Brain Tumor Classification

## What is a Brain Tumor?

A brain tumor refers to an abnormal collection or mass of cells within the brain. The skull, which encloses the brain, has limited space, and any growth within this confined area can lead to complications. Brain tumors can be either cancerous (malignant) or noncancerous (benign). As benign or malignant tumors grow, they can increase the pressure inside the skull. This elevated pressure can cause brain damage and pose a life-threatening risk.

## The Importance of Brain Tumor Classification

The early detection and classification of brain tumors are crucial areas of research in medical imaging. Accurate classification aids in selecting the most suitable treatment method, potentially saving patients' lives.

## Methods

The application of deep learning approaches in healthcare has yielded significant advancements in health diagnosis. According to the World Health Organization (WHO), effective brain tumor diagnosis involves detecting the tumor, identifying its location within the brain, and classifying it based on malignancy, grade, and type. This experimental work focuses on diagnosing brain tumors using Magnetic Resonance Imaging (MRI). The process entails tumor detection, classification by grade and type, and identification of the tumor's location. Instead of employing individual models for each classification task, this method utilizes a single model for classifying brain MRI images across different classification tasks. The classification and detection of tumors employ a Convolutional Neural Network (CNN)-based multi-task approach. Additionally, a CNN-based model is employed to segment the brain and identify the location of the tumor.

## Dataset Description

The dataset comprises a total of 7023 human brain MRI images, categorized into four distinct classes. The dataset focuses on brain tumors and their classification. The four classes are as follows:

Glioma: Cancerous brain tumors in glial cells.

Meningioma: Non-cancerous tumors originating from the meninges.

No Tumor: Normal brain scans without detectable tumors.

Pituitary: Tumors affecting the pituitary gland, which can be cancerous or non-cancerous.

Advancing the development of machine learning models for tumor classification is crucial for driving progress in the field of neurology and making a significant impact on the lives of individuals. These models have the potential to enhance medical research, improve diagnostic accuracy, and contribute to effective treatment strategies for various types of tumors. By leveraging machine learning techniques, we can significantly aid in the advancement of neurology and ultimately improve healthcare outcomes for people affected by tumors.

The "No Tumor" class images were obtained from the Br35H dataset.

Note: The images in this dataset have varying sizes. After pre-processing and removing excess margins, you can resize the images to the desired dimensions.

The data link and complete description here [Brain Tumor Data on Kaggle](https://www.kaggle.com/datasets/masoudnickparvar/brain-tumor-mri-dataset)

Initial visualization

