Segmentation labels & Radiomic features for pre-operative scans of the TCGA-GBM and TCGA-LGG collections

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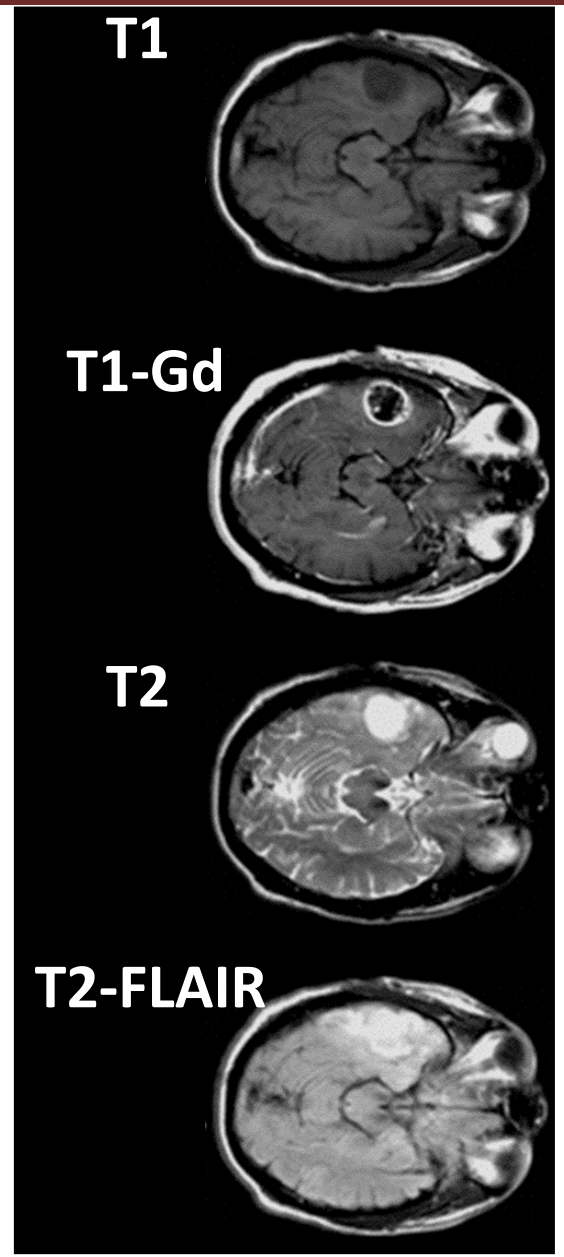
Overview

- Use of TCIA publicly accessible repository of tumor MRI scans
- Segmentation labels of tumor compartments
- Radiomic features based on accurate segmentation labels
- Allowing for direct utilization of TCIA/TCGA data

The Cancer Imaging Archive (TCIA)



NIH/NCI/CIP supported publicly accessible repository

Large collections of

- Multi-institutional routine clinically-acquired scans of cancer patients.
- Corresponding comprehensive collection of molecularly characterized tumors (TCGA).

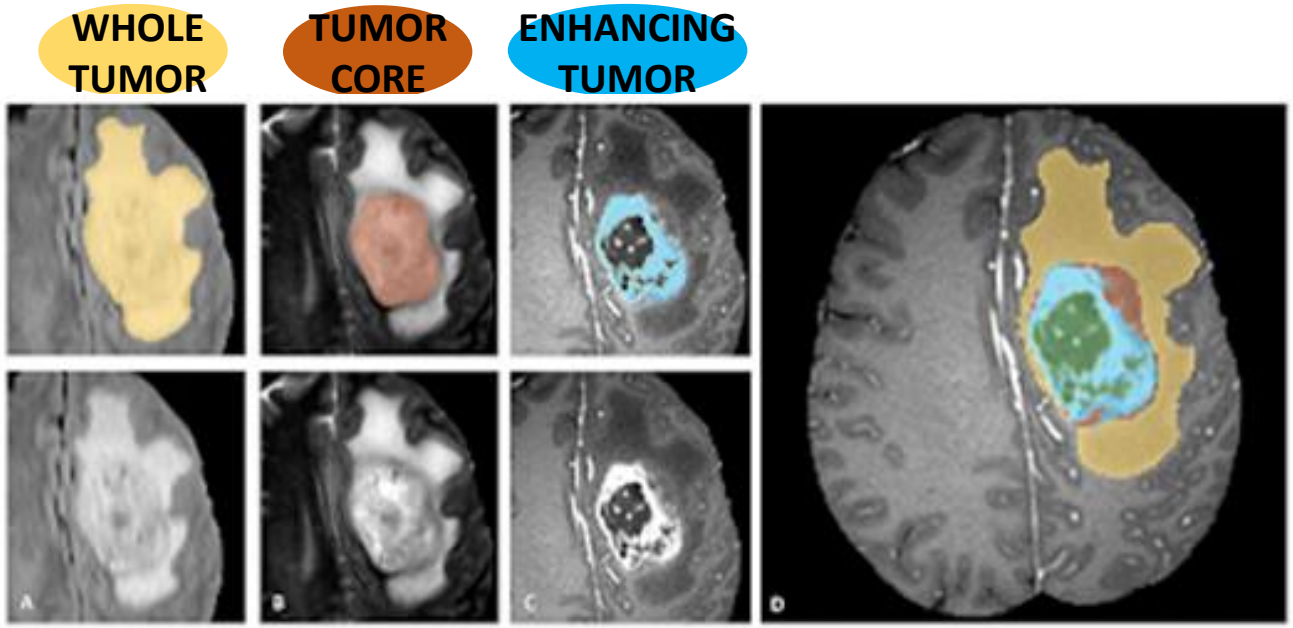
COLLECTION	MULTIMODAL SCANS	PRE-OPERATIVE with at least T1, T1-Gd, T2, T2-FLAIR
TCGA-GBM	262	135
TCGA-LGG	199	108

Lacks segmentation labels of tumor compartments

- Essential for clinical & computational studies.
- Enabling radiogenomic analyses.

Multimodal Brain Tumor Segmentation

GLISTRboost: Combining Biophysical Tumor Growth Modeling with Machine Learning for Glioma Segmentation



- Highly competitive challenge (in conjunction with MICCAI)

- Evaluating segmentations of pre-operative multimodal glioma scans

- Including academic & industrial participants, e.g. Microsoft Research, Sony Electronics

- Our method ranked 1st! - [Bakas et al., “GLISTRboost”, Springer LNCS 2016]

Segmentation Labels (Our Contribution)

- We identified all the **pre-operative scans** of TCIA GBM & LGG.
  (Expert board-certified neuroradiologist (Dr.Michel Bilello) with 14 years of experience working with gliomas)

- Initial segmentations, based on our method.
  [Bakas et al., "GLISTRboost", Springer LNCS 2016]

- **Rules** for manually correcting segmentations set **by expert board-certified neuroradiologist.**
  (Dr.Michel Bilello)

- **Manual segmentation labels** were iteratively re-evaluated, until satisfactory segmented.
  (Done by 2 imaging scientists & 1 medical doctor working in medical image analysis for 10-12 years)

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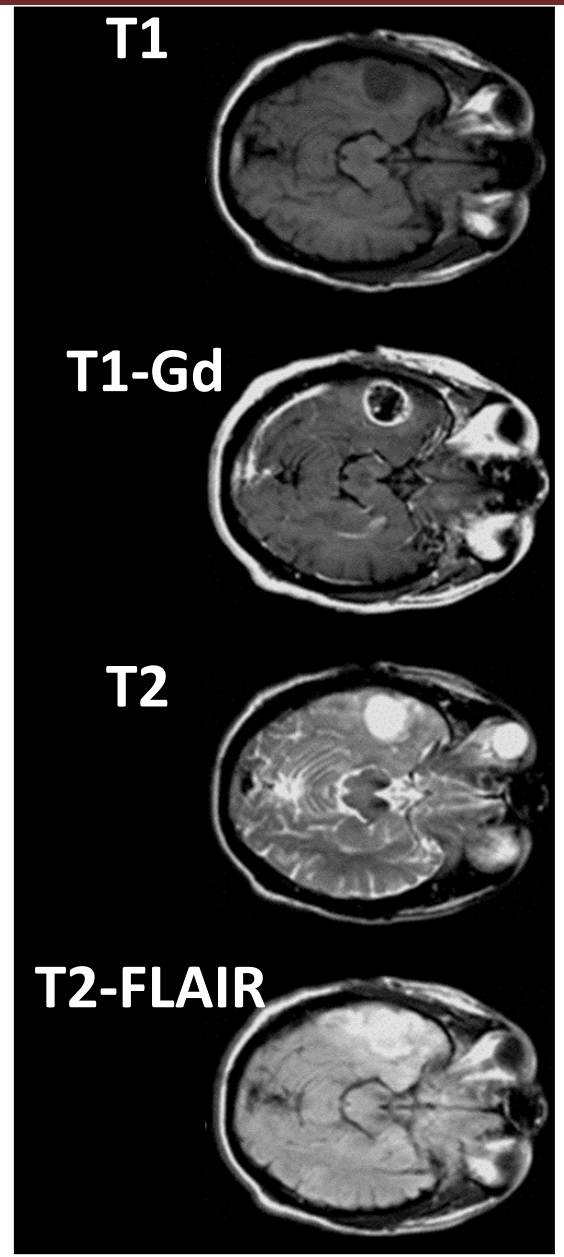
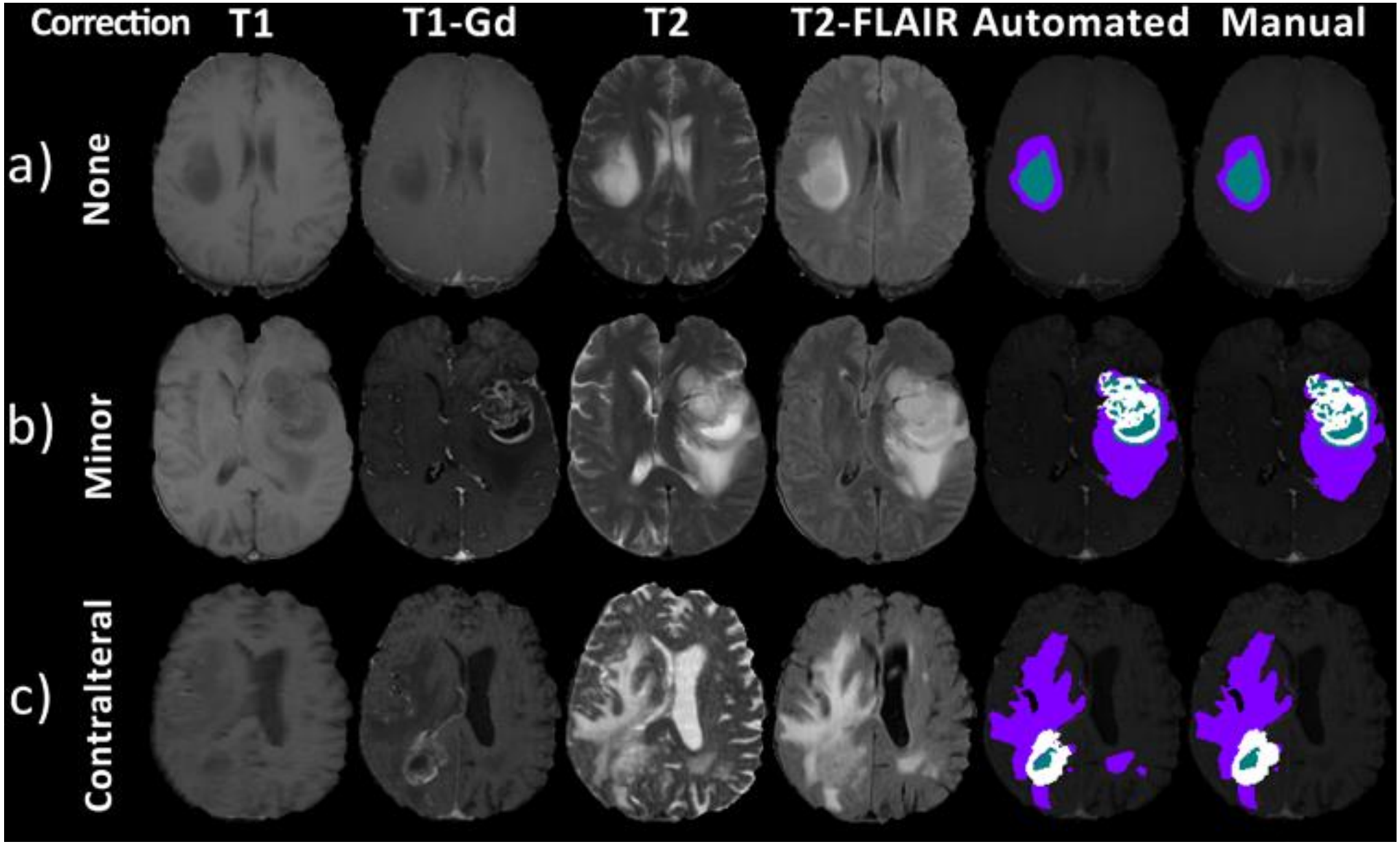
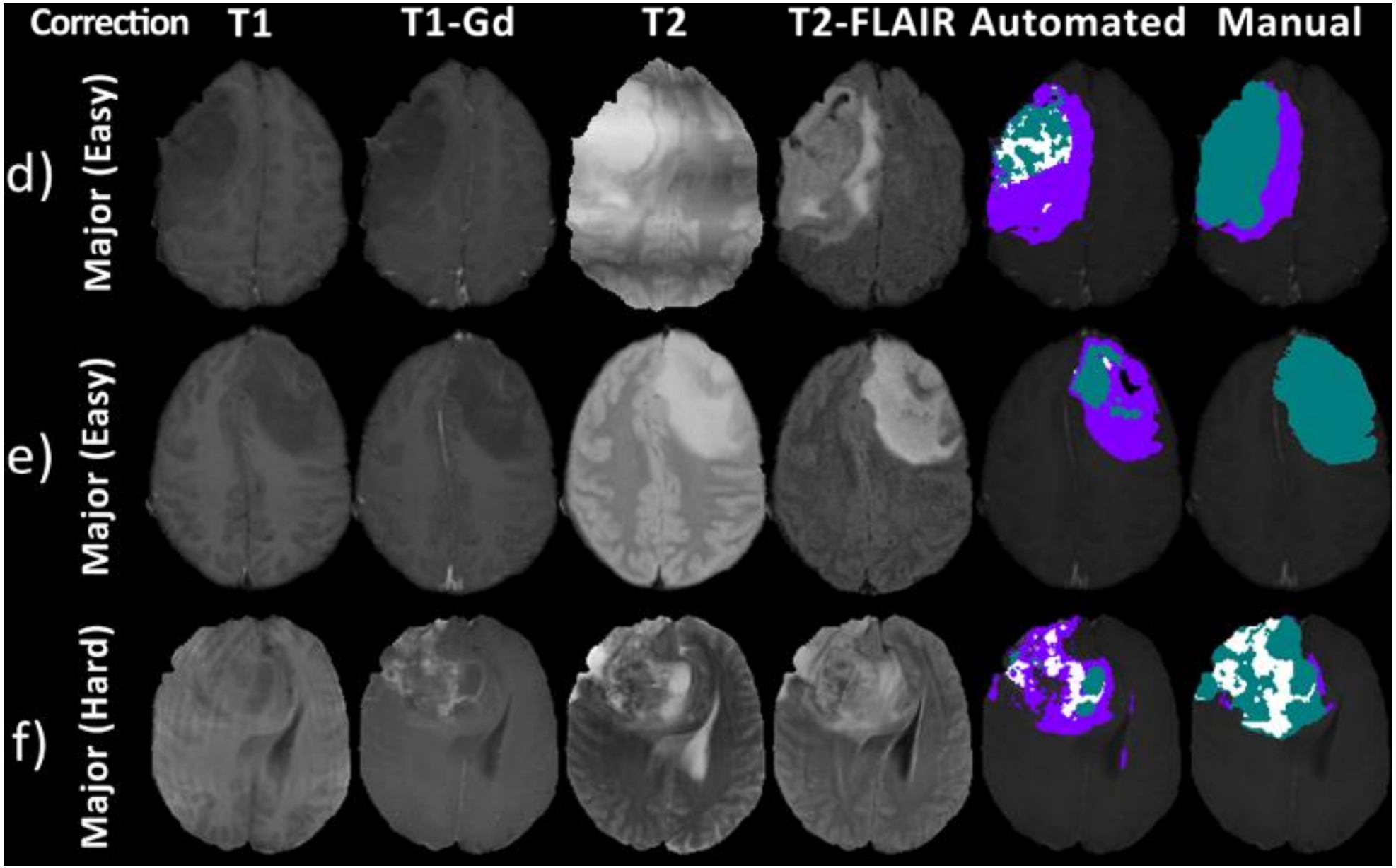


Example Segmentation Labels



Example Segmentation Labels



Radiomic features (Our Contribuition)

Panel of **>500 radiomic features**, extracted from the manual segmentation labels.

Extending beyond the traditionally used clinical measurements

i) Intensity,
ii) Volumetric,
iii) Morphologic,
iv) Histogram-based,
v) Textural parameters, (e.g. GLCM, GLRLM),
vi) Spatial/Location information,
vii) Glioma diffusion properties extracted from glioma growth models.

Provided to facilitate research on their association with molecular markers, clinical outcomes, treatment responses, and other endpoints, **by researchers without sufficient computational background** to extract such features.

Segmentation Labels & Radiomic features for TCIA collections

A contribution towards **repeatable, reproducible and comparative quantitative studies** leading to new predictive, prognostic, and diagnostic assessments, by

- enabling **direct utilization of the TCGA/TCIA** glioma collections
- allowing to **fully exploit their potential** in clinical and computational studies

Beneficial for two distinct user communities:

- non-imaging experts (bioinformatics, genomic, clinical) – allowing for **correlative genomic/clinical studies**.
- imaging experts – **evaluating other segmentation methods**, and comparing to our state-of-the-art method.

Data publicly available in a few weeks – manuscript submitted to Nature Scientific Data.

DOI:

- for TCGA-GBM: 10.7937/K9/TCIA.2017.KLXWJJ1Q
- for TCGA-LGG: 10.7937/K9/TCIA.2017.GJQ7R0EF