

Iowa Initiative for Artificial Intelligence

Final Report

Project title:	Differentiation between GBM and IMD using MPRAGE and VIBE T1-CE sequences	
Principal Investigator:	Girish Bathla, Sarv Priya	
Prepared by (IIAI):	Yanan Liu	
Other investigators:		
Date:		
Were specific aims fulfilled:	Y	
Readiness for extramural proposal?	N	
If yes ... Planned submission date		
Funding agency		
Grant mechanism		
If no ... Why not? What went wrong?	Prospective study will be needed. PI left UI	

Brief summary of accomplished results:

The mean AUC across the top-ten pipelines varied between 0.84-0.88 with MPRAGE and between 0.84-0.86 with the VIBE sequence. Seven of the top ten pipelines were common to both sequences. When comparing each of these pipelines, performance was not significantly different across different sequences.

Radiomics features derived from MPRAGE, and VIBE T1-CE sequences have similar diagnostic performance for differentiating between GBM and IMD, suggesting potential for model generalizability and less restrictive conformity to a certain sequence.

Research report:

Aims (provided by PI):

Aim: compare performance for differentiating between GBM and IMD using MPRAGE and VIBE T1-CE sequences.

Data:

The study was approved by the local institutional board and informed consent was waived, given the retrospective nature of the study. Using a Digital Imaging and Communications in Medicine (DICOM) header search functionality, the picture archiving and communication system (PACS) database was searched for studies where both MPRAGE and VIBE sequences were acquired during the same study session. Studies

were searched between 1/2016 to 11/2021. A total of 288 patients were identified. Of these, cases were excluded post chart and imaging review as follows: 1) Patients with any diagnosis other than IMD or GBM (n=88), 2) Lesions previously biopsied or treated with surgery or radiation therapy (n=46), 3) Non-enhancing lesions or lesions with less than 1 cm of enhancement as demonstrated in either or both MPRAGE and VIBE sequences (n=27), 4) Images done without contrast (n=5), 5) Presence of significant artifact impairing accurate image interpretation (4). This yielded a total of 118 subjects (GBM 31, IMD 87) who were further studied.

AI/ML Approach:

A total of 11 models were considered. The linear classifiers included: linear, logistic, ridge, LASSO, and elastic net (enet) regression. The non-linear classifiers included: support vector machine with polynomial kernel (svmPoly), support vector machine with radial kernel (svm-Rad), and multi-layer perceptron (mlp). The ensemble classifiers included: random forest (rf), generalized boosted regression (gbm), and classification trees with adaBoost (ada).

Experimental methods, validation approach:

Post standardized image pre-processing and segmentation of the tumor subregions, radiomics features were extracted from necrotic and solid enhancing tumor masks.

Results:

The mean AUC across the top-ten pipelines varied between 0.84-0.88 with MPRAGE and between 0.84-0.86 with the VIBE sequence. Seven of the top ten pipelines were common to both sequences. When comparing each of these pipelines, performance was not significantly different across different sequences.

Radiomics features derived from MPRAGE, and VIBE T1-CE sequences have similar diagnostic performance for differentiating between GBM and IMD, suggesting potential for model generalizability and less restrictive conformity to a certain sequence.

Publications resulting from project:

1. "Radiomics based differentiation of glioblastoma and metastatic disease: Does difference in type of contrast enhanced sequence matter?", submitted