

BRAIN TUMOR CLASSIFICATION

```
import numpy as np
import pandas as pd
import PIL
import tensorflow as tf
import keras
import cv2
import gradio as gr
import warnings
warnings.filterwarnings('ignore')

In [6]: data_dir=os.path.join(os.path.expanduser('~'), 'Desktop', 'apponorship letter', 'Training')

In [7]: import pathlib

In [8]: data_dir = pathlib.Path(data_dir)
image_count = len(list(data_dir.glob('*/*.jpg')))
print(image_count)
2475

In [9]: gilaoma=list(data_dir.glob('glioma/*'))

Picture Of Different Tumors

In [10]: PIL.Image.open(str(gilaoma[10]))

Out[10]: 

In [11]: meningioma=list(data_dir.glob('meningioma/*'))

In [12]: PIL.Image.open(str(meningioma[0]))

Out[12]: 

In [13]: pituitary=list(data_dir.glob('pituitary/*'))

In [14]: PIL.Image.open(str(pituitary[50]))

Out[14]: 

In [15]: cv2.imread(str(pituitary[50])).shape
(512, 512, 3)

In [16]: images_dict={
    "glioma":list(data_dir.glob('glioma/*')),
    "meningioma":list(data_dir.glob('meningioma/*')),
    "pituitary":list(data_dir.glob('pituitary/*'))
}

In [17]: images_label={
    "glioma":0,
    "meningioma":1,
    "pituitary":2
}

In [18]: X,y=[],[]
for tumor,images in images_dict.items():
    for image in images:
        image=cv2.imread(str(image))
        image_resize=cv2.resize(image,(180,180))
        X.append(image_resize)
        y.append(images_label[tumor])

In [19]: X=np.array(X)
y=np.array(y)

In [20]: X=X.astype('float32')
# y=y.astype('float32')

In [21]: image_classifications=["glioma", "meningioma", "pituitary"]

In [22]: import sklearn

In [23]: from sklearn.model_selection import train_test_split

In [24]: X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.2,random_state=10)
X_train.dtype
dtype('float32')

In [25]: len(X_train)
len(X_test)

Out[25]: 495

In [26]: data_augmentation=keras.Sequential([
    tf.keras.layers.experimental.preprocessing.RandomFlip("horizontal",input_shape=(180,180,3)),
    tf.keras.layers.experimental.preprocessing.RandomRotation(0.2),
    tf.keras.layers.experimental.preprocessing.RandomZoom(0.1),
    tf.keras.layers.experimental.preprocessing.RandomRotation(0.2),
    tf.keras.layers.experimental.preprocessing.RandomFlip("horizontal",input_shape=(180,180,3))
])

Model Training

In [27]: model=keras.Sequential([
    data_augmentation,
    # tf.keras.layers.experimental.preprocessing.RandomFlip("horizontal",input_shape=(180,180,3)),
    # tf.keras.layers.experimental.preprocessing.RandomRotation(0.2),
    # tf.keras.layers.experimental.preprocessing.RandomZoom(0.1),
    # tf.keras.layers.experimental.preprocessing.RandomRotation(0.2),
    # tf.keras.layers.experimental.preprocessing.RandomFlip("horizontal",input_shape=(180,180,3))
    keras.layers.MaxPooling2D(),
    keras.layers.Conv2D(32,3,activation="relu"),
    keras.layers.MaxPooling2D(),
    keras.layers.Conv2D(64,3,activation="relu"),
    keras.layers.MaxPooling2D(),
    keras.layers.Dropout(0.2),
    keras.layers.Flatten(),
    keras.layers.Dense(128,activation="relu"),
    keras.layers.Dense(3,activation="softmax")
])
model.compile(optimizer="adam",loss="sparse_categorical_crossentropy",metrics=["accuracy"])
model.fit(X_train,y_train,epochs=150)

Epoch 1/150
62/62 [=====] - 2s 47ms/step - loss: 43.8757 - accuracy: 0.4541
Epoch 2/150
62/62 [=====] - 2s 39ms/step - loss: 0.8817 - accuracy: 0.9563
Epoch 3/150
62/62 [=====] - 2s 39ms/step - loss: 0.7849 - accuracy: 0.9411
Epoch 4/150
62/62 [=====] - 2s 43ms/step - loss: 0.7416 - accuracy: 0.6662
Epoch 5/150
62/62 [=====] - 2s 39ms/step - loss: 0.6795 - accuracy: 0.9595
Epoch 6/150
62/62 [=====] - 2s 39ms/step - loss: 0.6740 - accuracy: 0.7379
Epoch 7/150
62/62 [=====] - 2s 39ms/step - loss: 0.5531 - accuracy: 0.7509
Epoch 8/150
62/62 [=====] - 2s 39ms/step - loss: 0.5032 - accuracy: 0.7847
Epoch 9/150
62/62 [=====] - 2s 39ms/step - loss: 0.5032 - accuracy: 0.7847
Epoch 10/150
62/62 [=====] - 2s 39ms/step - loss: 0.5892 - accuracy: 0.7265
Epoch 11/150
62/62 [=====] - 2s 39ms/step - loss: 0.5892 - accuracy: 0.7265
Epoch 12/150
62/62 [=====] - 2s 39ms/step - loss: 0.5603 - accuracy: 0.7581
Epoch 13/150
62/62 [=====] - 2s 39ms/step - loss: 0.5536 - accuracy: 0.7621
Epoch 14/150
62/62 [=====] - 2s 39ms/step - loss: 0.5331 - accuracy: 0.9195
Epoch 15/150
62/62 [=====] - 2s 39ms/step - loss: 0.5539 - accuracy: 0.7635
Epoch 16/150
62/62 [=====] - 2s 39ms/step - loss: 0.5267 - accuracy: 0.7769
Epoch 17/150
62/62 [=====] - 2s 39ms/step - loss: 0.5084 - accuracy: 0.7747
Epoch 18/150
62/62 [=====] - 2s 39ms/step - loss: 0.4994 - accuracy: 0.7947
Epoch 19/150
62/62 [=====] - 2s 39ms/step - loss: 0.4641 - accuracy: 0.7936
Epoch 20/150
62/62 [=====] - 2s 39ms/step - loss: 0.4687 - accuracy: 0.7954
Epoch 21/150
62/62 [=====] - 2s 39ms/step - loss: 0.4382 - accuracy: 0.8084
Epoch 22/150
62/62 [=====] - 2s 39ms/step - loss: 0.4313 - accuracy: 0.8086
Epoch 23/150
62/62 [=====] - 2s 39ms/step - loss: 0.4494 - accuracy: 0.8182
Epoch 24/150
62/62 [=====] - 2s 39ms/step - loss: 0.4102 - accuracy: 0.8160
Epoch 25/150
62/62 [=====] - 2s 39ms/step - loss: 0.4455 - accuracy: 0.8163
Epoch 26/150
62/62 [=====] - 2s 39ms/step - loss: 0.4386 - accuracy: 0.8229
Epoch 27/150
62/62 [=====] - 2s 39ms/step - loss: 0.4381 - accuracy: 0.8265
Epoch 28/150
62/62 [=====] - 2s 39ms/step - loss: 0.3904 - accuracy: 0.8403
Epoch 29/150
62/62 [=====] - 2s 39ms/step - loss: 0.3806 - accuracy: 0.8434
Epoch 30/150
62/62 [=====] - 2s 39ms/step - loss: 0.3744 - accuracy: 0.8448
Epoch 31/150
62/62 [=====] - 2s 39ms/step - loss: 0.3831 - accuracy: 0.8433
Epoch 32/150
62/62 [=====] - 2s 39ms/step - loss: 0.3602 - accuracy: 0.8484
Epoch 33/150
62/62 [=====] - 2s 39ms/step - loss: 0.3256 - accuracy: 0.8714
Epoch 34/150
62/62 [=====] - 2s 39ms/step - loss: 0.3479 - accuracy: 0.8606
Epoch 35/150
62/62 [=====] - 2s 39ms/step - loss: 0.3453 - accuracy: 0.8569
Epoch 36/150
62/62 [=====] - 2s 39ms/step - loss: 0.3642 - accuracy: 0.8593
Epoch 37/150
62/62 [=====] - 2s 39ms/step - loss: 0.3432 - accuracy: 0.8593
Epoch 38/150
62/62 [=====] - 2s 39ms/step - loss: 0.3399 - accuracy: 0.8504
Epoch 39/150
62/62 [=====] - 2s 39ms/step - loss: 0.3127 - accuracy: 0.8552
Epoch 40/150
62/62 [=====] - 2s 39ms/step - loss: 0.3127 - accuracy: 0.8712
Epoch 41/150
62/62 [=====] - 2s 39ms/step - loss: 0.3542 - accuracy: 0.8480
Epoch 42/150
62/62 [=====] - 2s 39ms/step - loss: 0.2839 - accuracy: 0.8870
Epoch 43/150
62/62 [=====] - 2s 41ms/step - loss: 0.3035 - accuracy: 0.8885
Epoch 44/150
62/62 [=====] - 2s 39ms/step - loss: 0.3076 - accuracy: 0.8692
Epoch 45/150
62/62 [=====] - 2s 39ms/step - loss: 0.3122 - accuracy: 0.8785
Epoch 46/150
62/62 [=====] - 2s 39ms/step - loss: 0.3058 - accuracy: 0.8736
Epoch 47/150
62/62 [=====] - 2s 39ms/step - loss: 0.2947 - accuracy: 0.8906
Epoch 48/150
62/62 [=====] - 2s 40ms/step - loss: 0.3162 - accuracy: 0.8615
Epoch 49/150
62/62 [=====] - 2s 41ms/step - loss: 0.2812 - accuracy: 0.8926
Epoch 50/150
62/62 [=====] - 2s 39ms/step - loss: 0.2847 - accuracy: 0.8796
Epoch 51/150
62/62 [=====] - 2s 39ms/step - loss: 0.2622 - accuracy: 0.9029
Epoch 52/150
62/62 [=====] - 2s 39ms/step - loss: 0.2916 - accuracy: 0.9157
Epoch 53/150
62/62 [=====] - 2s 39ms/step - loss: 0.2655 - accuracy: 0.8961
Epoch 54/150
62/62 [=====] - 2s 39ms/step - loss: 0.2459 - accuracy: 0.8922
Epoch 55/150
62/62 [=====] - 2s 40ms/step - loss: 0.2343 - accuracy: 0.9121
Epoch 56/150
62/62 [=====] - 2s 39ms/step - loss: 0.2381 - accuracy: 0.9042
Epoch 57/150
62/62 [=====] - 2s 39ms/step - loss: 0.2478 - accuracy: 0.9025
Epoch 58/150
62/62 [=====] - 2s 39ms/step - loss: 0.2525 - accuracy: 0.9087
Epoch 59/150
62/62 [=====] - 2s 39ms/step - loss: 0.2228 - accuracy: 0.9130
Epoch 60/150
62/62 [=====] - 2s 39ms/step - loss: 0.2667 - accuracy: 0.9105
Epoch 61/150
62/62 [=====] - 2s 39ms/step - loss: 0.2264 - accuracy: 0.8975
Epoch 62/150
62/62 [=====] - 2s 39ms/step - loss: 0.2224 - accuracy: 0.9173
Epoch 63/150
62/62 [=====] - 2s 39ms/step - loss: 0.2301 - accuracy: 0.9078
Epoch 64/150
62/62 [=====] - 2s 39ms/step - loss: 0.2489 - accuracy: 0.9073
Epoch 65/150
62/62 [=====] - 2s 39ms/step - loss: 0.2070 - accuracy: 0.9195
Epoch 66/150
62/62 [=====] - 2s 39ms/step - loss: 0.2877 - accuracy: 0.8841
Epoch 67/150
62/62 [=====] - 2s 39ms/step - loss: 0.2256 - accuracy: 0.9161
Epoch 68/150
62/62 [=====] - 2s 39ms/step - loss: 0.2197 - accuracy: 0.9087
Epoch 69/150
62/62 [=====] - 2s 39ms/step - loss: 0.1981 - accuracy: 0.9105
Epoch 70/150
62/62 [=====] - 2s 39ms/step - loss: 0.2115 - accuracy: 0.9109
Epoch 71/150
62/62 [=====] - 2s 39ms/step - loss: 0.2200 - accuracy: 0.9106
Epoch 72/150
62/62 [=====] - 2s 38ms/step - loss: 0.2070 - accuracy: 0.9129
Epoch 73/150
62/62 [=====] - 2s 39ms/step - loss: 0.1878 - accuracy: 0.9319
Epoch 74/150
62/62 [=====] - 2s 39ms/step - loss: 0.1990 - accuracy: 0.9171
Epoch 75/150
62/62 [=====] - 2s 38ms/step - loss: 0.1805 - accuracy: 0.9281
Epoch 76/150
62/62 [=====] - 2s 39ms/step - loss: 0.1784 - accuracy: 0.9253
Epoch 77/150
62/62 [=====] - 2s 39ms/step - loss: 0.1777 - accuracy: 0.9350
Epoch 78/150
62/62 [=====] - 2s 39ms/step - loss: 0.1783 - accuracy: 0.9329
Epoch 79/150
62/62 [=====] - 2s 37ms/step - loss: 0.1974 - accuracy: 0.9263
Epoch 80/150
62/62 [=====] - 2s 36ms/step - loss: 0.1907 - accuracy: 0.9155
Epoch 81/150
62/62 [=====] - 2s 37ms/step - loss: 0.1732 - accuracy: 0.9315
Epoch 82/150
62/62 [=====] - 2s 37ms/step - loss: 0.1887 - accuracy: 0.9279
Epoch 83/150
62/62 [=====] - 2s 36ms/step - loss: 0.1948 - accuracy: 0.9218
Epoch 84/150
62/62 [=====] - 2s 37ms/step - loss: 0.1714 - accuracy: 0.9368
Epoch 85/150
62/62 [=====] - 2s 36ms/step - loss: 0.2104 - accuracy: 0.9204
Epoch 86/150
62/62 [=====] - 2s 37ms/step - loss: 0.1511 - accuracy: 0.9386
Epoch 87/150
62/62 [=====] - 2s 36ms/step - loss: 0.1687 - accuracy: 0.9359
Epoch 88/150
62/62 [=====] - 2s 36ms/step - loss: 0.1931 - accuracy: 0.9203
Epoch 89/150
62/62 [=====] - 2s 38ms/step - loss: 0.1835 - accuracy: 0.9274
Epoch 90/150
62/62 [=====] - 2s 36ms/step - loss: 0.1935 - accuracy: 0.9347
Epoch 91/150
62/62 [=====] - 2s 36ms/step - loss: 0.1847 - accuracy: 0.9296
Epoch 92/150
62/62 [=====] - 2s 36ms/step - loss: 0.1900 - accuracy: 0.9332
Epoch 93/150
62/62 [=====] - 2s 38ms/step - loss: 0.2250 - accuracy: 0.9221
Epoch 94/150
62/62 [=====] - 2s 38ms/step - loss: 0.1658 - accuracy: 0.9411
Epoch 95/150
62/62 [=====] - 2s 39ms/step - loss: 0.1634 - accuracy: 0.9400
Epoch 96/150
62/62 [=====] - 2s 38ms/step - loss: 0.2000 - accuracy: 0.9453
Epoch 97/150
62/62 [=====] - 2s 36ms/step - loss: 0.1309 - accuracy: 0.9524
Epoch 98/150
62/62 [=====] - 2s 36ms/step - loss: 0.1158 - accuracy: 0.9544
Epoch 99/150
62/62 [=====] - 2s 36ms/step - loss: 0.1342 - accuracy: 0.9464
Epoch 100/150
62/62 [=====] - 2s 35ms/step - loss: 0.1517 - accuracy: 0.9407
Epoch 101/150
62/62 [=====] - 2s 36ms/step - loss: 0.1282 - accuracy: 0.9427
Epoch 102/150
62/62 [=====] - 2s 36ms/step - loss: 0.1320 - accuracy: 0.9465
Epoch 103/150
62/62 [=====] - 2s 36ms/step - loss: 0.1472 - accuracy: 0.9414
Epoch 104/150
62/62 [=====] - 2s 35ms/step - loss: 0.1678 - accuracy: 0.9436
Epoch 105/150
62/62 [=====] - 2s 35ms/step - loss: 0.1410 - accuracy: 0.9512
Epoch 106/150
62/62 [=====] - 2s 35ms/step - loss: 0.1111 - accuracy: 0.9650
Epoch 107/150
62/62 [=====] - 2s 36ms/step - loss: 0.1732 - accuracy: 0.9378
Epoch 108/150
62/62 [=====] - 2s 36ms/step - loss: 0.1286 - accuracy: 0.9454
Epoch 109/150
62/62 [=====] - 2s 36ms/step - loss: 0.1225 - accuracy: 0.9504
Epoch 110/150
62/62 [=====] - 2s 36ms/step - loss: 0.1150 - accuracy: 0.9499
Epoch 111/150
62/62 [=====] - 2s 36ms/step - loss: 0.1615 - accuracy: 0.9412
Epoch 112/150
62/62 [=====] - 2s 36ms/step - loss: 0.1514 - accuracy: 0.9462
Epoch 113/150
62/62 [=====] - 2s 36ms/step - loss: 0.1309 - accuracy: 0.9551
Epoch 114/150
62/62 [=====] - 2s 36ms/step - loss: 0.1284 - accuracy: 0.9511
Epoch 115/150
62/62 [=====] - 2s 36ms/step - loss: 0.1230 - accuracy: 0.9548
Epoch 116/150
62/62 [=====] - 2s 36ms/step - loss: 0.1314 - accuracy: 0.9491
Epoch 117/150
62/62 [=====] - 2s 36ms/step - loss: 0.1078 - accuracy: 0.9632
Epoch 118/150
62/62 [=====] - 2s 35ms/step - loss: 0.1808 - accuracy: 0.9413
Epoch 119/150
62/62 [=====] - 2s 35ms/step - loss: 0.1127 - accuracy: 0.9544
Epoch 120/150
62/62 [=====] - 2s 36ms/step - loss: 0.1427 - accuracy: 0.9488
Epoch 121/150
62/62 [=====] - 2s 35ms/step - loss: 0.1405 - accuracy: 0.9474
Epoch 122/150
62/62 [=====] - 2s 36ms/step - loss: 0.1148 - accuracy: 0.9591
Epoch 123/150
62/62 [=====] - 2s 36ms/step - loss: 0.1366 - accuracy: 0.9540
Epoch 124/150
62/62 [=====] - 2s 36ms/step - loss: 0.1366 - accuracy: 0.9437
Epoch 125/150
62/62 [=====] - 2s 36ms/step - loss: 0.1487 - accuracy: 0.9457
Epoch 126/150
62/62 [=====] - 2s 36ms/step - loss: 0.1303 - accuracy: 0.9589
Epoch 127/150
62/62 [=====] - 2s 35ms/step - loss: 0.1251 - accuracy: 0.9564
Epoch 128/150
62/62 [=====] - 2s 36ms/step - loss: 0.1277 - accuracy: 0.9545
Epoch 129/150
62/62 [=====] - 2s 36ms/step - loss: 0.1137 - accuracy: 0.9572
Epoch 130/150
62/62 [=====] - 2s 37ms/step - loss: 0.1696 - accuracy: 0.9479
Epoch 131/150
62/62 [=====] - 2s 36ms/step - loss: 0.1075 - accuracy: 0.9529
Epoch 132/150
62/62 [=====] - 2s 36ms/step - loss: 0.1222 - accuracy: 0.9573
Epoch 133/150
62/62 [=====] - 2s 36ms/step - loss: 0.1292 - accuracy: 0.9590
Epoch 134/150
62/62 [=====] - 2s 36ms/step - loss: 0.1355 - accuracy: 0.9491
Epoch 135/150
62/62 [=====] - 2s 36ms/step - loss: 0.1081 - accuracy: 0.9626
Epoch 136/150
62/62 [=====] - 2s 36ms/step - loss: 0.0987 - accuracy: 0.9637
Epoch 137/150
62/62 [=====] - 2s 38ms/step - loss: 0.0945 - accuracy: 0.9626
Epoch 138/150
62/62 [=====] - 2s 44ms/step - loss: 0.1180 - accuracy: 0.9619
Epoch 139/150
62/62 [=====] - 3s 42ms/step - loss: 0.1431 - accuracy: 0.9476
Epoch 140/150
62/62 [=====] - 2s 36ms/step - loss: 0.0863 - accuracy: 0.9670
Epoch 141/150
62/62 [=====] - 2s 36ms/step - loss: 0.0820 - accuracy: 0.9682
Epoch 142/150
62/62 [=====] - 2s 36ms/step - loss: 0.0993 - accuracy: 0.9647
Epoch 143/150
62/62 [=====] - 2s 36ms/step - loss: 0.1304 - accuracy: 0.9567
Epoch 144/150
62/62 [=====] - 2s 36ms/step - loss: 0.1106 - accuracy: 0.9619
Epoch 145/150
62/62 [=====] - 2s 36ms/step - loss: 0.0993 - accuracy: 0.9619
Epoch 146/150
62/62 [=====] - 2s 35ms/step - loss: 0.1118 - accuracy: 0.9574
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62/62 [=====] - 2s 35ms/step - loss: 0.1118 - accuracy: 0.9574
Epoch 193/150
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Epoch 231/150
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Epoch 232/150
62/62 [=====] - 2s 35ms/step - loss: 0.1118 - accuracy: 0.9574

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