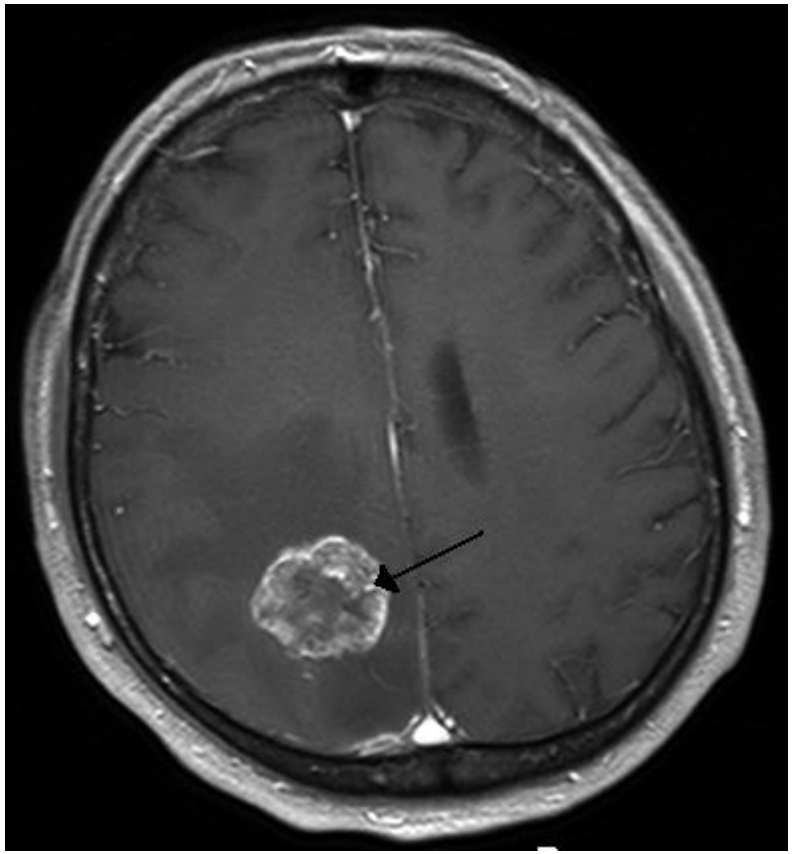
What is Brain Tumor?

A brain tumor occurs when abnormal cells form within the brain. There are two main types of tumors: cancerous (malignant) tumors and benign tumors. Cancerous tumors can be divided into primary tumors, which start within the brain, and secondary tumors, which have spread from elsewhere, known as brain metastasis tumors. All types of brain tumors may produce symptoms that vary depending on the part of the brain involved. These symptoms may include headaches, seizures, problems with vision, vomiting and mental changes. The headache is classically worse in the morning and goes away with vomiting. Other symptoms may include difficulty walking, speaking or with sensations. As the disease progresses, unconsciousness may occur.



Brain metastasis in the right cerebral hemisphere from lung cancer, shown on magnetic resonance imaging.

```
from google.colab import files

uploaded = files.upload()

for fn in uploaded.keys():
  print('User uploaded file "{name}" with length {length} bytes'.format(
      name=fn, length=len(uploaded[fn])))

# Then move kaggle.json into the folder where the API expects to find it.
!mkdir -p ~/.kaggle/ && mv kaggle.json ~/.kaggle/ && chmod 600 ~/.kaggle/kaggle.json
```

```
Choose Files No file chosen  Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.
Saving kaggle.json to kaggle.json
User uploaded file "kaggle.json" with length 71 bytes
```

```
!kaggle datasets download -d navoneel/brain-mri-images-for-brain-tumor-detection
```

```
Dataset URL: https://www.kaggle.com/datasets/navoneel/brain-mri-images-for-brain-tumor-detection
License(s): copyright-authors
Downloading brain-mri-images-for-brain-tumor-detection.zip to /content
 86% 13.0M/15.1M [00:01<00:00, 14.5MB/s]
100% 15.1M/15.1M [00:01<00:00, 8.84MB/s]
```

```
import tensorflow as tf
from zipfile import ZipFile
import os,glob
import cv2
from tqdm._tqdm_notebook import tqdm_notebook as tqdm
import numpy as np
from sklearn import preprocessing
from sklearn.model_selection import train_test_split
from keras.models import Sequential
from keras.layers import Convolution2D, Dropout, Dense,MaxPooling2D
from keras.layers import BatchNormalization
```

```
from keras.layers import MaxPooling2D
from keras.layers import Flatten
```

```
<ipython-input-4-4addd0ae159c>:5: TqdmDeprecationWarning: This function will be removed in tqdm==5.0.0
Please use `tqdm.notebook.*` instead of `tqdm._tqdm_notebook.*`
  from tqdm._tqdm_notebook import tqdm_notebook as tqdm
```

```
from zipfile import ZipFile
file_name = "/content/brain-mri-images-for-brain-tumor-detection.zip"
with ZipFile(file_name,'r') as zip:
  zip.extractall()
  print('Done')
```

```
Done
```

```
os.chdir('/content/yes')
X = []
y = []
for i in tqdm(os.listdir()):
      img = cv2.imread(i)
      img = cv2.resize(img,(224,224))
      X.append(img)
      y.append((i[0:1]))
      print(i[0:1])
os.chdir('/content/no')
for i in tqdm(os.listdir()):
      img = cv2.imread(i)
      img = cv2.resize(img,(224,224))
      X.append(img)
for i in range(1,99):
    y.append('N')
print(y)
```

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100%                155/155 [00:00<00:00, 506.86it/s]
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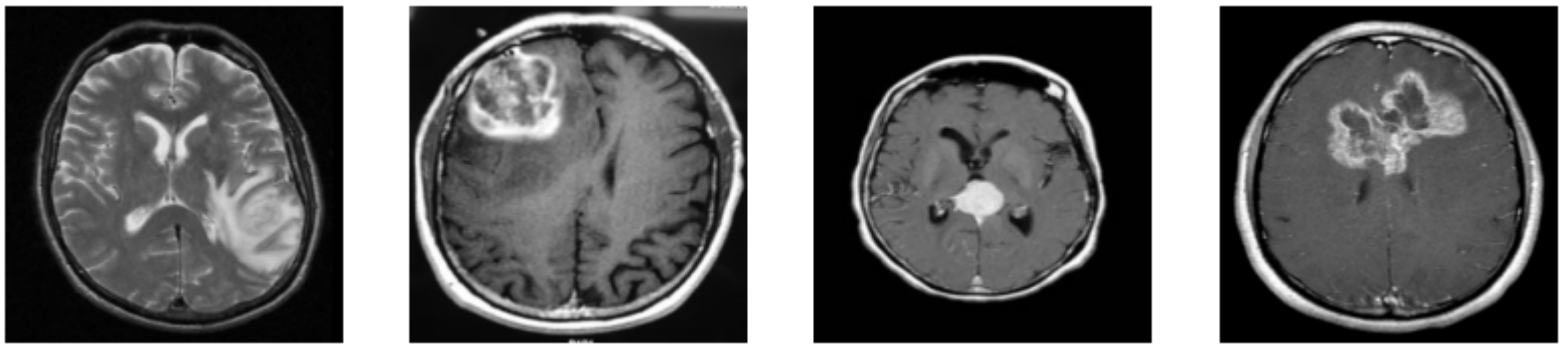
```
%matplotlib inline
import matplotlib.pyplot as plt
plt.figure(figsize=(10, 10))
for i in range(4):
    plt.subplot(1, 4, i+1)
    plt.imshow(X[i], cmap="gray")
    plt.axis('off')
plt.show()
```



```
Y

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.33, random_state=42)
print ("Shape of an image in X_train: ", X_train[0].shape)
print ("Shape of an image in X_test: ", X_test[0].shape)
```

```
Shape of an image in X_train:  (224, 224, 3)
Shape of an image in X_test:  (224, 224, 3)
```

```
le = preprocessing.LabelEncoder()
y_train = le.fit_transform(y_train)
y_test = le.fit_transform(y_test)
y_train = tf.keras.utils.to_categorical(y_train, num_classes=2)
y_test = tf.keras.utils.to_categorical(y_test, num_classes=2)
y_train = np.array(y_train)
X_train = np.array(X_train)
y_test = np.array(y_test)
X_test = np.array(X_test)
```

```
print("X_train Shape: ", X_train.shape)
print("X_test Shape: ", X_test.shape)
print("y_train Shape: ", y_train.shape)
print("y_test Shape: ", y_test.shape)
```

```
X_train Shape:  (169, 224, 224, 3)
X_test Shape:  (84, 224, 224, 3)
y_train Shape:  (169, 2)
y_test Shape:  (84, 2)
```

```
from keras.applications import vgg16


img_rows, img_cols = 224, 224


vgg = vgg16.VGG16(weights = 'imagenet',
                  include_top = False,
                  input_shape = (img_rows, img_cols, 3))

# Here we freeze the last 4 layers
# Layers are set to trainable as True by default
for layer in vgg.layers:
    layer.trainable = False

# Let's print our layers
```

```
for (i,layer) in enumerate(vgg.layers):
    print(str(i) + " "+ layer.__class__.__name__, layer.trainable)
```

```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/vgg16/vgg16_weights_tf_dim_ordering_tf_kernel
58889256/58889256 ━━━━━━━━━━━━━━━━━━━━ 4s 0us/step
0 InputLayer False
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2 Conv2D False
3 MaxPooling2D False
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7 Conv2D False
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10 MaxPooling2D False
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12 Conv2D False
13 Conv2D False
14 MaxPooling2D False
15 Conv2D False
16 Conv2D False
17 Conv2D False
18 MaxPooling2D False
```

```
def lw(bottom_model, num_classes):
    """creates the top or head of the model that will be
    placed ontop of the bottom layers"""

    top_model = bottom_model.output
    top_model = GlobalAveragePooling2D()(top_model)
    top_model = Dense(1024,activation='relu')(top_model)
    top_model = Dense(1024,activation='relu')(top_model)
    top_model = Dense(512,activation='relu')(top_model)
    top_model = Dense(num_classes,activation='softmax')(top_model)
    return top_model
```

```
from keras.models import Sequential
from keras.layers import Dense, Dropout, Activation, Flatten, GlobalAveragePooling2D
from keras.layers import Conv2D, MaxPooling2D, ZeroPadding2D

from keras.models import Model


num_classes = 2

FC_Head = lw(vgg, num_classes)

model = Model(inputs = vgg.input, outputs = FC_Head)

print(model.summary())
```

Model: "functional"

Layer (type)	Output Shape	Param #
input_layer (InputLayer)	(None, 224, 224, 3)	0
block1_conv1 (Conv2D)	(None, 224, 224, 64)	1,792
block1_conv2 (Conv2D)	(None, 224, 224, 64)	36,928
block1_pool (MaxPooling2D)	(None, 112, 112, 64)	0
block2_conv1 (Conv2D)	(None, 112, 112, 128)	73,856
block2_conv2 (Conv2D)	(None, 112, 112, 128)	147,584
block2_pool (MaxPooling2D)	(None, 56, 56, 128)	0
block3_conv1 (Conv2D)	(None, 56, 56, 256)	295,168
block3_conv2 (Conv2D)	(None, 56, 56, 256)	590,080
block3_conv3 (Conv2D)	(None, 56, 56, 256)	590,080
block3_pool (MaxPooling2D)	(None, 28, 28, 256)	0
block4_conv1 (Conv2D)	(None, 28, 28, 512)	1,180,160
block4_conv2 (Conv2D)	(None, 28, 28, 512)	2,359,808
block4_conv3 (Conv2D)	(None, 28, 28, 512)	2,359,808
block4_pool (MaxPooling2D)	(None, 14, 14, 512)	0
block5_conv1 (Conv2D)	(None, 14, 14, 512)	2,359,808
block5_conv2 (Conv2D)	(None, 14, 14, 512)	2,359,808
block5_conv3 (Conv2D)	(None, 14, 14, 512)	2,359,808
block5_pool (MaxPooling2D)	(None, 7, 7, 512)	0

global_average_pooling2d (GlobalAveragePooling2D)	(None, 512)	0
dense (Dense)	(None, 1024)	525,312
dense_1 (Dense)	(None, 1024)	1,049,600
dense_2 (Dense)	(None, 512)	524,800
dense_3 (Dense)	(None, 2)	1,026

Total params: 16,815,426 (64.15 MB)

```
from tensorflow.keras.models import Model
model.compile(optimizer='adam', loss = 'categorical_crossentropy',metrics = ['accuracy'])


history = model.fit(X_train,y_train,
                    epochs=5,
                    validation_data=(X_test,y_test),
                    verbose = 1,
                    initial_epoch=0)
```

```
Epoch 1/5
6/6 ━━━━━━━━━━━━━━━━━━━━ 32s 3s/step - accuracy: 0.5675 - loss: 3.6616 - val_accuracy: 0.7262 - val_loss: 0.5274
Epoch 2/5
6/6 ━━━━━━━━━━━━━━━━━━━━ 13s 273ms/step - accuracy: 0.7754 - loss: 0.5398 - val_accuracy: 0.6190 - val_loss: 0.8361
Epoch 3/5
6/6 ━━━━━━━━━━━━━━━━━━━━ 1s 237ms/step - accuracy: 0.7391 - loss: 0.5230 - val_accuracy: 0.8571 - val_loss: 0.5348
Epoch 4/5
6/6 ━━━━━━━━━━━━━━━━━━━━ 2s 276ms/step - accuracy: 0.9129 - loss: 0.1697 - val_accuracy: 0.8810 - val_loss: 0.3843
Epoch 5/5
6/6 ━━━━━━━━━━━━━━━━━━━━ 1s 244ms/step - accuracy: 0.9577 - loss: 0.1202 - val_accuracy: 0.9405 - val_loss: 0.2795
```

```
%matplotlib inline
acc = history.history['accuracy']
val_acc = history.history['val_accuracy']
```