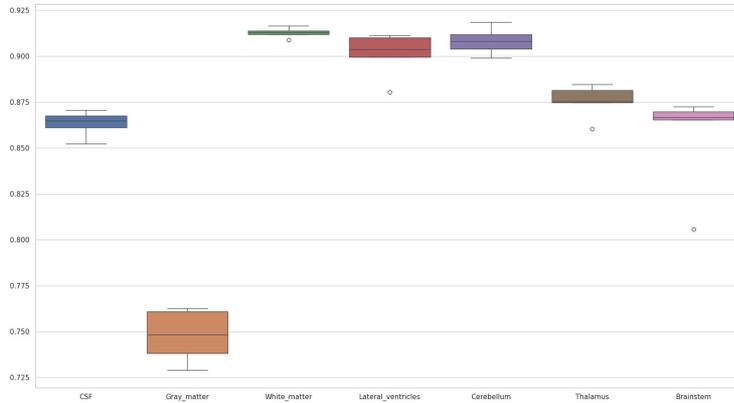
[1] F. Isensee, et al. "nnu-net revisited: A call for rigorous validation in 3d medical image segmentation." *arXiv preprint arXiv:2404.09556* (2024).

[2] S. Roy, et al. "Mednext: transformer-driven scaling of convnets for medical image segmentation." *International Conference on Medical Image Computing and Computer-Assisted Intervention*. Cham: Springer Nature Switzerland, 2023.

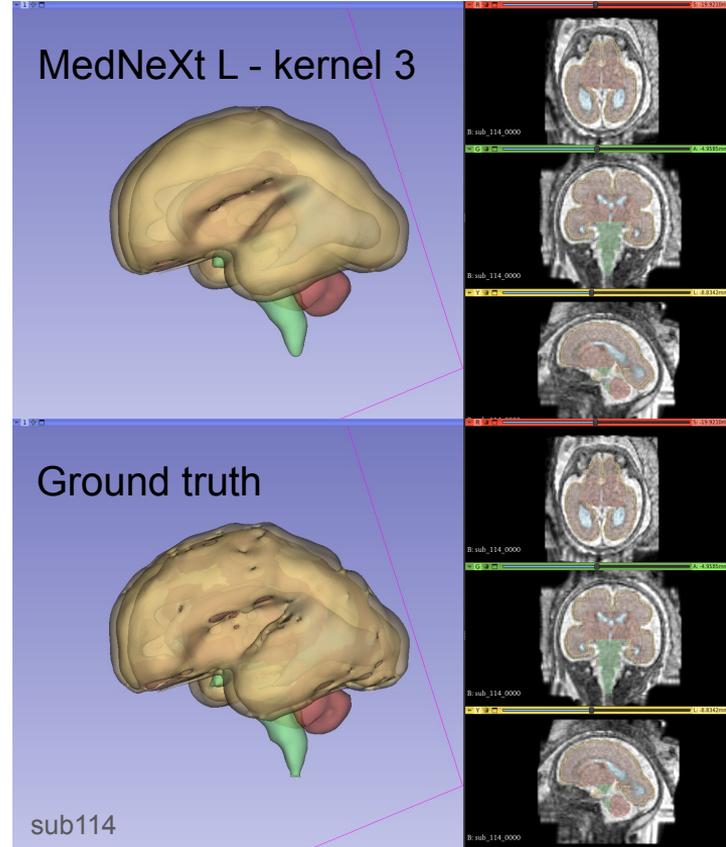
	BTCV	ACDC	LITS	BrATS	KITS	AMOS	VRAM	RT Arch.	unU	
	n=30	n=200	n=131	n=1251	n=489	n=360	[GB]	[h]	[h]	
nnU-Net (org.) [29]	83.08	91.54	80.09	91.24	86.04	88.64	7.70	9	CNN	Yes
nnU-Net ResEnc M	83.31	91.99	80.75	91.26	86.79	88.77	9.10	12	CNN	Yes
nnU-Net ResEnc L	83.35	91.60	81.60	91.13	88.17	89.41	22.70	35	CNN	Yes
nnU-Net ResEnc XL	83.28	91.48	81.19	91.18	88.67	89.68	36.60	66	CNN	Yes
MedNeXt L k3 [32]	84.70	92.85	82.14	91.35	88.25	89.62	17.30	68	CNN	Yes
MedNeXt L k5 [34]	85.04	92.62	82.34	91.50	87.74	89.73	18.00	233	CNN	Yes
STU-Net S [20]	82.92	91.04	78.50	90.55	84.93	88.08	1.20	10	CNN	Yes
STU-Net B [20]	83.05	91.30	79.19	90.85	86.32	88.46	8.80	15	CNN	Yes
STU-Net L [20]	83.36	91.31	80.31	91.26	85.84	89.34	26.50	51	CNN	Yes
SwinUNETR [22]	78.89	91.29	76.50	90.68	81.27	83.81	13.10	15	TF	Yes
SwinUNETRv2 [33]	80.85	92.01	77.85	90.74	84.14	86.24	13.40	15	TF	Yes
nuFormer [31]	80.86	92.40	77.40	90.22	75.85	81.55	5.70	8	TF	Yes
CoTr [35]	81.95	90.56	79.10	90.73	84.59	88.02	8.20	18	TF	Yes
No-Mamba Base	83.69	91.89	80.57	91.26	85.98	89.04	12.0	21	CNN	Yes
U-Mamba Bot [20]	83.51	91.79	80.40	91.26	86.22	89.13	12.40	24	Mamba	Yes
U-Mamba Enc [20]	82.41	91.22	80.27	90.91	86.34	88.38	21.50	47	Mamba	Yes
A3DS S ₂ -R ₂ -Net [10,23]	80.60	90.60	79.28	90.79	81.11	87.27	20.00	22	CNN	No
A3DS DINTS [10,24]	78.18	82.97	69.05	87.75	65.28	82.35	29.20	16	CNN	No
A3DS SwinUNETR [10,25]	76.54	82.68	68.59	89.90	52.82	85.05	34.50	9	TF	No

Segmentation task : Results

- Predicts smoother structures than the expert annotations
- Compares on pare with previous FeTA submissions
- Has been evaluated by radiologist experts on a private dataset : 45 reconstructed foetus MRI (1.5T)



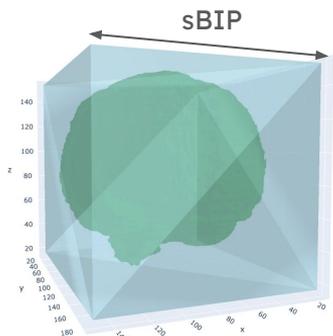
[3] K. Payette, et al. "Multi-Center Fetal Brain Tissue Annotation (FeTA) Challenge 2022 Results." *arXiv preprint arXiv:2402.09463* (2024).



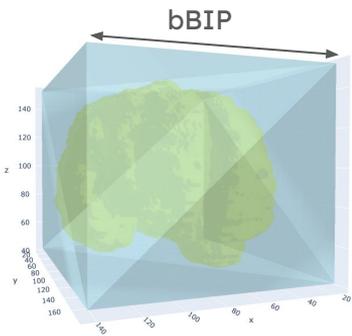
Biometry task : Rule based strategy

- Measures correlate well with segmentations bounding boxes
- Estimation of the rotation matrix would certainly improve the results

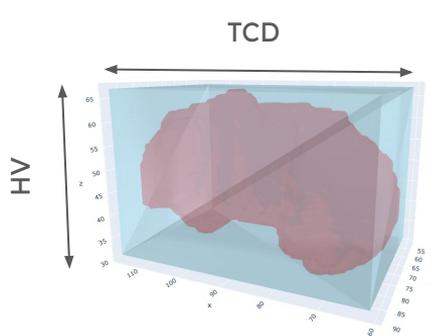
Measure	ME (%)	R2
sBIP	5.703417	0.865769
bBIP	7.969022	0.754252
HV	39.190029	-2.12880
TCD	4.48192	0.94305
LCC	19.55445	-0.73959



Extra axial CSF



Gray matter



Cerebellum

sBIP + bBIP

HV + TCD + LCC

sub012