

# Disclaimer

---

If a student turns on their microphone or camera or uses the public chat feature, this constitutes consent for the student's video image or sound audio to be uploaded with the office hour or tutorial on university approved platforms such as D2L. If the student wishes to ensure that their questions/faces/voices are not recorded in the video, they should instead use private chat to ask questions.



# Brain MRI Segmentation with the U-net Model

---

Roberto Souza  
Assistant Professor  
Electrical and Computer Engineering  
Schulich School of Engineering

February 2022



UNIVERSITY OF  
CALGARY



# Brain MRI Dataset

---

Vendor	Scanner	Field	Age	Gender	Datasets
Siemens	Avanto	1.5 T	$53.9 \pm 7.3$	30M/30F	60
	Skyra	3 T	$56.6 \pm 6.9$	30M/30F	60
Philips	Achieva	1.5 T	$52.8 \pm 9.6$	26M/33F	59
	Achieva	3 T	$50.0 \pm 9.3$	30M/30F	60
GE	Signa and Optima*	1.5 T	$53.9 \pm 5.8$	30M/30F	60
	Discovery	3 T	$53.6 \pm 5.7$	30M/30F	60
All	-	1.5 and 3 T	$53.5 \pm 7.8$	176M/183F	359

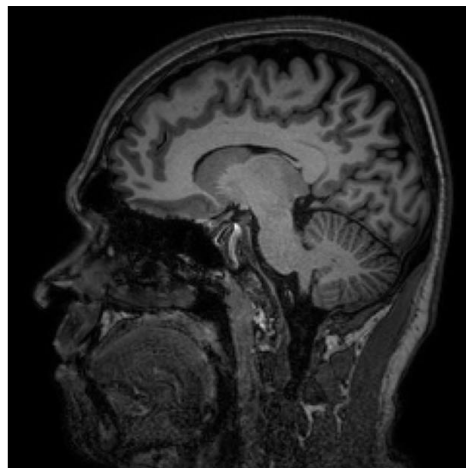
- \*40 datasets collected in the Signa scanner and 20 in the Optima
- [www.ccdataset.com](http://www.ccdataset.com)

# Sample Images

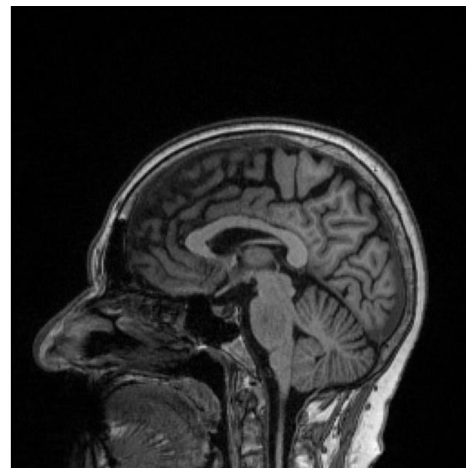
philips\_15



philips\_3



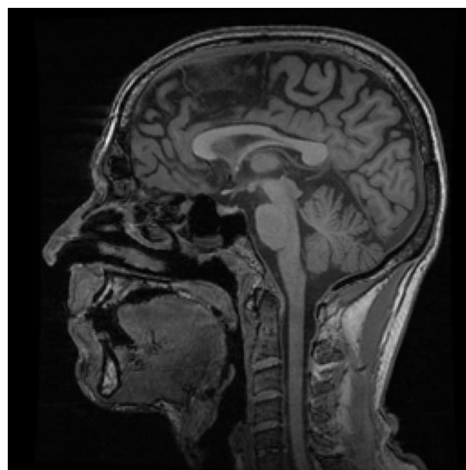
siemens\_15



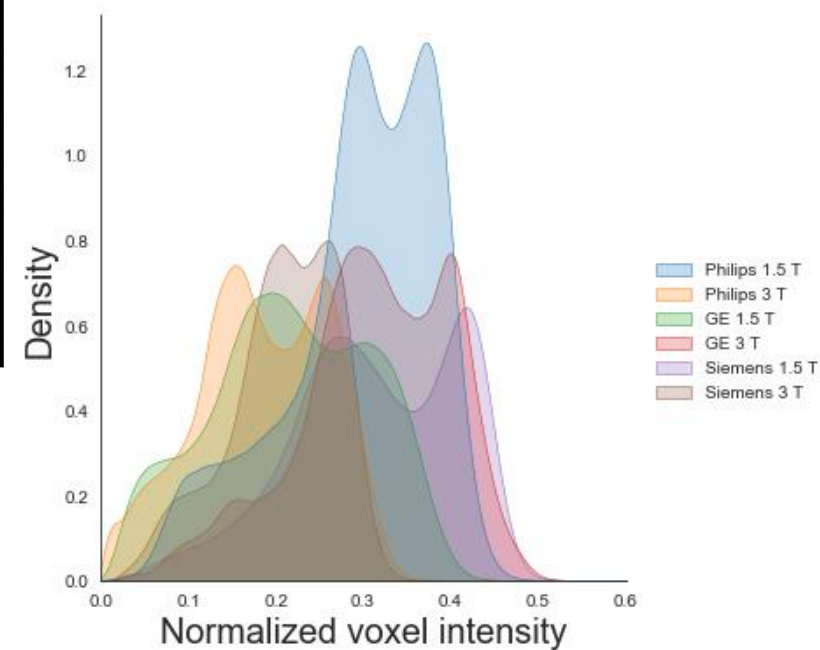
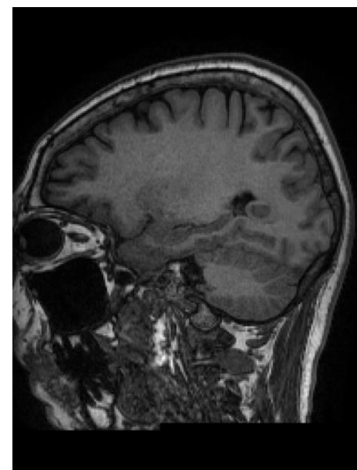
siemens\_3



ge\_3

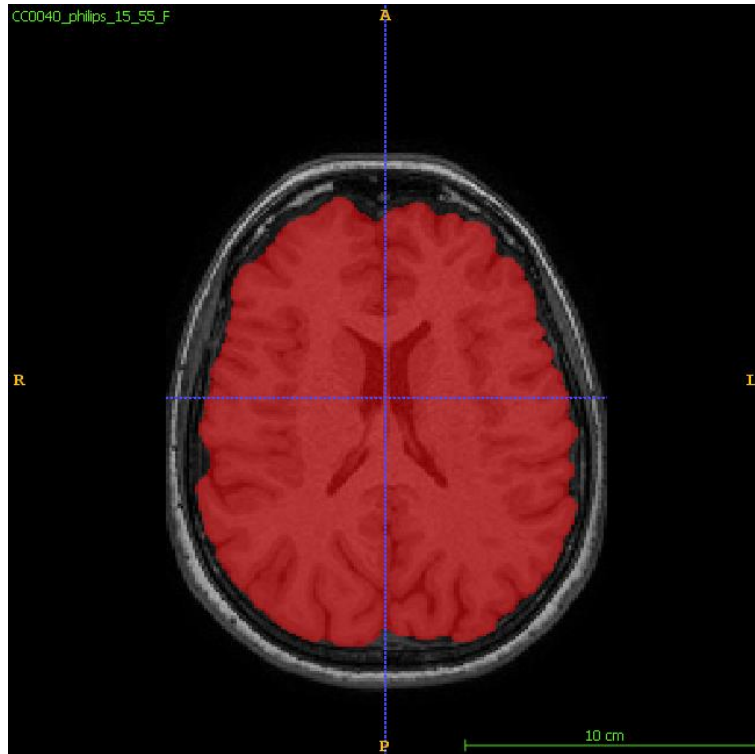


ge\_15

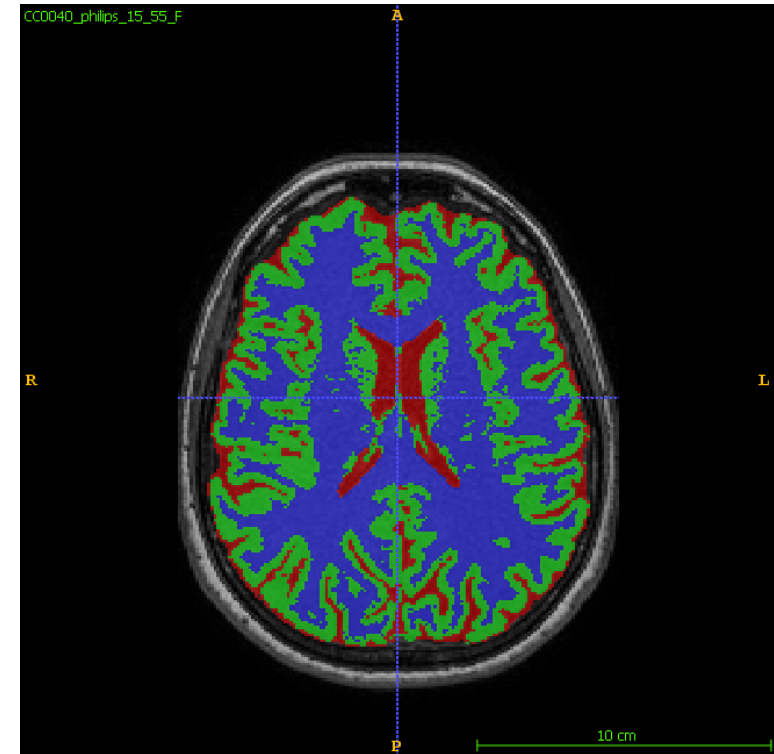


# Brain Extraction and WM, GM, CSF Segmentation

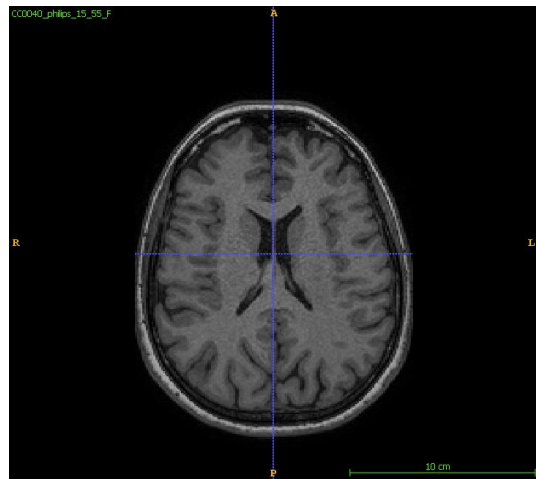
Brain mask



WM, GM, CSF mask



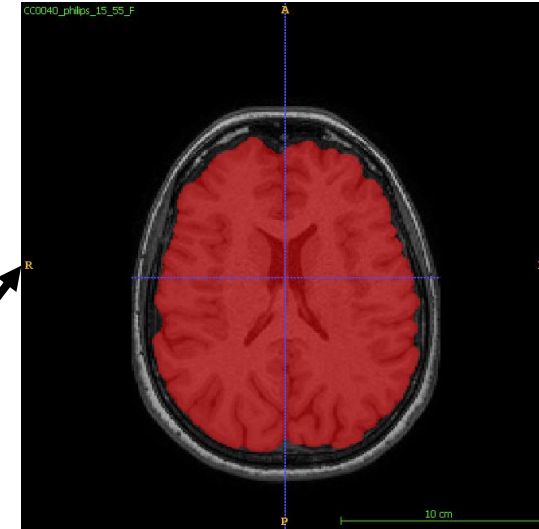
# Segmentation Tasks



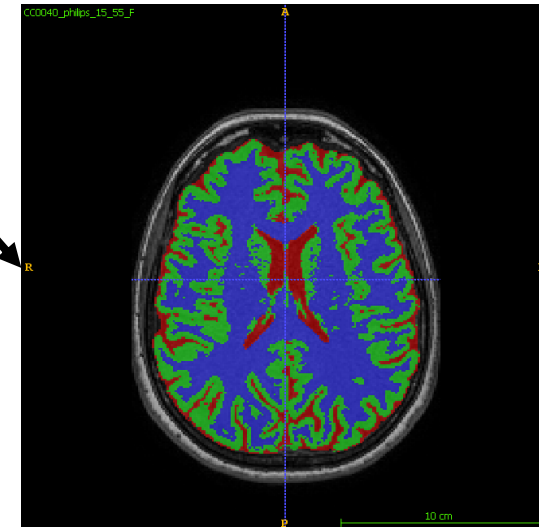
Brain MRI



U-net Model



Brain mask

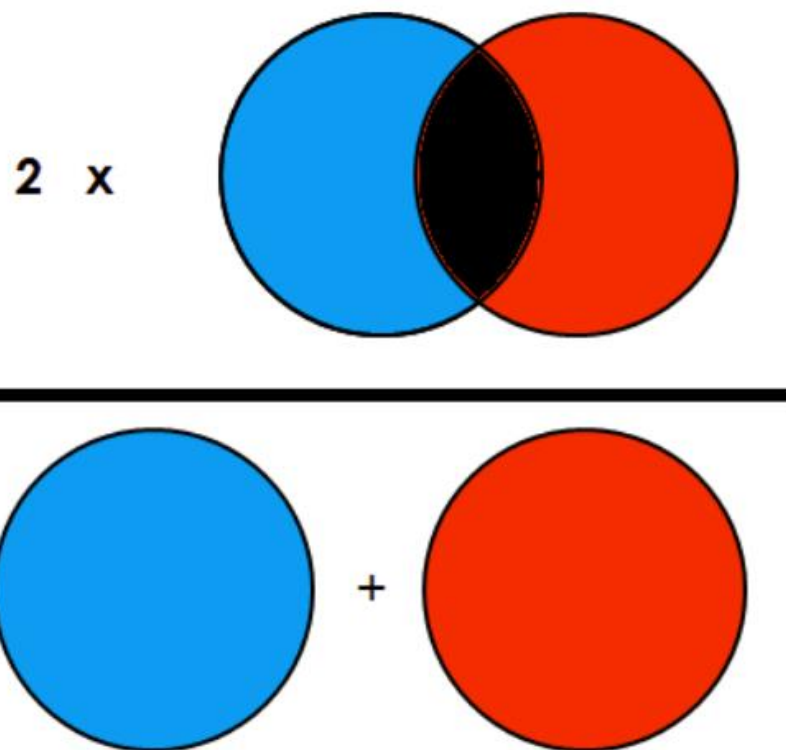


WN, GM, CSF mask

# Segmentation Metric

---

Dice coefficient =



# Experimental Setup

---

- 2D multitask U-Net
  - Brain extraction
  - WM, GM, CSF segmentation
- Train/Validation/Test = 335/12/12 volumes
  - Images are 3D
  - > 100 2D slices per volume
  - We will use the axial plane
- Min-max normalization
  - (Suggestion: add standardization)
- Loss function: Negative Dice coefficient



# Step-by-step Procedure

---

1. EDA (exploratory data analysis)
2. Experimental setup
3. Data Preparation
4. Training the U-net model
5. Testing the trained model and extracting the metrics in the test set

**Let's get to work!**

# Thank you!

---