Brain Tumor Classification in MRI Images Proposal

Brain tumor is the collection is an abnormal mass of tissue in which cells grow and multiply uncontrollably, seemingly unchecked by the mechanisms that control normal cells. Brain tumors can be both malignant or benign.

According to CBTRUS (Central Brain Tumor Registry of the United States) report [1] an estimated 84,000 new cases of malignant and benign brain tumors are expected to be diagnosed in the US in 2021.This includes an estimated 29.7% malignant tumor. The estimated deaths due to malignant [1]tumor is 18,000 per year.

The five-year relative survival rate in the US from 2001 to 2016 following diagnosis of a malignant brain was 36%, whereas for benign it was 91.7%. Therefore it is important to obtain an accurate diagnosis in a short exam time to develop the right treatment plan.

There are several medical imaging techniques used to acquire information about tumors (tumor type, shape, size, location, etc.), which are needed for their diagnosis. Magnetic Resonance Imaging (MRI) is one of the most used technique. These images are examined by the radiologist and doctors. A manual examination can be time consuming and error-prone due to the level of complexities involved in brain tumors and their properties.

The goal of this project is to develop a Deep Learning approach by using Convolutional Neural Network and Transfer Learning (TL) to detect and classify Brain Tumor more accurately and to shorten the exam times.

To achieve this goal the data set provided by https://www.kaggle.com/sartajbhuvaji/brain-tumor-classification-mri is used. The data set contains 4 sub-folders which are consisted of respective tumor classes, Glioma, Meningioma, Pituitary, and No Tumor datasets.

Multiple steps will be taken to build a predictive model for this project as well as to analyze the resulting predictions.

1. Due to limited memory GPU will be used through Kaggle and Google Colab.
2. The images will be preprocessed by reshaping and data augmentation. Categorical variables will be encoded to numerical variables using LabelEncoder, One Hot Encoding.
3. The 4 sub-folders will be for multi-class calssification. And also for each tumor class binary classes will be created for further to develop binary classification models.
4. 3 different approaches Multi-Class Classifiers Method, Multiple Binary-Classifiers Method and Ensemble Method will be used to develop models.
5. For each methods models will be evaluated by using Validation Accuracy, Test Accuracy and learning plots.
6. The best models of each method will be compared for each tumor class by using evaluation metrics recall and precision.

A Github repository containing slide deck and formal project report for the project will be created.

1 https://cbtrus.org/cbtrus-fact-sheet-2020/