



# BRATS-METS

## LITERATURE REVIEW

Sep. 24. 2024

The Brain Tumor Segmentation - Metastases (BRATS-METS) Challenge 2023: Brain Metastases Segmentation on Pre-Treatment MRI Background

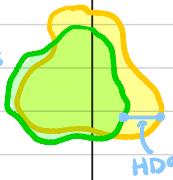
Magnetic Resonance Imaging (MRI):

MRI Sequences:

- T1 : to look at normal anatomy (emphasizes fat)
- T2 : used for pathological conditions (emphasizes fluid)
- Fluid Attenuated Inversion Recovery (FLAIR): A T2-weighted sequence that suppresses cerebrospinal fluid
- T1 Post-Gadolinium (T1PG)

Evaluation Metrics

Dice = 0.85



1) Lesion-Wise Dice Score

- Returns score between 0 and 1 (no overlap - perfect overlap)

2) Hausdorff Distance (HD95):

- Measures how far two sets of points are, indicates the max distance.
- HD95 indicates the 95<sup>th</sup> percentile of distances

Tumor Labels

- Label 3: Gd-Enhancing Tumor (ET) → part of the tumor that "lights up" on certain MRI images (T1Gd) because it absorbs a contrast dye. most obvious part of the tumor
- Label 2: Surrounding non-enhancing FLAIR hyperintensity (SNFH) → stands out brightly on T2-FLAIR. This is the area around the tumor core
- Label 1: Non-enhancing tumor core (NETC) → dead part of the tumor that doesn't absorb contrast dye, surrounded by the brighter active tumor

BRATS Tumor Annotation

- Whole tumor (WT) = Label 1 + Label 2 + Label 3
- Tumor Core (TC) = Label 1 + Label 3
- Enhancing tumor = Label 3

# Deep Learning-Based Detection Algorithm for Brain Metastases on Black Blood Imaging

Questions ??

→ 3D Magnetization-Prepared Rapid Gradient Echo (MPRAGE)

→ Single slab 3D turbo spin echo BB images with slab ??

BB → more sensitive to detecting (T1MPRAGE)

MPRAGE → post contrast (dual)



Update:

- analyze dataset and observing the diff.  
MRI sequences in the data

UV Net

3D mesh

ITK Snap  
Toolbox

## Questions for Naqui

### Newer symbolic approach

- general shape or size
- when you get a scan what do you look for
- any sort of rules
- template matching
- if you want to draw tumour by hand

any shape or size

very variable

contrast difference

blood  
water  
brain tissue  
CSF fluid  
bone  
soft tissue

} variable contrast  
range for each

: texture (not sure if shown on MRI)

- blood vessels are enhanced with contrast & could be misinterpreted but they are more tubular
- infection can be mistaken for something
- stroke

do we have negative classes

Meeting w Bardia  
Ator. 2

### Preprocessing

- add contrast (simple) → edge detection
- template matching

HOMOGRAPHY → 3D prediction  
(final visualization)

### Model:

- Start with UV net
- consider generic CNN

### MILESTONES

#### a) Preprocessing

- 0: Lit. Review.
- 1: contrast preprocessing  
template matching
- 2: reducing search area
- 3: choosing slices, voting algorithm  
if two slices vote for tumour, go back to last
- 4: put all together

from a paper POV, we can discuss all of the above.