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MSDS 458 – AI & Deep Learning

Project Proposal

Glioblastoma, the most commonly occurring malignant brain cancer (47.7% of all cases)¹, is a fatal condition. Expected life expectancy post diagnosis is less than one year in a vast majority of cases. However, the presence of a genetic sequence known as MGMT promoter methylation is a favorable biomarker of the body's response to chemotherapy². Based on [this Kaggle competition](#) put forth by the Radiological Society of North America, "development of an accurate method to predict the genetics of the cancer through imaging (i.e., radiogenomics) alone could potentially minimize the number of surgeries needed to identify the sequence and refine the type of therapy required."

For my final project in MSDS 458, I plan to implement deep learning principles to classify over 500 MRI brain scans provided in a multi-parametric structure along MGMT values.

The project will involve:

- Combining image layers into singular 3D images and adjoining corresponding data to form Voxel matrices

¹ Vikram C Prabhu, MD (2021, May 5). Glioblastoma Multiforme. Retrieved from American Association of Neurological Surgeons: <https://www.aans.org/en/Patients/Neurosurgical-Conditions-and-Treatments/Glioblastoma-Multiforme>

² Weller, M., Stupp, R., Reifenberger, G. et al. MGMT promoter methylation in malignant gliomas: ready for personalized medicine?. Nat Rev Neurol 6, 39–51 (2010). <https://doi.org/10.1038/nrneurol.2009.197>

- Identifying various significant parts of the brain tumor, including the MGMT genetic sequence, using CNN (and possibly Transformers)
- Categorizing these identifications to align with MGMT Boolean values provided
- Analyzing outliers, if any, to evaluate model performance and to subsequently expand or narrow down the scope of CNN/Transformers as needed

Relevant studies conducted by scholars in the field that I will be referencing:

- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7071415/>
- <https://www.hindawi.com/journals/ijbi/2017/9749108/>
- <https://www.nature.com/articles/s41598-021-90428-8>
- <https://www.kdnuggets.com/2020/03/brain-tumor-detection-mask-r-cnn.html>