1. **Title of Project:**

Brain Tumor Detection

1. **List of Group members with their registration numbers:** a. Muhammad Usman Ghouri (SP22-BCS-053)
2. Nadeem Jalal (SP22-BCS-068)
3. Ahsan Ali (SP22-BCS-128)
4. **A short abstract of what you are going to implement (upto 6 lines).**

This project focuses on creating a system that can automatically detect brain tumors in MRI images using PyTorch. It will use a custom-built Convolutional Neural Network (CNN) to analyze MRI scans and identify whether a tumor is present. The goal is to make the diagnosis process faster and more accurate, reducing the need for manual work in finding tumors. The project will involve preparing the data, training the model, testing its accuracy, and making improvements to ensure it gives reliable results, ultimately helping doctors with early detection of tumors.

1. **The reason you chose it as a topic for semester project (Motivation) (upto 6 lines).**

Brain tumors, if detected early, can significantly improve treatment outcomes. However, manual analysis of MRI scans is labor-intensive and subject to human error. This project aims to automate brain tumor detection to assist radiologists and improve diagnostic accuracy. The choice of PyTorch as a framework provides flexibility in building and fine-tuning deep learning models, which aligns with my goal of mastering the application of machine learning in healthcare and also help me in my final year project.

1. **Related Work (describe at least 3 similar projects done and how yours will differ)**
2. **Kidney Stone Detection Using Deep Learning:**

Kidney stone detection from CT scans or ultrasound images is a common medical imaging task. Similar to brain tumor detection, this project uses Convolutional Neural Networks (CNNs) to identify the presence of kidney stones in medical images. The approach often includes image preprocessing, feature extraction, and classification. The main difference is that kidney stone detection focuses on a different region of the body and uses various medical imaging techniques specific to kidney analysis.

### **Lung Cancer Detection:**

Lung cancer detection uses deep learning models to analyze CT scan images of the lungs to identify cancerous nodules. Projects in this area typically employ CNNs, similar to brain tumor detection, for classifying lung nodules as benign or malignant. While brain tumor detection focuses on MRI images, lung cancer detection deals with a different imaging modality (CT scans).

1. **Breast Cancer Detection:**

Breast cancer detection is performed using mammogram images (x-ray images) to identify abnormal growths in breast tissue. Like brain tumor detection, this project uses CNNs to analyze medical imaging data and classify tumors. Techniques such as feature extraction, segmentation, and image enhancement are often used to improve accuracy. This project focuses on mammograms, whereas brain tumor detection typically involves MRI scans.

1. **Detailed description of the implementation:**

Following are the main points of implementation:

***Data Collection and reading the dataset:***  
 The dataset comprises MRI scans that are labeled as either having a tumor or not. Images are collected from publicly available sources.

***Data Preprocessing:***

To convert data into that form which facilitates in model training. Following are some techniques used for data preprocessing:

* Image Resizing
* Normalization
* Data Enhancement
* Noise Removal
* Data Splitting

It helps in improving model accuracy and reduces overfitting.

***Model Selection and Training:***

The goal of training is to build a model that accurately classifies MRI images into tumor or no tumor categories. It will help in reducing diagnostic time and helps in early detection of brain tumors.

One of the most important steps in selection of model is to consider using pretrained models.

To train the model, first of all data is fed into the CNN in small batches. Then data is passed through models and prediction error is measured. Take steps to improve model performance. Then prevent overfitting by repeating validation.