



# Navigating the Frontiers of Healthcare

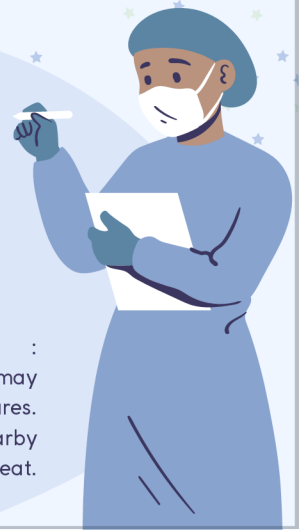


## Definition:

A brain tumor is an abnormal growth of cells in or around the brain. These cells can multiply uncontrollably, forming a mass that may disrupt normal brain

## Exploration of innovations in medicine : Brain tumors are classified into two main categories

1. Benign Tumors: These are non-cancerous and typically grow slowly. They may still cause problems by pressing on nearby brain structures.
2. Malignant Tumors: These are cancerous, grow rapidly, and can invade nearby brain tissue. They are often more serious and harder to treat.



# The future of Medical Science

An exploration of innovations in medicine

Brain tumors can be primary (originating in the brain) or secondary/metastatic (spreading to the brain from another part of the body). Common symptoms include headaches, seizures, difficulty speaking or walking, and changes in vision or behavior.

Their treatment depends on the type, size, and location of the tumor, and options may include surgery, radiation therapy, chemotherapy, or targeted therapies. Early detection and advancements in medical imaging and AI technologies are helping improve diagnosis and treatment outcomes.



# Here's a detailed summary of the brain tumor types



- 1. No Tumor**
- **Definition:** This refers to normal brain conditions without any evidence of tumor formation. The brain structure and function are unaffected, and imaging scans typically appear clear with no abnormal masses.
  - **Importance:** Distinguishing "No Tumor" cases in diagnostic systems ensures that healthy individuals are not subjected to unnecessary treatments or further invasive tests.

- 3. Pituitary Tumor**
- **Definition:** A tumor arising in the pituitary gland, a small pea-shaped gland located at the base of the brain responsible for hormone regulation.
  - **Types:**
    - **Functioning Tumors:** Produce excessive hormones, causing conditions like Cushing's disease or acromegaly.
    - **Non-Functioning Tumors:** Do not produce hormones but may press on surrounding structures.
  - **Symptoms:**
    - Hormonal imbalances leading to changes in growth, metabolism, or reproduction.
    - Vision problems due to pressure on the optic nerves.
    - Headaches and fatigue.
  - **Treatment:**
    - Surgery (often minimally invasive).
    - Medications to regulate hormone levels.
    - Radiation therapy for residual or recurrent tumors.

- 2. Glioma**
- **Definition:** A glioma is a type of tumor that originates in the glial cells, which provide support and insulation for neurons in the brain and spinal cord.
  - **Subtypes:** Includes astrocytomas, oligodendrogliomas, and glioblastomas, with glioblastomas being the most aggressive.
  - **Characteristics:**
    - Can be benign or malignant.
    - Often occurs in the cerebral hemispheres but may also appear in the spinal cord.
  - **Symptoms:**
    - Headaches, seizures, nausea.
    - Cognitive or personality changes depending on the tumor's location.
  - **Treatment:**
    - Surgery to remove the tumor, followed by radiation therapy and/or chemotherapy.
    - Targeted therapy for advanced cases.

- 4. Meningioma**
- **Definition:** A tumor that arises from the meninges, the protective membranes covering the brain and spinal cord. Most meningiomas are benign.
  - **Characteristics:**
    - Slow-growing and may not cause symptoms for years.
    - Often discovered incidentally during imaging for unrelated issues.
  - **Symptoms:**
    - Headaches, vision changes, or seizures.
    - Weakness in limbs if the spinal cord is affected.
    - Neurological deficits depending on the tumor's location.
  - **Treatment:**
    - Surgery is the primary treatment.
    - Radiation therapy may be used for incomplete resections or inoperable tumors.



# The DataSet



## **Brain Tumor MRI Dataset**

This dataset is a combination of the following three datasets :

[figshare](#)

[SARTAJ dataset](#)

[Br35H](#)

This dataset contains 7023 images of human brain MRI images which are classified into 4 classes: glioma - meningioma - no tumor and pituitary. no tumor class images were taken from the Br35H dataset.

I think SARTAJ dataset has a problem that the glioma class images are not categorized correctly, I realized this from the results of other people's work as well as the different models I trained, which is why I deleted the images in this folder and used the images on the figshare site instead.



# My Model

## Libraries

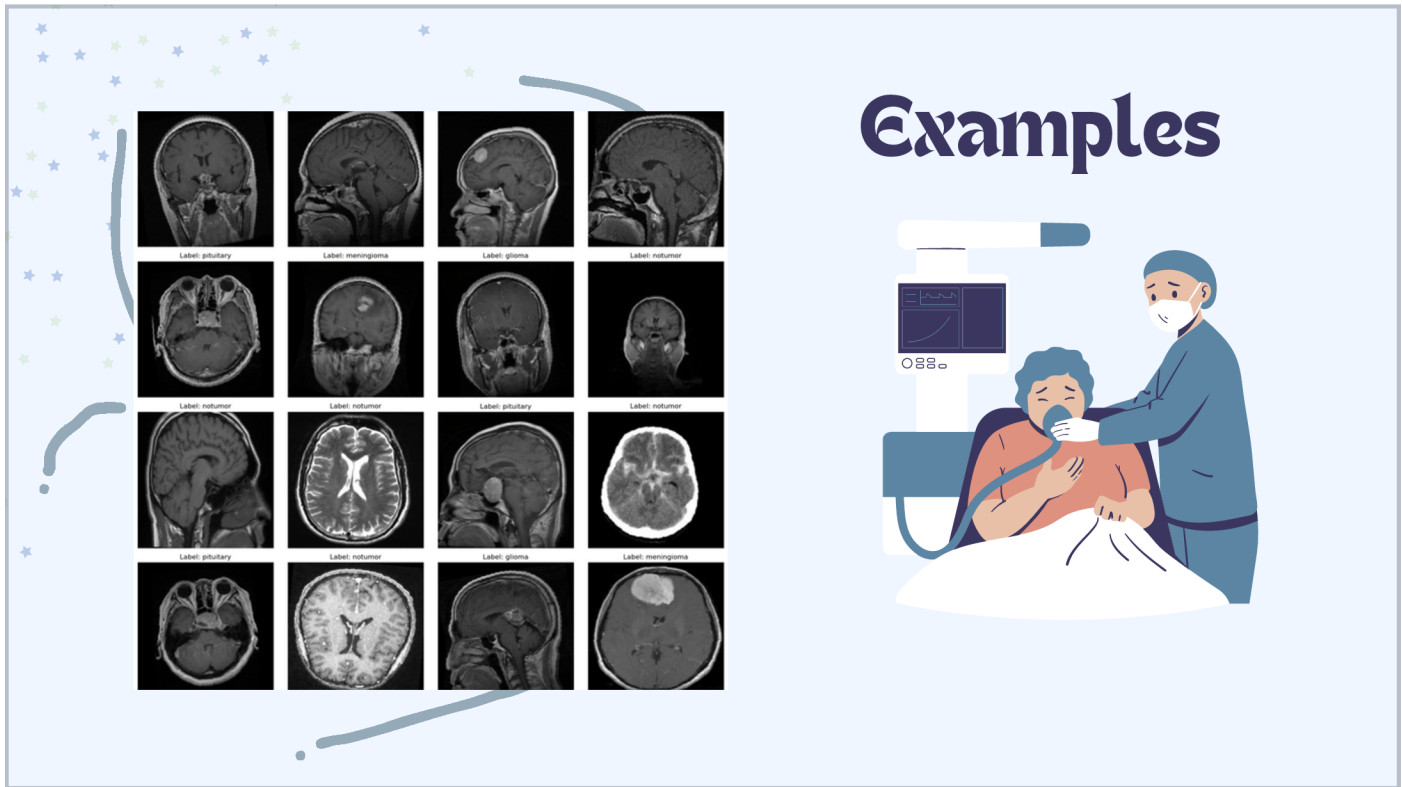
```
import torch
import torch.nn as nn
import torch.optim as optim
import torchvision.transforms as transforms
from torch.utils.data import DataLoader, random_split
from torch.utils.data import DataLoader
from torchvision.models import resnet18
from torchvision.datasets import ImageFolder
from torchvision.utils import make_grid
import torchvision.transforms.functional as F
import numpy as np
import matplotlib.pyplot as plt
from sklearn.metrics import confusion_matrix, classification_report, roc_curve, auc
import seaborn as sns
from PIL import Image
```

## Model Architecture

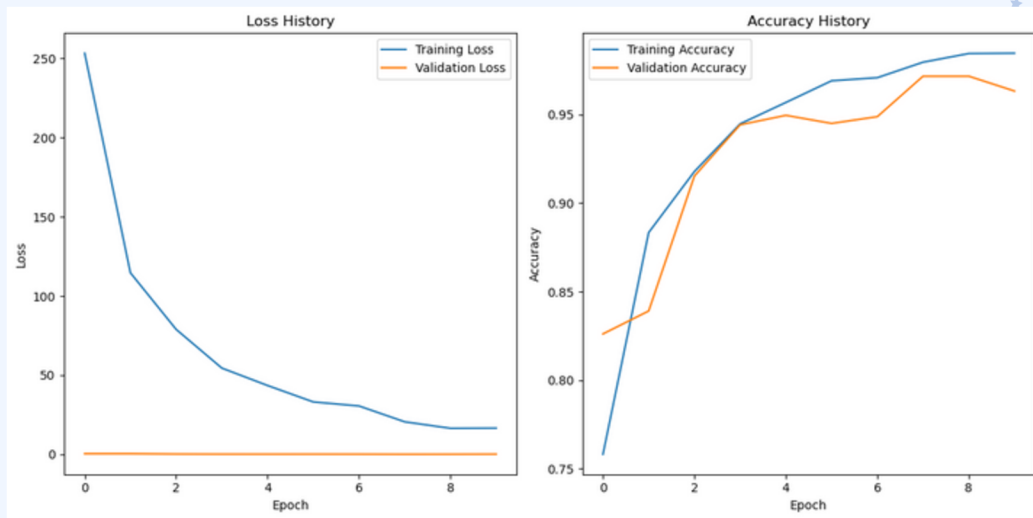
```
class TumorClassifier(nn.Module):
    def __init__(self, num_classes):
        super(TumorClassifier, self).__init__()
        self.features = nn.Sequential(
            nn.Conv2d(3, 16, kernel_size=3, padding=1),
            nn.ReLU(inplace=True),
            nn.MaxPool2d(kernel_size=2, stride=2),
            nn.Conv2d(16, 32, kernel_size=3, padding=1),
            nn.ReLU(inplace=True),
            nn.MaxPool2d(kernel_size=2, stride=2)
        )
        self.classifier = nn.Sequential(
            nn.Linear(32 * 16 * 16, 128),
            nn.ReLU(inplace=True),
            nn.Linear(128, num_classes)
        )

    def forward(self, x):
        x = self.features(x)
        x = x.view(x.size(0), -1)
        x = self.classifier(x)
        return x

model = TumorClassifier(num_classes=1)
# Load a pre-trained ResNet model and modify the classifier
model.to(device)
```

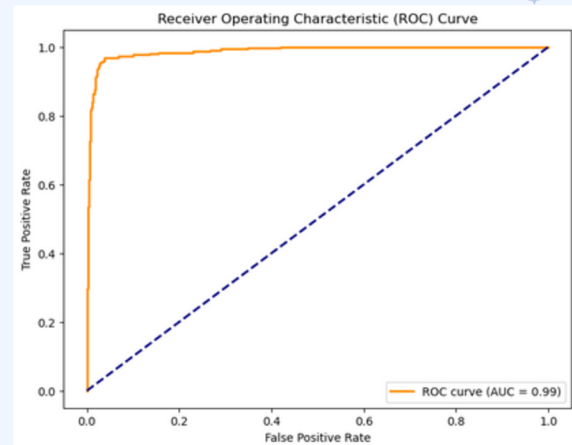
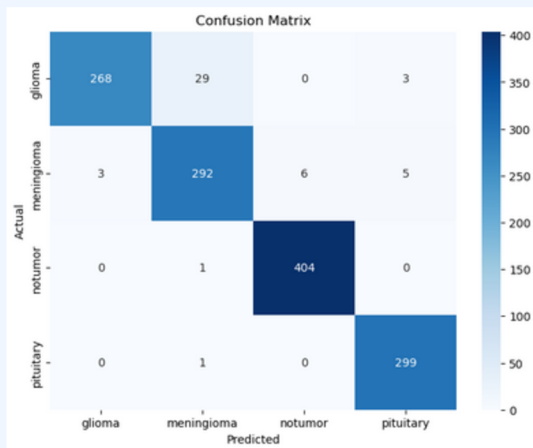


# Visualization Of Model





# Visualization Of Model



# Futures



**Use This Model To Build A Model To Get A  
Treatment For Every Type Of Tumor**



