

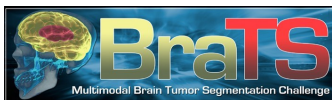
## ▼ Problem definition

### Segmentation of gliomas in pre-operative MRI scans.

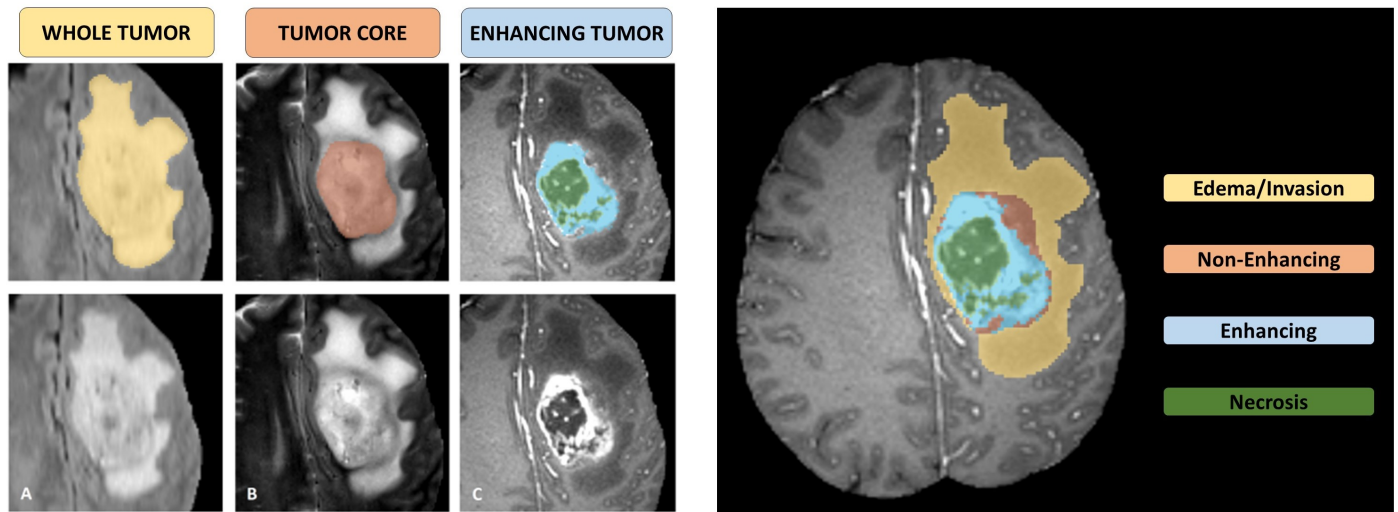
*Each pixel on image must be labeled:*

- Pixel is part of a tumor area (1 or 2 or 3) -> can be one of multiple classes / sub-regions
- Anything else -> pixel is not on a tumor region (0)

The sub-regions of tumor considered for evaluation are: 1) the "enhancing tumor" (ET), 2) the "tumor core" (TC), and 3) the "whole tumor" (WT). The provided segmentation labels have values of 1 for NCR & NET, 2 for ED, 4 for ET, and 0 for everything else.



## BraTS Annotations & Structures



## ▼ Setup env

```
import os
import cv2
import glob
import PIL
import shutil
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from skimage import data
from skimage.util import montage
```

```

import skimage.transform as skTrans
from skimage.transform import rotate
from skimage.transform import resize
from PIL import Image, ImageOps

# neural imaging
!pip install nilearn
import nilearn as nl
import nibabel as nib
import nilearn.plotting as nlplt
!pip install git+https://github.com/miykael/gif_your_nifti # nifti to gif
!pip install gif_your_nifti
import gif_your_nifti.core as gif2nif

# ml libs
import keras
import keras.backend as K
from keras.callbacks import CSVLogger
import tensorflow as tf
from tensorflow.keras.utils import plot_model
from sklearn.preprocessing import MinMaxScaler
from sklearn.model_selection import train_test_split
from sklearn.metrics import classification_report
from tensorflow.keras.models import *
from tensorflow.keras.layers import *
from tensorflow.keras.optimizers import *
from tensorflow.keras.callbacks import ModelCheckpoint, ReduceLROnPlateau, EarlyStopping, TensorBoard
from tensorflow.keras.layers.experimental import preprocessing

# Make numpy printouts easier to read.
np.set_printoptions(precision=3, suppress=True)

```

```

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Requirement already satisfied: nilearn in /usr/local/lib/python3.10/dist-packages (0.10.1)
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  Cloning https://github.com/miykael/gif\_your\_nifti to /tmp/pip-req-build-6jgxmwf6
  Running command git clone --filter=blob:none --quiet https://github.com/miykael/gif\_your\_nifti
  Resolved https://github.com/miykael/gif\_your\_nifti to commit bcf9c0a2f4a755792548085b1
  Preparing metadata (setup.py) ... done
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```

```

# DEFINE seg-areas
SEGMENT_CLASSES = {
    0 : 'NOT tumor',
    1 : 'NECROTIC/CORE', # or NON-ENHANCING tumor CORE
    2 : 'EDEMA',
    3 : 'ENHANCING' # original 4 -> converted into 3 later
}

# there are 155 slices per volume
# to start at 5 and use 145 slices means we will skip the first 5 and last 5
VOLUME_SLICES = 100
VOLUME_START_AT = 22 # first slice of volume that we will include

```

## ▼ Image data descriptions

All BraTS multimodal scans are available as NIfTI files (.nii.gz) -> commonly used medical imaging format to store brain imaging data obtained using MRI and describe different MRI settings

1. **T1**: T1-weighted, native image, sagittal or axial 2D acquisitions, with 1–6 mm slice thickness.
2. **T1c**: T1-weighted, contrast-enhanced (Gadolinium) image, with 3D acquisition and 1 mm isotropic voxel size for most patients.
3. **T2**: T2-weighted image, axial 2D acquisition, with 2–6 mm slice thickness.
4. **FLAIR**: T2-weighted FLAIR image, axial, coronal, or sagittal 2D acquisitions, 2–6 mm slice thickness.

Data were acquired with different clinical protocols and various scanners from multiple (n=19) institutions.

All the imaging datasets have been segmented manually, by one to four raters, following the same annotation protocol, and their annotations were approved by experienced neuro-radiologists. Annotations comprise the GD-enhancing tumor (ET – label 4), the peritumoral edema (ED – label 2), and the necrotic and non-enhancing tumor core (NCR/NET – label 1), as described both in the BraTS 2012-2013 TMI paper and in the latest BraTS summarizing paper. The provided data are distributed after their pre-processing, i.e., co-registered to the same anatomical template, interpolated to the same resolution (1 mm<sup>3</sup>) and skull-stripped.

```
!pip install -q kaggle
from google.colab import files
files.upload()
! mkdir ~/.kaggle
! cp kaggle.json ~/.kaggle/
! chmod 600 ~/.kaggle/kaggle.json
! kaggle datasets download -d awsaf49/brats20-dataset-training-validation
! mkdir brats20-dataset-training-validation
! unzip brats20-dataset-training-validation.zip -d brats20-dataset-training-validation
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