Functional and Structural biomarkers of cognitive outcomes after brain tumor resection

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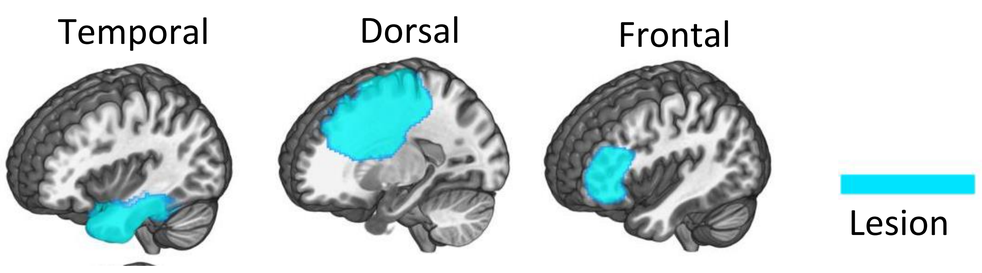
INTRODUCTION

• **Diffuse Low Grade Glioma** is a slow growth brain tumor that affects **cognitive faculties** and triggers **neuroplasticity mechanisms** (Duffau, 2014, 2005)



3D imaging of three samples of DLGG tumor location

•Previous studies have focused on predicting **postsurgical survival rate and lesion recurrence** by using clinical and neuroanatomical measures with **Machine Learning algorithms.** (Senders, 2018; Vergun, 2018)

• Few literature on **cognitive prognosis prediction** after brain surgery. Most of them focused on neuropsychological assessments to predict **quality of life** prognosis in patients diagnosed with DLGG (Krupp, 2009)

• Little is known about the **combination** of neuropsychological and neuroanatomical variables for predicting **postsurgical cognitive prognosis.**

Objective

To build, implement and validate a **classifier tool based on supervised machine learning algorithms** that allows clinicians to preoperatively predict DLGG patient postsurgical cognitive outcomes.

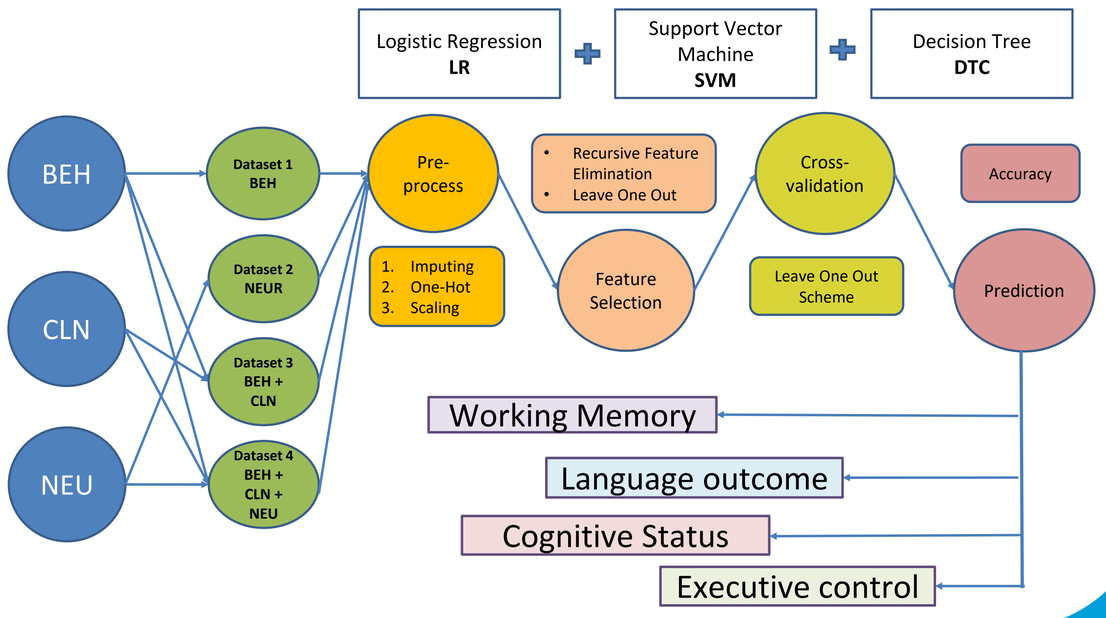
METHODS

Participants: 17 patients with DLGG (M_{age} = 40.0, SD = 14.15) underwent preoperative and postoperative neuropsychological assessments.

Materials:

- **Behavioral data (BEH):** Demographic data, language proficiency, neuropsychological measures
- **Clinical data (CLN):** Tumor location, tumor type, tumor volume
- **Neuroanatomic data (NEU):** Grey matter tissue volume

Procedure:



RESULTS

- ANOVA suggested a main effect of **algorithm** (F = 12.31, p < 0.001) but no significant effect of **dataset** (F = 0.394, p = 0.793). Post-hoc tests indicated that **Logistic Regression** outperformed both SVM (p_{tukey} = 0.048) and DTC (p_{tukey} < 0.001)

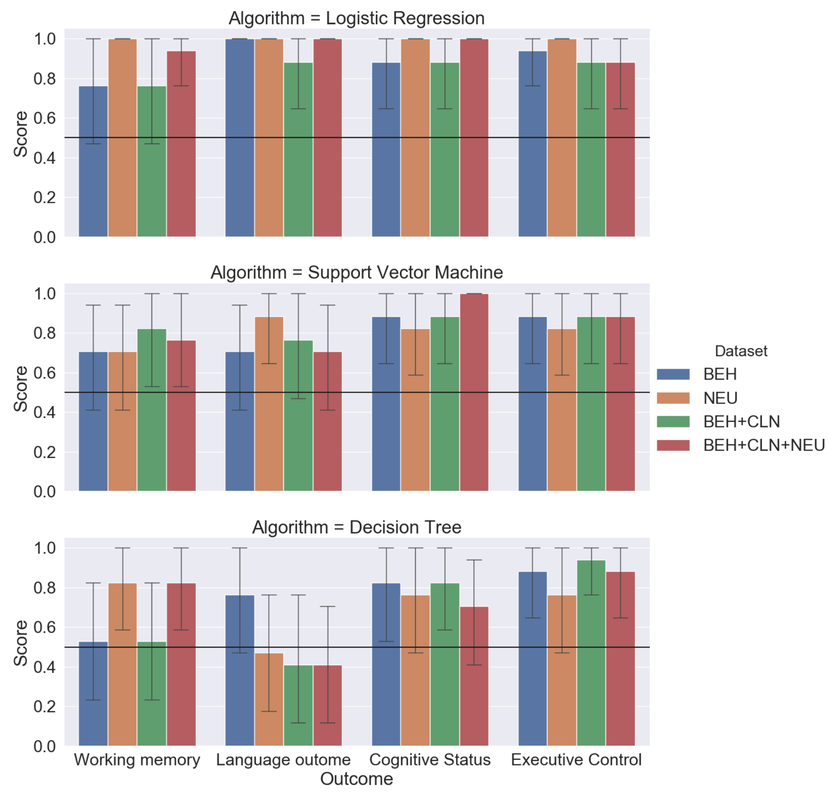


Figure 1. Outcome prediction by algorithm and dataset.

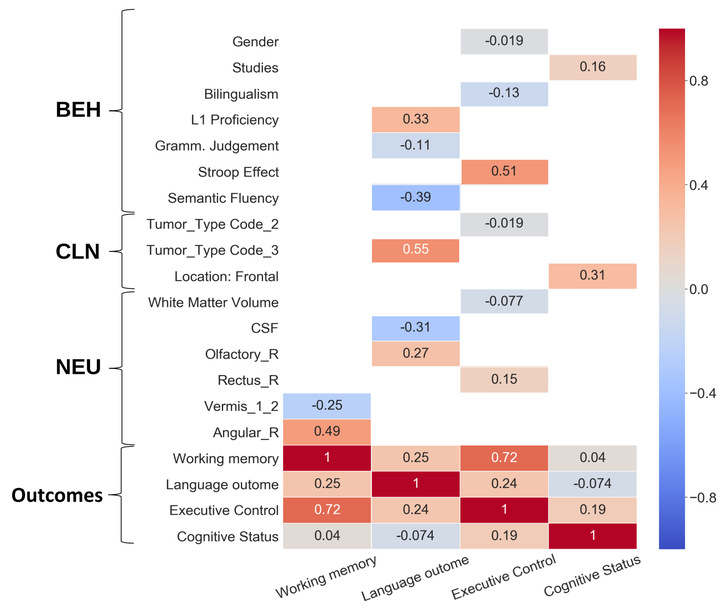


Figure 2. Correlation of selected features with outcomes for logistic regression classifier and full dataset

Logistic Regression classifier employs a subset of features from all datasets when predicting **Language** and **Executive Control**.

CONCLUSIONS

- **Logistic Regression** yielded the highest performance when predicting cognitive prognosis.
- There were no significant differences among the datasets.
- Features from all datasets were selected to better classify **language** and **executive control** outcomes
- These results are **proof-of-concept** for classifying patient's cognitive prognosis
- Future directions will involve increasing sample size and including detailed white matter volume features.

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