**Deep learning for brain tumor detection and prediction**

**Significance:**

Medical images are one of the most important resources used by doctors to diagnose brain tumors. A tool with high accuracy to automate this process can be extremely valuable. In recently years, interest in designing tools for diagnosing brain tumors has been increasing. In our project, we apply machine learning such as deep learning into brain tumor detection and prediction. Deep learning is a new area of machine learning research, which has been introduced with the objective of moving Machine Learning closer to one of its original goals: Artificial Intelligence. Our goal is to extract the most important and discriminating features of the preprocessed images and then predict the brain tumor progression.

**Novelty:**

Past research on brain tumor were focusing using the image processing and machine learning techniques to extract features from MRI records to diagnose the tumor, and as well to predict the type, locations and progression of it. Few studies have been conducted in relation to assessment of the potential association between clinical data (i.e. age, survival time etc.), molecular data (DNA alternations) and the extracted features. For our project, we plan to use deep learning to study these associations, and construct some models to predict the non-tumor-characteristics variables referred to above.

**Dataset:**

The dataset we use in this work comes from Dr. Cooper and Dr. Gutman. It consists of 117 MRI image volumes with tumor masks. The images were acquired from the Winship Cancer Institute at Emory University.

**Tools:**

We plan use existing machine learning libraries for Python to perform deep learning on our data set. In particular, we plan to use sci-kit learn, which has some built-in deep learning functionality (Restricted Boltzmann machines) or Theanos, which both build off of NumPy. Python is preferred because in general, NumPy and Python allow for simple, high-level coding.

**Project Events and TimeLine (Chronological Order):**

1. Data Collection (Week 1-2)

a. Meet with Lee Cooper (and/or Dr. Gutman) to discuss the general problem and get data. ***All members.***

b. Determine desired outcomes to predict (life expectancy, time to relapse, etc.). ***All members.***

2. Literature Review (Weeks 1-3)

a. Collect papers on past brain tumor work (***Xiaolong and Liang)*** and deep learning including validation (***Clarissa***).

b. Read papers; meet to discuss literature. ***All members.***

3. Implementation (Weeks 4-9)

a. Discuss and plan implementation based on literature, data, and discussions with Lee Cooper and/or Dr. Gutman. (Week 4) ***All members.***

b. Begin basic implementation: loading data in Python, implementation (using machine learning libraries) of various deep learning algorithms on data. Evaluate tools to ensure they are intuitive and acceptable. (Week 5-6) ***All members.***

c. Continue implementation, begin test runs on a small sample set. (Weeks 7-8) ***All members.***

d. Run on full dataset and tweak weights, input functions, and other performance factors (Week 8-9) ***All members.***

4. Validation (Weeks 9-10)

a. Perform validation of data. ***All members.***

5. Writing (Weeks 8-11)

a. Write report (Weeks 8-11) ***All members***

b. Write talk outline. (Week 10) ***Clarissa.***

c. Create slides (Week 10) ***Xiaolong and Liang.***

d. Practice talk (Week 11) ***All members.***