F Frouin

NeoTex

Prédiction de la réponse à la chimiothérapie néoajuvante avec des données d'IRM mammaire

LITO
Service Radiologie, EH
KUL

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Marie Skłodowska-Curie Grant Agreement No 764458

ENSEMBLE, PRENONS
LE CANCER DE VITESSE

Contexte clinique et défis à résoudre

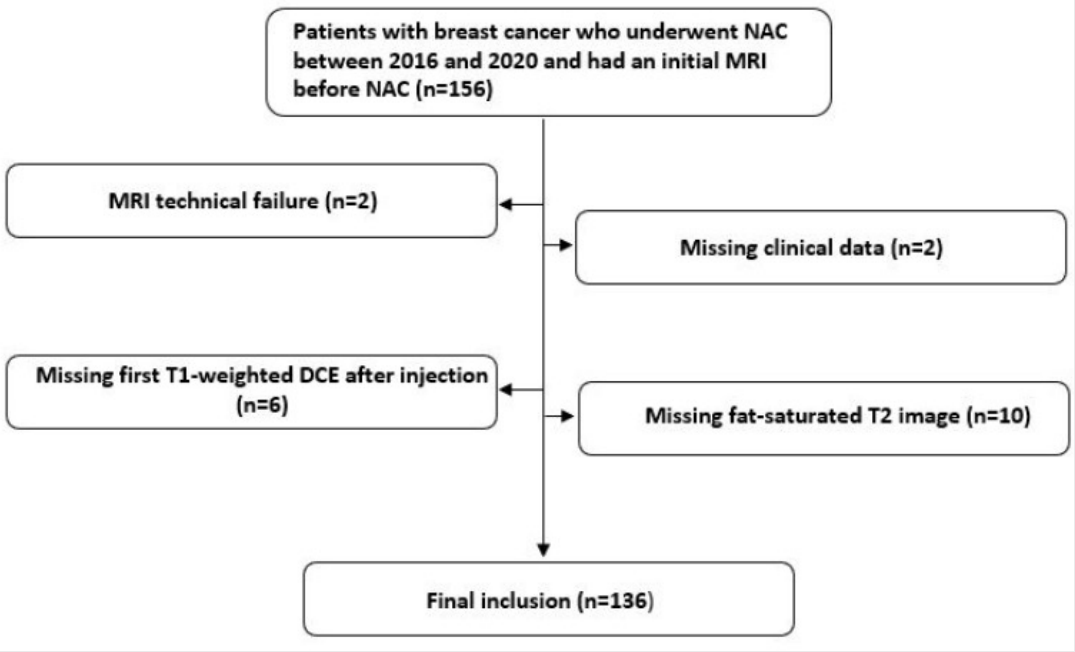
Prédiction pCR/ non pCR à partir IRM réalisée au moment du diagnostic

Données IRM imagerie T1 avant et après contraste (T1 DCE)/ T2 + ADC

1. • Acquisition et constitution BDD -> EH & LITO
2. • Preprocessing & Standardisation IRM -> *Saint Martin et al, MAGMA 2021*
3. • Segmentation -> EH (Manuelle)
4. • Extraction et sélection de caractéristiques radiomiques -> *Saint Martin et al, IEEE EMBC 2022*
5. • Harmonisation -> *Saint Martin et al, IEEE EMBC 2022 + Thèse*
6. • Construction modèles radiomiques -> *Saint Martin et al, IEEE EMBC 2022 + Thèse*
7. • **Test** -> *Saint Martin Thèse*

Constitution BDD projet NeoTex

156 sujets -> 136 sujets
(tous avec segmentation manuelle)



- 103 training (3 settings Curie)
- 33 test (26 hors Curie)

Imaging centers	Manufacturers	Coils	Training	Testing
Institut Curie	GE	8-channel coil	25	3
Institut Curie	Siemens	18-channel coil	19	0
Institut Curie	Siemens	Sentinelle (16-channel) coil	59	4
Other center	Siemens	16-channel coil	0	4
Other center	Siemens	18-channel coil	0	3
Other center	Siemens	Spine 32-channel coil	0	1
Other center	Siemens	18-channel coil	0	1
Other center	Siemens	Breast matrix coil	0	1
Other center	Siemens	16-Channel AI Breast coil	0	1
Other center	Siemens	Breast matrix coil	0	1
Other center	GE	HD Breast coil	0	1
Other center	GE	HD Breast coil	0	4
Other center	GE	HD Breast coil	0	2
Other center	GE	HD Breast coil	0	3
Other center	GE	HD Breast coil	0	2
Other center	GE	HD Breast coil	0	2

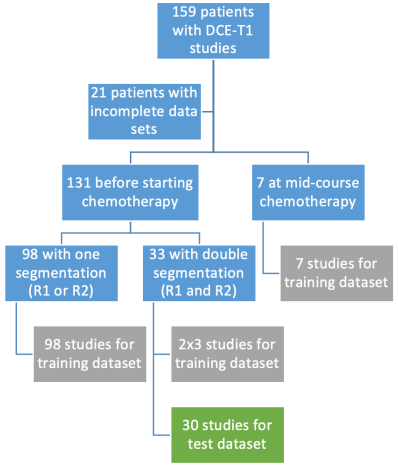
Constitution BDD

European Radiology
https://doi.org/10.1007/s00330-022-09113-7

IMAGING INFORMATICS AND ARTIFICIAL INTELLIGENCE

Check for updates

Visual ensemble selection of deep convolutional neural networks for 3D segmentation of breast tumors on dynamic contrast enhanced MRI



MRI settings	Database	Cases
Institut Curie - GE Healthcare - 8 channel breast coil	Training	13
Institut Curie - Siemens Healthineers - Sentinelle breast coil	Training	50
Institut Curie - Siemens Healthineers - 18 channel breast coil	Training	16
External centers (n = 10) - GE Healthcare - breast coil	Training	21
External centers (n = 6) - Siemens Healthineers - breast coil	Training	11
Total	**Training**	**111**
Institut Curie - GE Healthcare - 8 channel breast coil	Test	13
Institut Curie - Siemens Healthineers - Sentinelle breast coil	Test	13
Institut Curie - Siemens Healthineers - 18 channel breast coil	Test	4
Total	**Test**	**30**

LITO Inserm institut Curie

Constitution BDD

MRI settings	Database	Cases
Institut Curie - GE Healthcare - 8 channel breast coil	Training	13
Institut Curie - Siemens Healthineers - Sentinelle breast coil	Training	50
Institut Curie - Siemens Healthineers - 18 channel breast coil	Training	16
External centers (n = 10) - GE Healthcare - breast coil	Training	21
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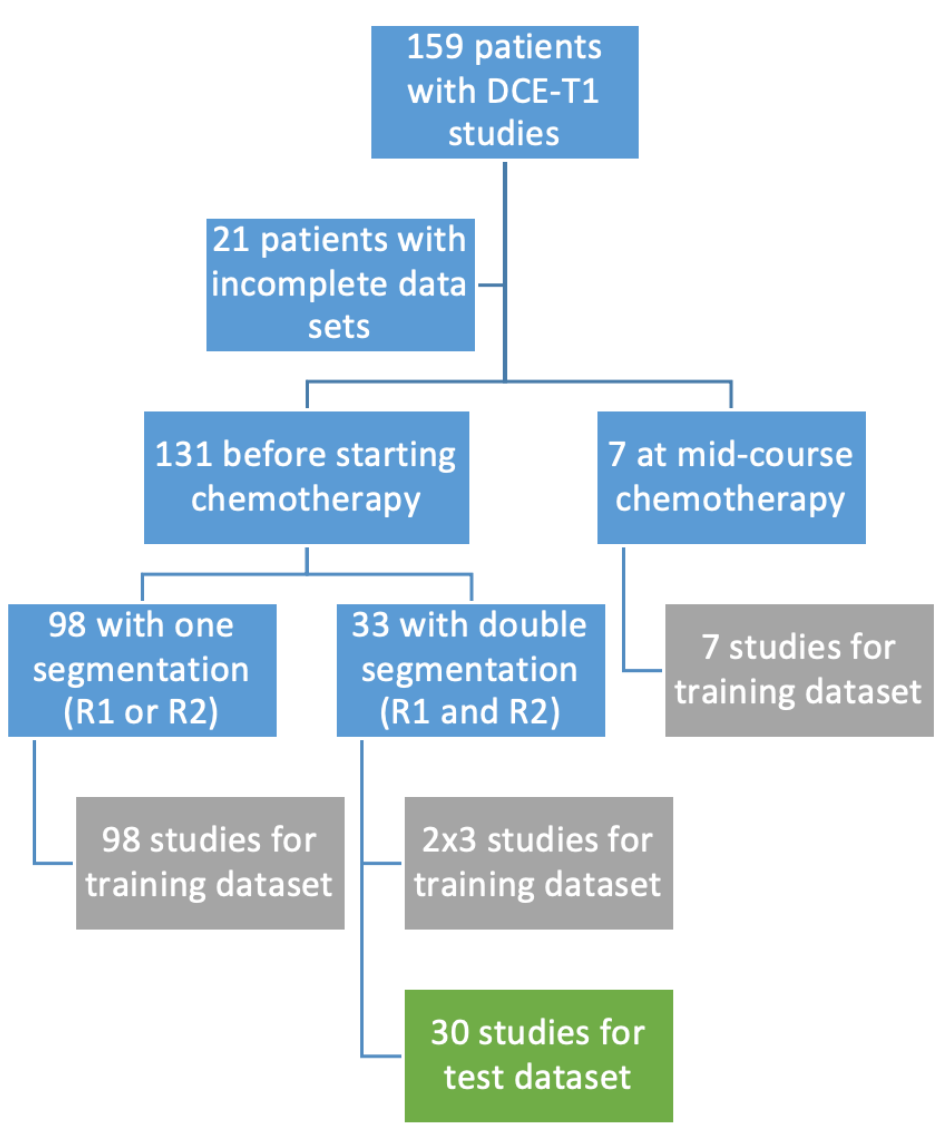
Total	**Training**	**111**
Institut Curie - GE Healthcare - 8 channel breast coil	Test	13
Institut Curie - Siemens Healthineers - Sentinelle breast coil	Test	13
Institut Curie - Siemens Healthineers - 18 channel breast coil	Test	4
Total	**Test**	**30**

- 103 training (3 settings Curie)
- 33 test (26 hors Curie)

- 111 training (Curie et hors Curie)
- 30 test (30 Curie)

LITO Inserm institut Curie

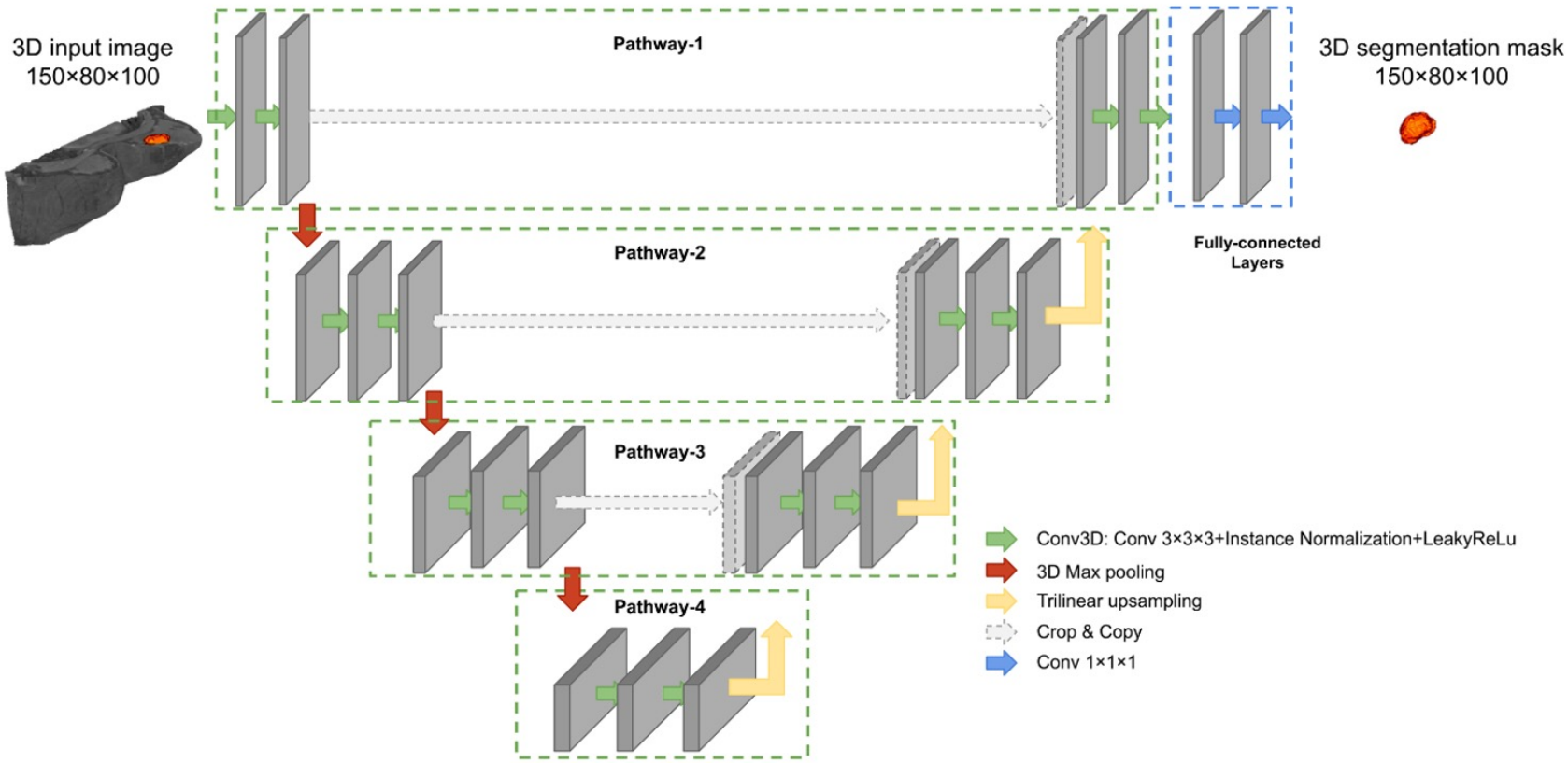
Constitution BDD



- 111 training (Curie et hors Curie)
- 30 test (30 Curie)

Modèle de segmentation

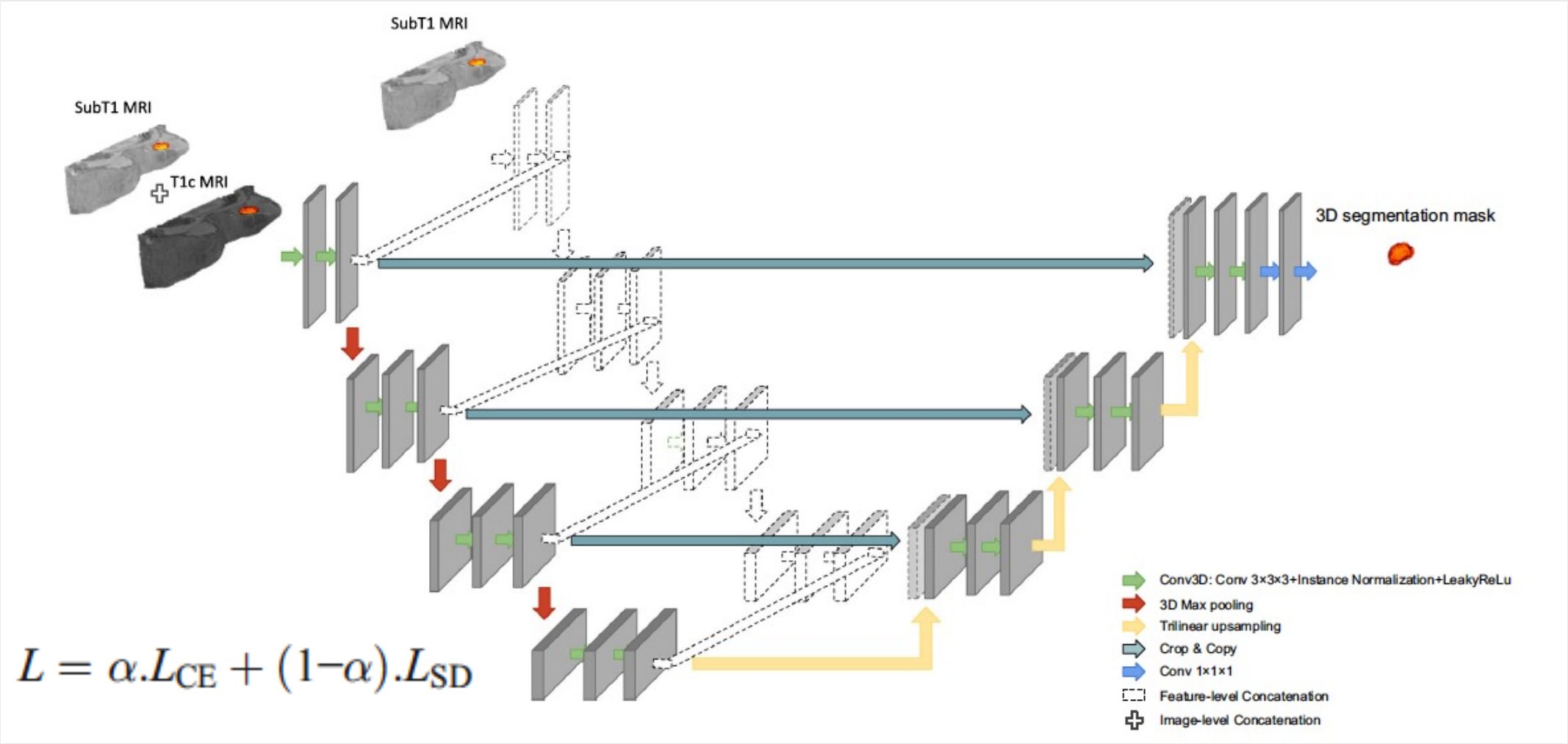
Approche U-Net (1)



Modèle de segmentation

Approches U-Net (2)

Cross-Validation 5 plis - 5 modèles appliqués en test



$$L = \alpha.L_{CE} + (1-\alpha).L_{SD}$$

Evaluation

Critère d'Evaluation ?

Evaluation

Critère d'Evaluation -> Score de Dice (DSC)

	DSC (%)	
Radiologist or model	Radiologist R1	Radiologist R2
Radiologist R2	77.8 ± 10.0	
U-Net (T1c)	72.7 ± 22.8	70.6 ± 20.8
U-Net ILF (T1c + SubT1)	74.9 ± 20.3	71.9 ± 19.7
U-Net FLF (T1c + SubT1)	70.2 ± 26.1	67.3 ± 25.0

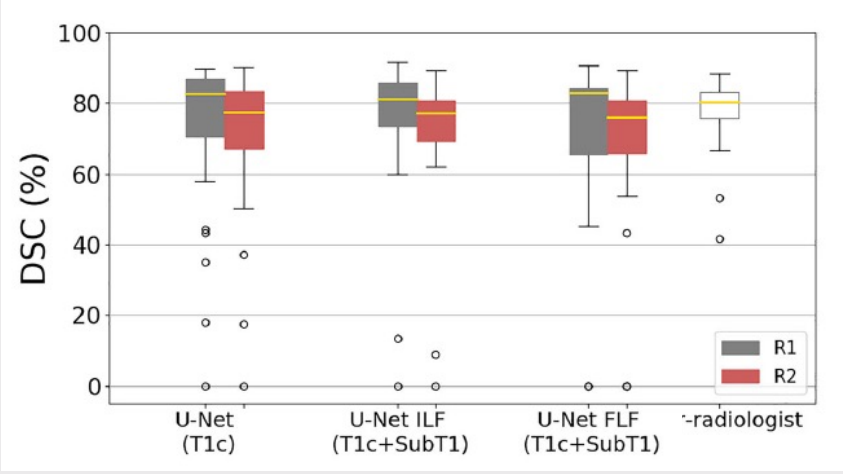
Evaluation

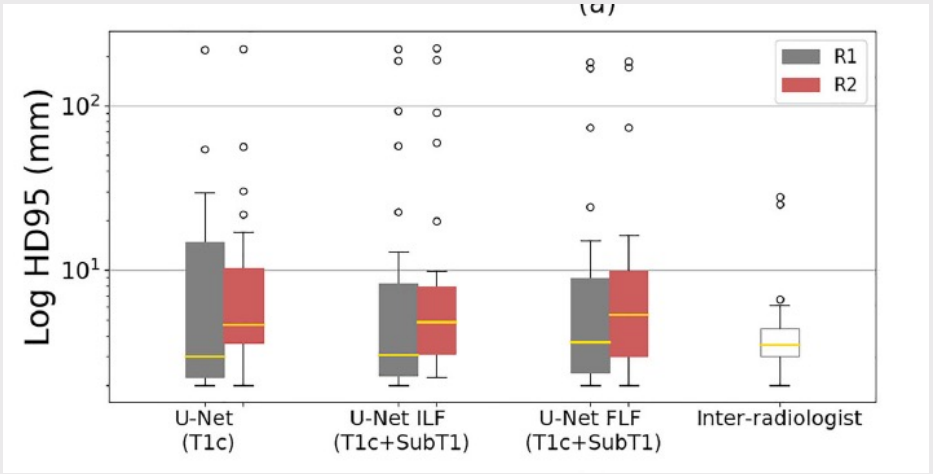
Critère d'Evaluation -> Score de Dice (DSC) et distance Hausdorff

	DSC (%)		HD95 (mm)	
Radiologist or model	Radiologist R1	Radiologist R2	Radiologist R1	Radiologist R2
Radiologist R2	77.8 ± 10.0		5.2 ± 5.9	
U-Net (T1c)	72.7 ± 22.8	70.6 ± 20.8	15.6 ± 40.3	15.9 ± 40.6
U-Net ILF (T1c + SubT1)	74.9 ± 20.3	71.9 ± 19.7	22.9 ± 53.2	23.6 ± 53.6
U-Net FLF (T1c + SubT1)	70.2 ± 26.1	67.3 ± 25.0	19.3 ± 45.1	19.8 ± 45.4

Evaluation

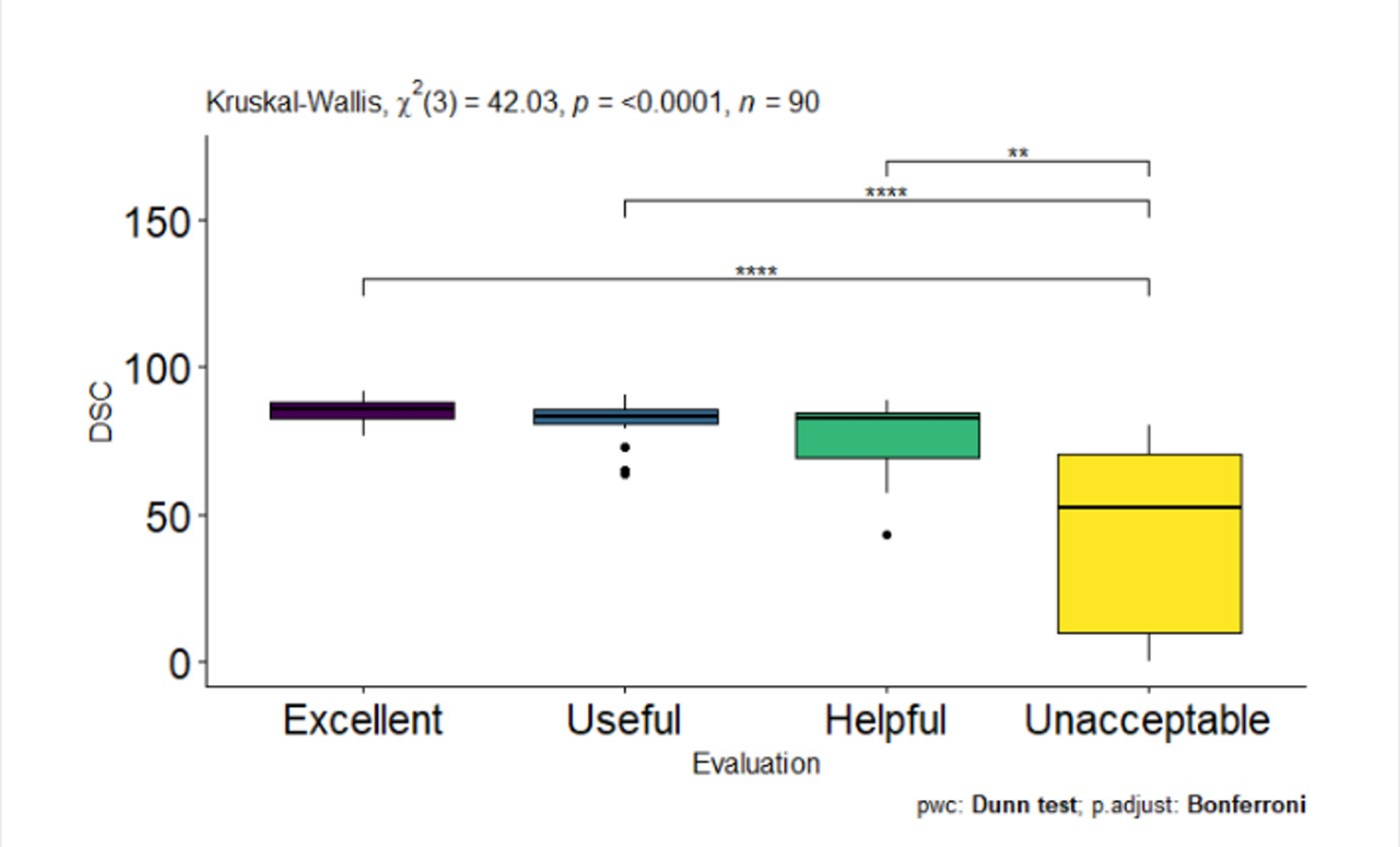
	DSC (%)		HD95 (mm)	
Radiologist or model	Radiologist R1	Radiologist R2	Radiologist R1	Radiologist R2
Radiologist R2	77.8 ± 10.0		5.2 ± 5.9	
U-Net (T1c)	72.7 ± 22.8	70.6 ± 20.8	15.6 ± 40.3	15.9 ± 40.6
U-Net ILF (T1c + SubT1)	74.9 ± 20.3	71.9 ± 19.7	22.9 ± 53.2	23.6 ± 53.6
U-Net FLF (T1c + SubT1)	70.2 ± 26.1	67.3 ± 25.0	19.3 ± 45.1	19.8 ± 45.4





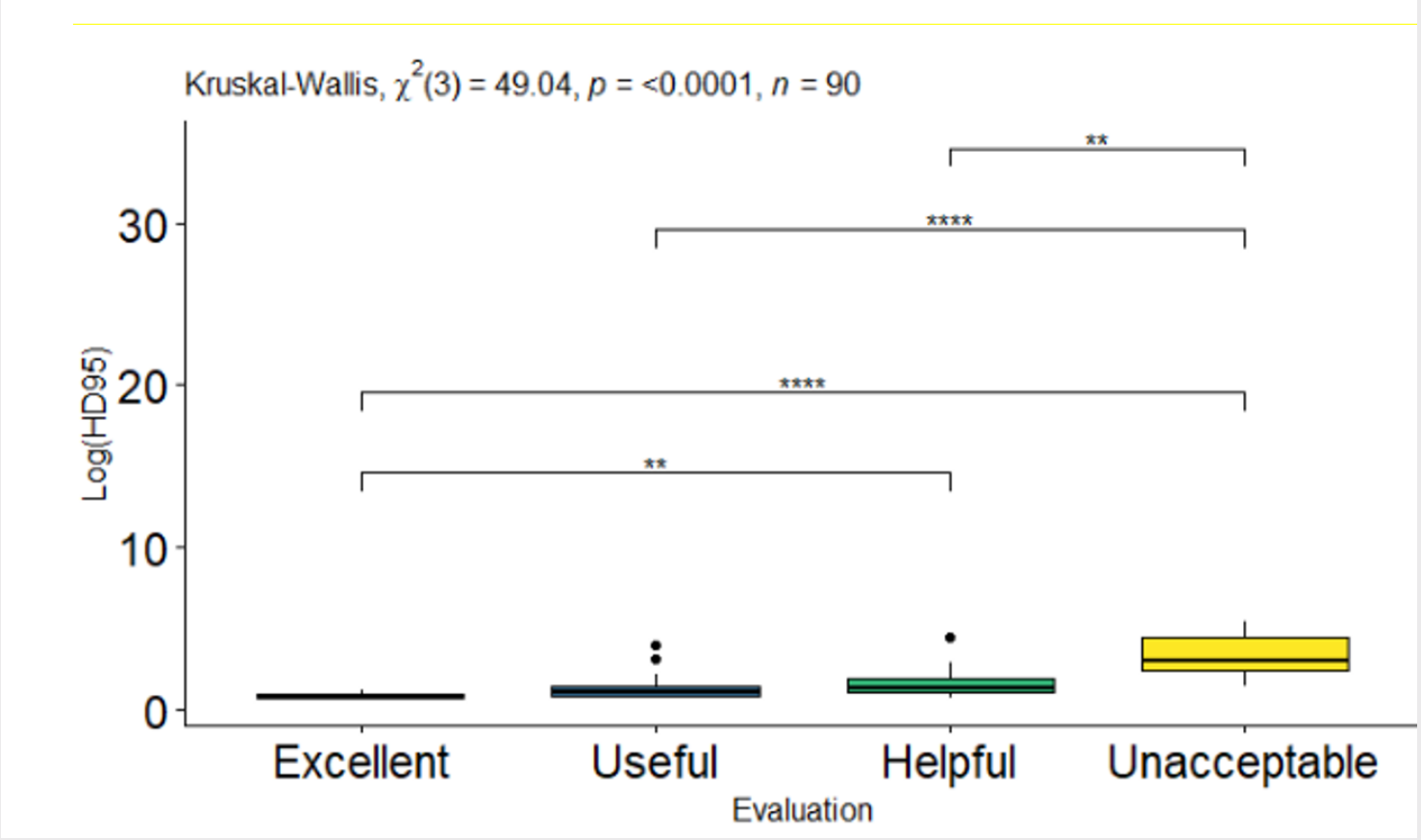
Evaluation

Critère d'Evaluation -> Evaluation visuelle versus Evaluation quantitative



Evaluation

Critère d'Evaluation -> Evaluation visuelle versus Evaluation quantitative



Evaluation

Excellent (4)	33.33%
Useful (3)	20.00%
Helpful (2)	20.00%
Unacceptable (1)	26.67%

Excellent (4)	30.00%
Useful (3)	30.00%
Helpful (2)	23.33%
Unacceptable (1)	16.67%

Excellent (4)	26.67%
Useful (3)	23.33%
Helpful (2)	26.67%
Unacceptable (1)	23.33%

Visual Ensemble Segmentation

Excellent (4)	50.00%
Useful (3)	26.67%
Helpful (2)	16.67%
Unacceptable (1)	6.67%

Evaluation

Visual Ensemble Segmentation

Excellent (4)	50.00%
Useful (3)	26.67%
Helpful (2)	16.67%
Unacceptable (1)	6.67%

	DSC (%)		HD95 (mm)	
Radiologist or model	Radiologist R1	Radiologist R2	Radiologist R1	Radiologist R2
Radiologist R2	77.8 ± 10.0		5.2 ± 5.9	
U-Net (T1c)	72.7 ± 22.8	70.6 ± 20.8	15.6 ± 40.3	15.9 ± 40.6
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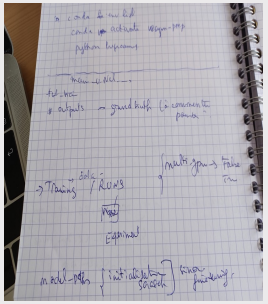
U-Net FLF (T1c + SubT1)	70.2 ± 26.1	67.3 ± 25.0	19.3 ± 45.1	19.8 ± 45.4
Visual ensemble selection	78.1 ± 16.2	76.5 ± 14.5	14.1 ± 40.8	14.1 ± 41.2

En plus de l'article



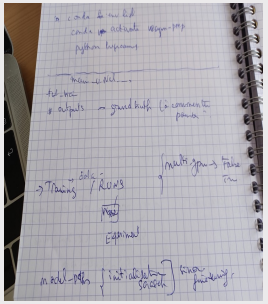
Codes

- Permettant le test des modèles appris à Louvain
- Permettant l'apprentissage sur de nouvelles données

65 **NOUVEAUX SUJETS** -> tous avec segmentation manuelle (Radiol 3)

100 **SUJETS** -> mi-parcours tous avec segmentation manuelle (CM)

En plus de l'article



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Question : Quelles expérimentations envisagez vous ?

Vous avez 5 minutes et carte blanche
(avec les moyens du LITO)