

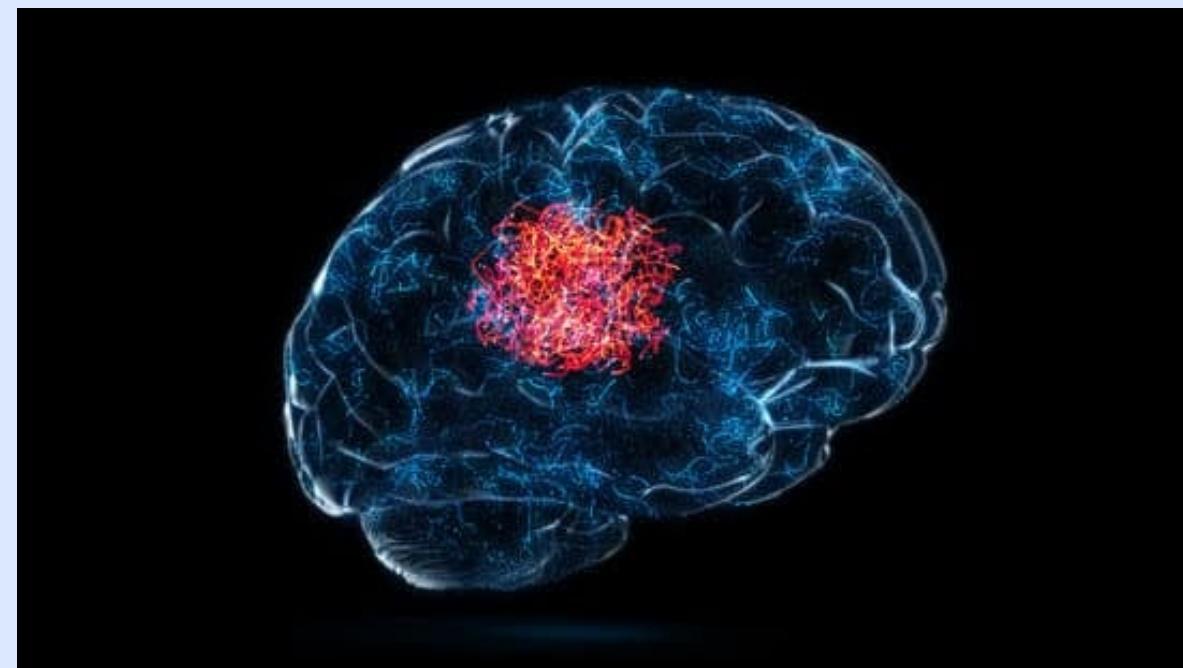
USECASE

BRAIN TUMORS

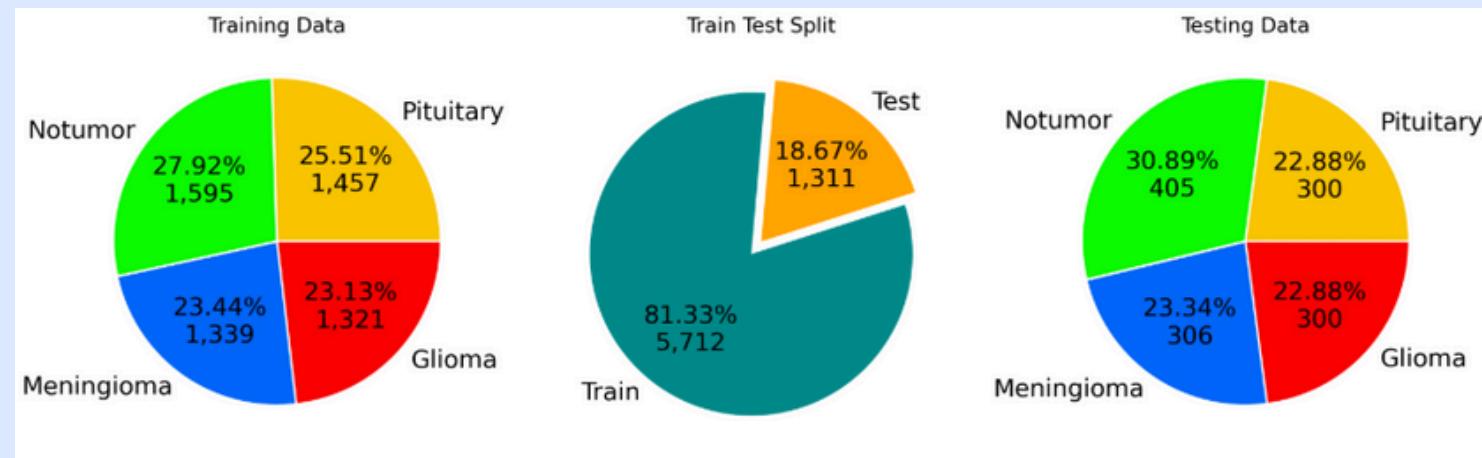
Team Name: Adi & Les

PROBLEM DEFINITION

The objective of this UseCase, is to clasify different types of brain tumors with models of CNN using image clasification



DATASET DESCRIPTION



Training: Found 5712 images belonging to 4 classes.

Test: Found 1311 images belonging to 4 classes.
8,334 Images

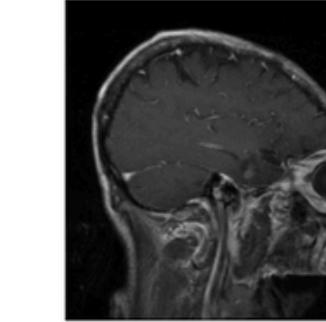
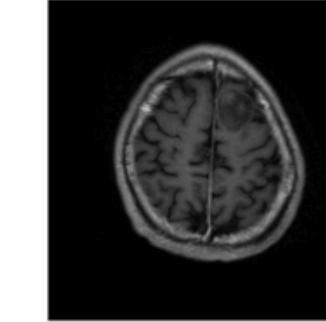
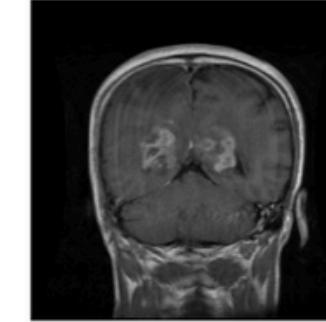
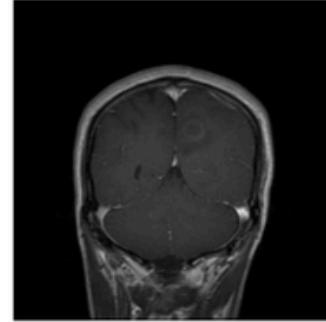
Classes: Glioma, Meningioma, Notumor, Pituitary'



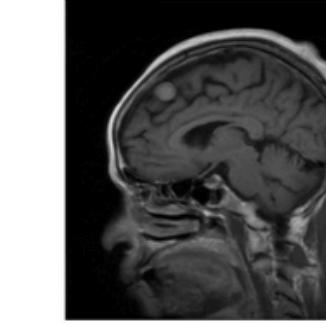
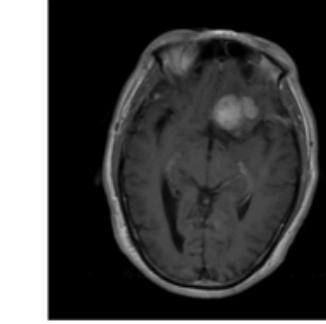
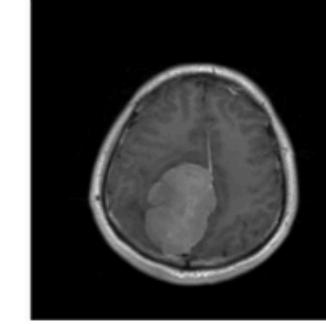
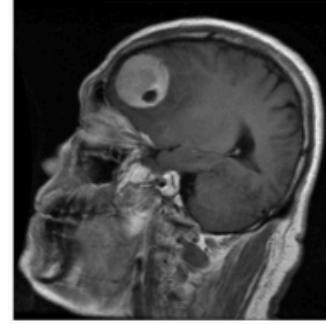
Image Size: 225px * 225px
GrayScale

Muestra de Imágenes por Clase del Dataset de Entrenamiento

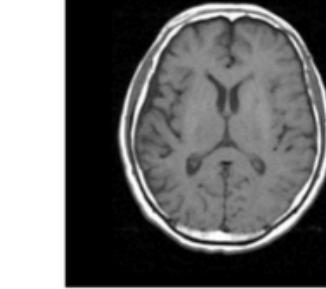
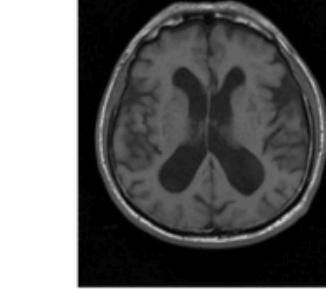
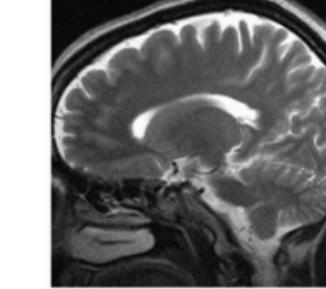
glioma



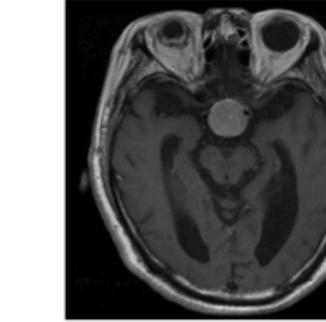
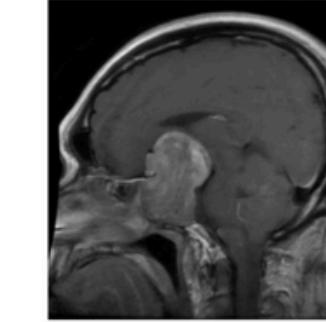
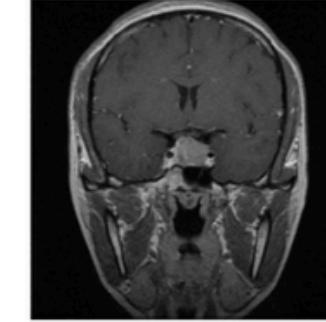
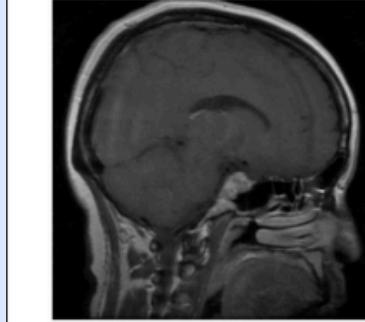
meningioma



notumor



pituitary



SOLUTION APPROACH

IMAGE PREPROCESSING

```
IMG_SIZE = (150, 150)  
BATCH_SIZE = 32
```

```
train_datagen = ImageDataGenerator(  
    rescale=1./255,  
    rotation_range=10,  
    brightness_range=(0.85, 1.15),  
    width_shift_range=0.002,  
    height_shift_range=0.002,  
    shear_range=12.5,  
    zoom_range=0,  
    horizontal_flip=True,  
    vertical_flip=False,  
    fill_mode="nearest")
```

- ★ Resizing. All images were standardized to a size of 150x150 px.
- ★ Normalization. Pixel values were rescaled to a [0, 1] range.

DATA AUGMENTATION

Applied transformations

- ★ Geometric variations.
- ★ Contrast simulation.
- ★ Anatomical symmetry.

Deliberate exclusions

- ★ No vertical flipping.
- ★ No significant zoom.

MODEL PERFORMANCE

ANALYSIS

MODEL #1

Params

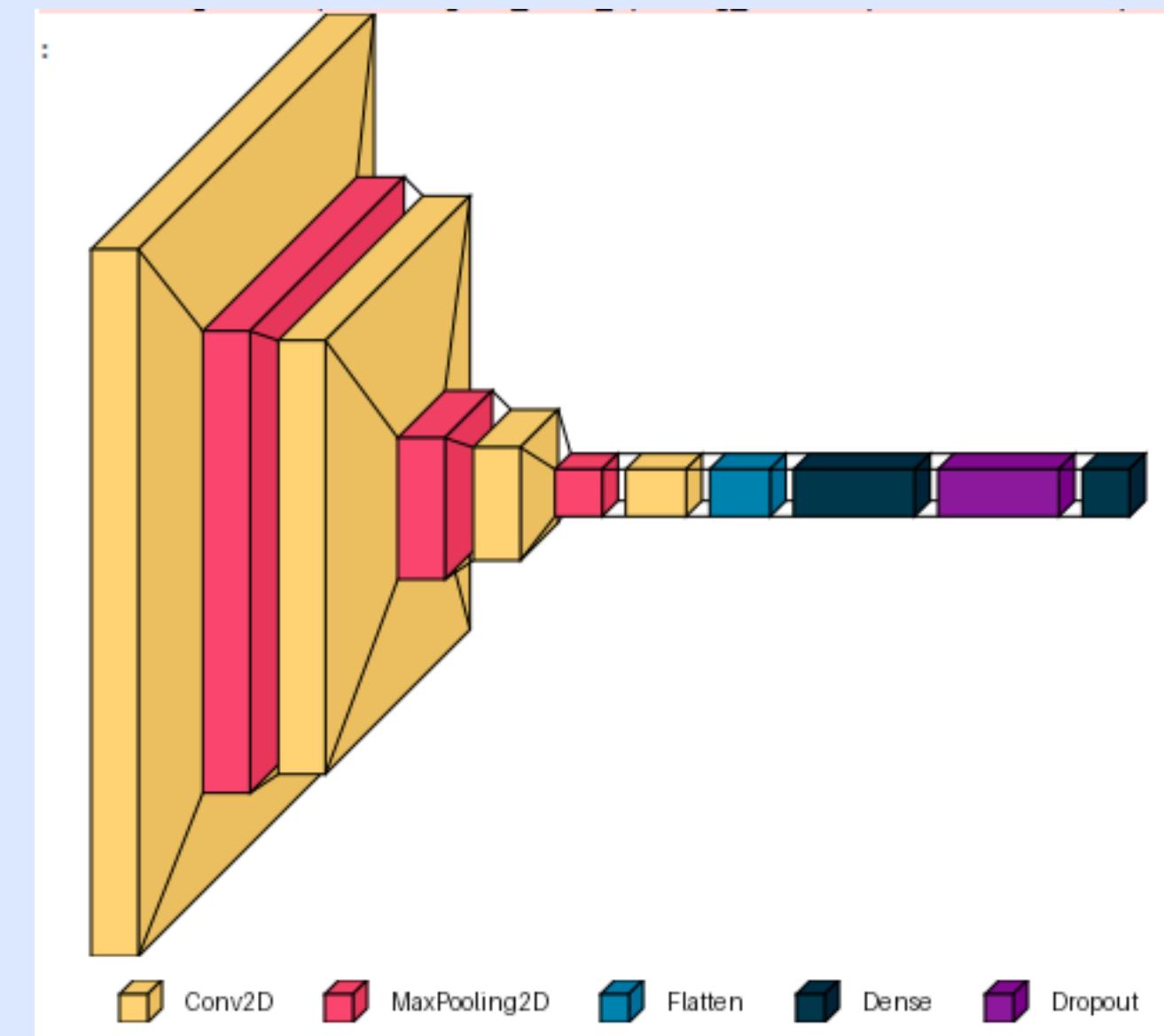
Layer (type)	Output Shape	Param #
conv2d_22 (Conv2D)	(None, 147, 147, 32)	1,568
max_pooling2d_18 (MaxPooling2D)	(None, 49, 49, 32)	0
conv2d_23 (Conv2D)	(None, 46, 46, 64)	32,832
max_pooling2d_19 (MaxPooling2D)	(None, 15, 15, 64)	0
conv2d_24 (Conv2D)	(None, 12, 12, 128)	131,200
max_pooling2d_20 (MaxPooling2D)	(None, 4, 4, 128)	0
conv2d_25 (Conv2D)	(None, 1, 1, 256)	524,544
flatten_6 (Flatten)	(None, 256)	0
dense_12 (Dense)	(None, 512)	131,584
dropout_6 (Dropout)	(None, 512)	0
dense_13 (Dense)	(None, 4)	2,052

Total params: 823,780 (3.14 MB)

Trainable params: 823,780 (3.14 MB)

Non-trainable params: 0 (0.00 B)

Visualization



MODEL PERFORMANCE

ANALYSIS

MODEL #2

Params

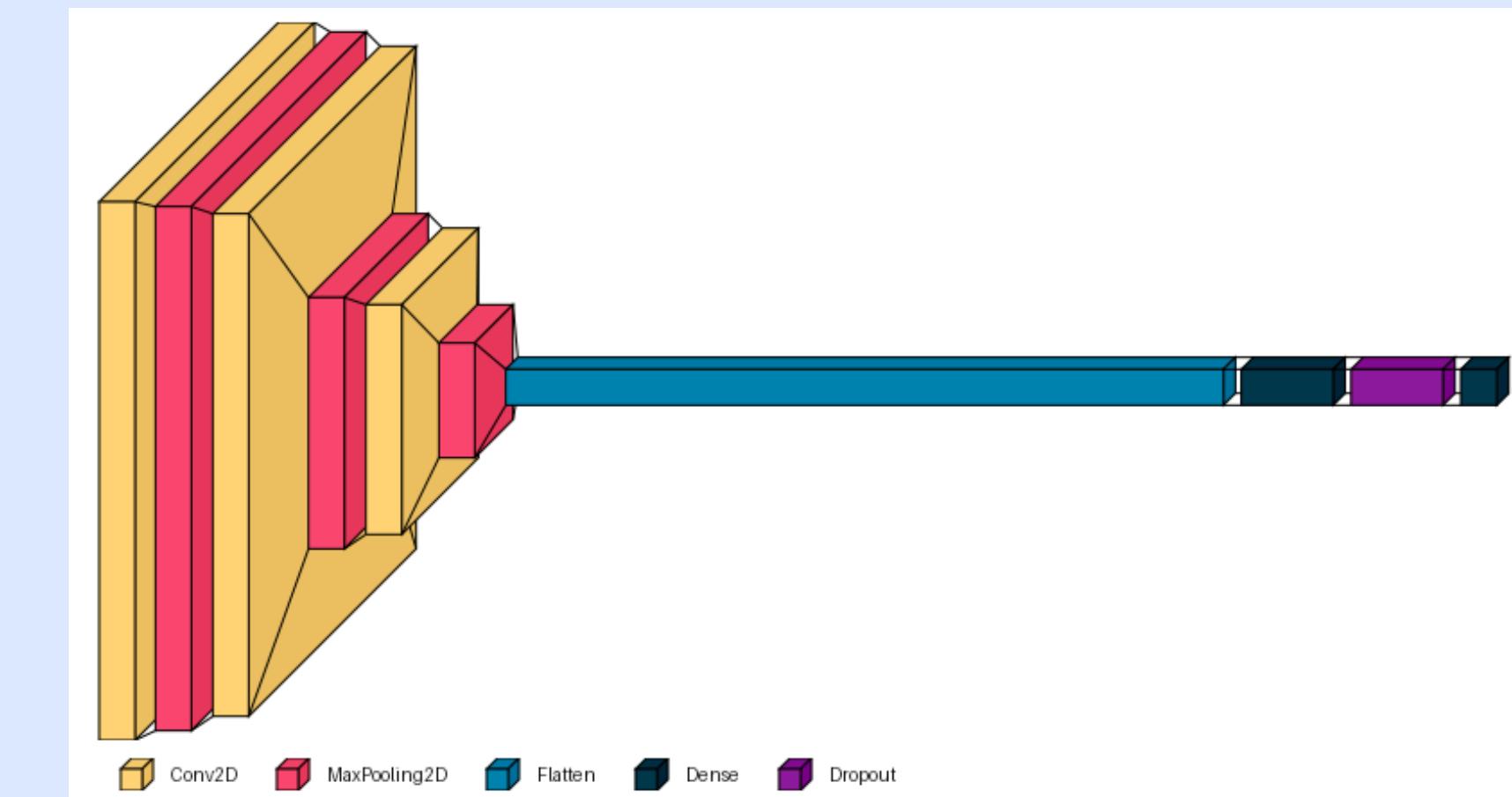
Layer (type)	Output Shape	Param #
conv2d_26 (Conv2D)	(None, 147, 147, 32)	1,568
max_pooling2d_21 (MaxPooling2D)	(None, 73, 73, 32)	0
conv2d_27 (Conv2D)	(None, 70, 70, 64)	32,832
max_pooling2d_22 (MaxPooling2D)	(None, 35, 35, 64)	0
conv2d_28 (Conv2D)	(None, 32, 32, 128)	131,200
max_pooling2d_23 (MaxPooling2D)	(None, 16, 16, 128)	0
flatten_7 (Flatten)	(None, 32768)	0
dense_14 (Dense)	(None, 512)	16,777,728
dropout_7 (Dropout)	(None, 512)	0
dense_15 (Dense)	(None, 4)	2,052

Total params: 16,945,380 (64.64 MB)

Trainable params: 16,945,380 (64.64 MB)

Non-trainable params: 0 (0.00 B)

Visualization



MODEL PERFORMANCE

ANALYSIS

MODEL #3

Params

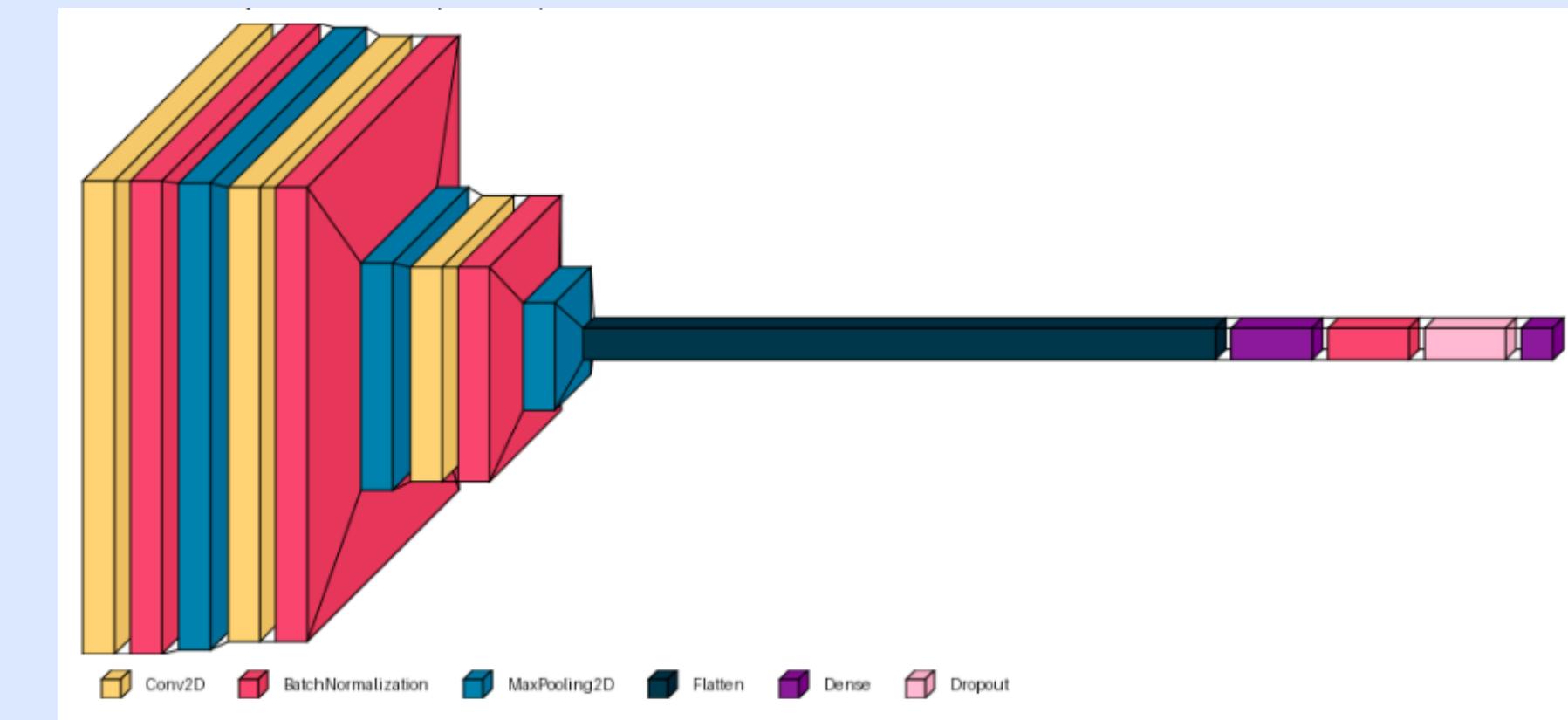
Layer (type)	Output Shape	Param #
Conv1_M3 (Conv2D)	(None, 148, 148, 32)	896
BN1_M3 (BatchNormalization)	(None, 148, 148, 32)	128
Pool1_M3 (MaxPooling2D)	(None, 74, 74, 32)	0
Conv2_M3 (Conv2D)	(None, 72, 72, 64)	18,496
BN2_M3 (BatchNormalization)	(None, 72, 72, 64)	256
Pool2_M3 (MaxPooling2D)	(None, 36, 36, 64)	0
Conv3_M3 (Conv2D)	(None, 34, 34, 128)	73,856
BN3_M3 (BatchNormalization)	(None, 34, 34, 128)	512
Pool3_M3 (MaxPooling2D)	(None, 17, 17, 128)	0
Flatten_M3 (Flatten)	(None, 36992)	0
Dense_M3 (Dense)	(None, 512)	18,940,416
BN4_M3 (BatchNormalization)	(None, 512)	2,048
Dropout_M3 (Dropout)	(None, 512)	0
Output_M3 (Dense)	(None, 4)	2,052

Total params: 19,038,660 (72.63 MB)

Trainable params: 19,037,188 (72.62 MB)

Non-trainable params: 1,472 (5.75 KB)

Visualization

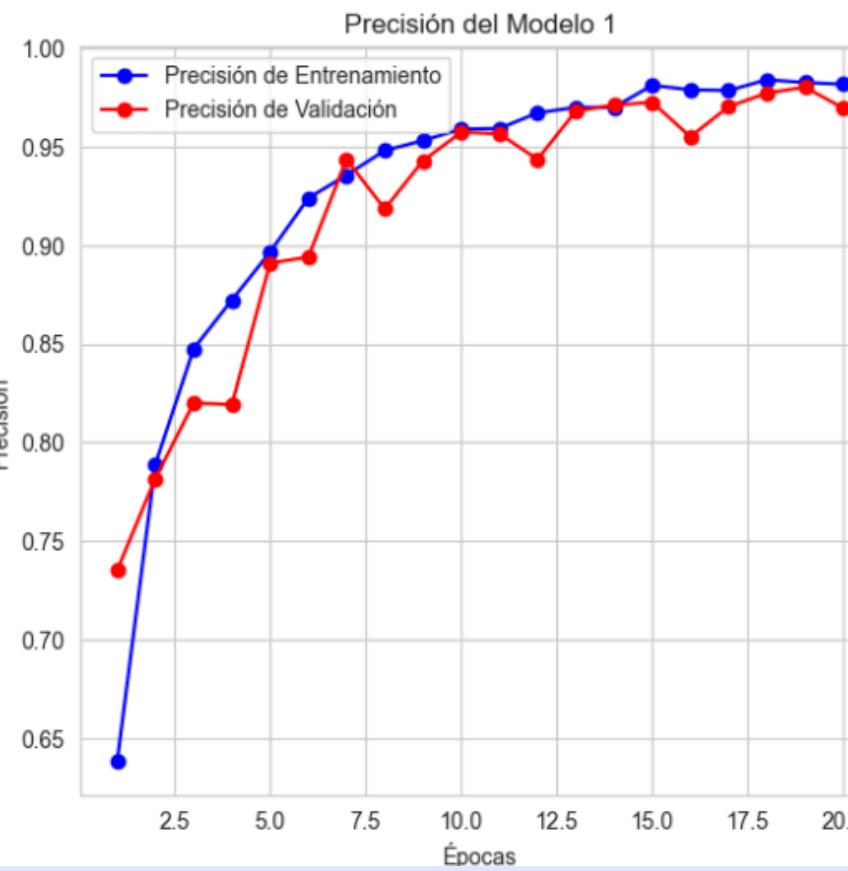


Model Performance Analysis

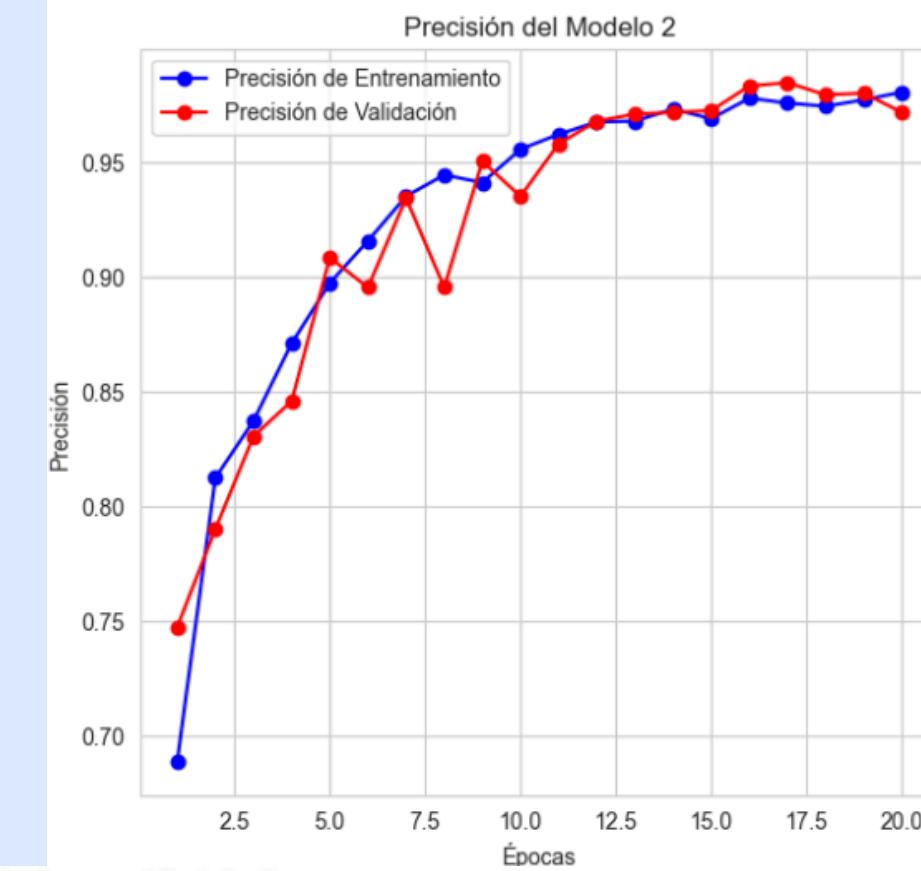
```
41/41 ----- 2s 46ms/step - accuracy: 0.9486 - loss: 0.1550
Modelo 1
Pérdida en el conjunto de prueba: 0.0977
Precisión en el conjunto de prueba: 96.95%
41/41 ----- 3s 67ms/step - accuracy: 0.9581 - loss: 0.1473
Modelo 2
Pérdida en el conjunto de prueba: 0.1007
Precisión en el conjunto de prueba: 97.18%
41/41 ----- 3s 65ms/step - accuracy: 0.9274 - loss: 0.4166
Modelo 3
Pérdida en el conjunto de prueba: 0.4405
Precisión en el conjunto de prueba: 93.97%
```

Final results

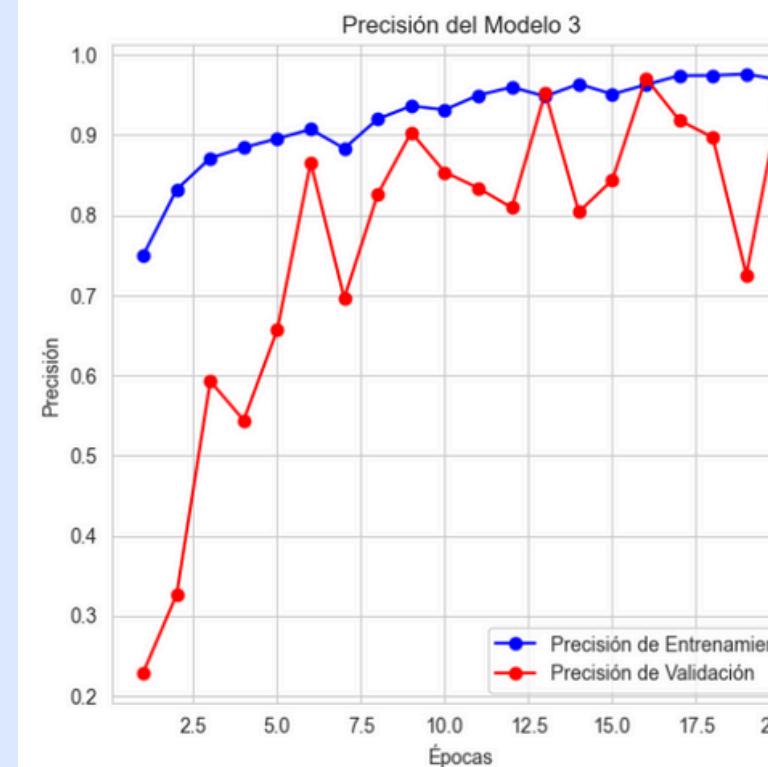
Curvas de Aprendizaje para Modelo 1



Curvas de Aprendizaje para Modelo 2

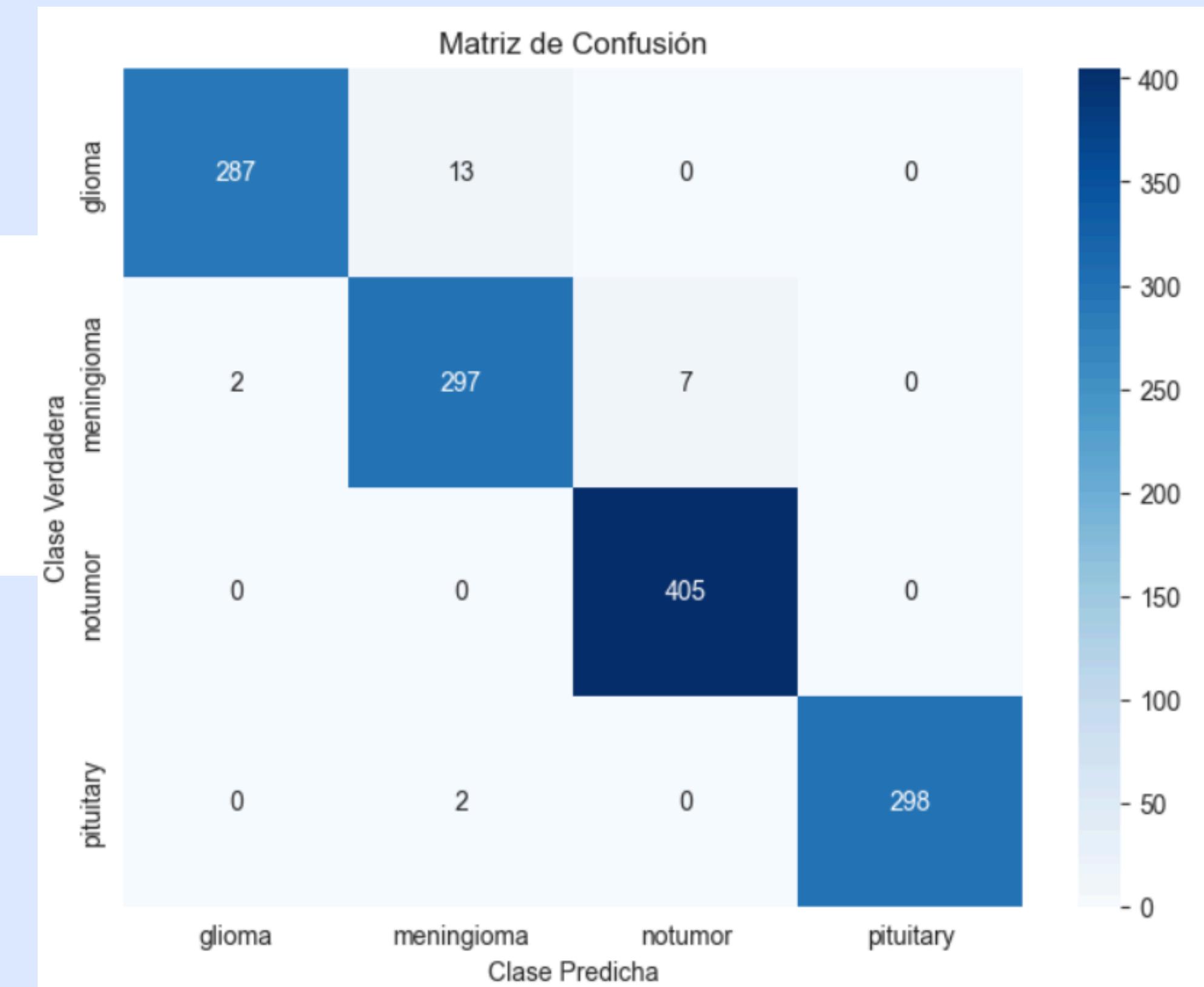


Curvas de Aprendizaje para Modelo 3



Final Result Model 2

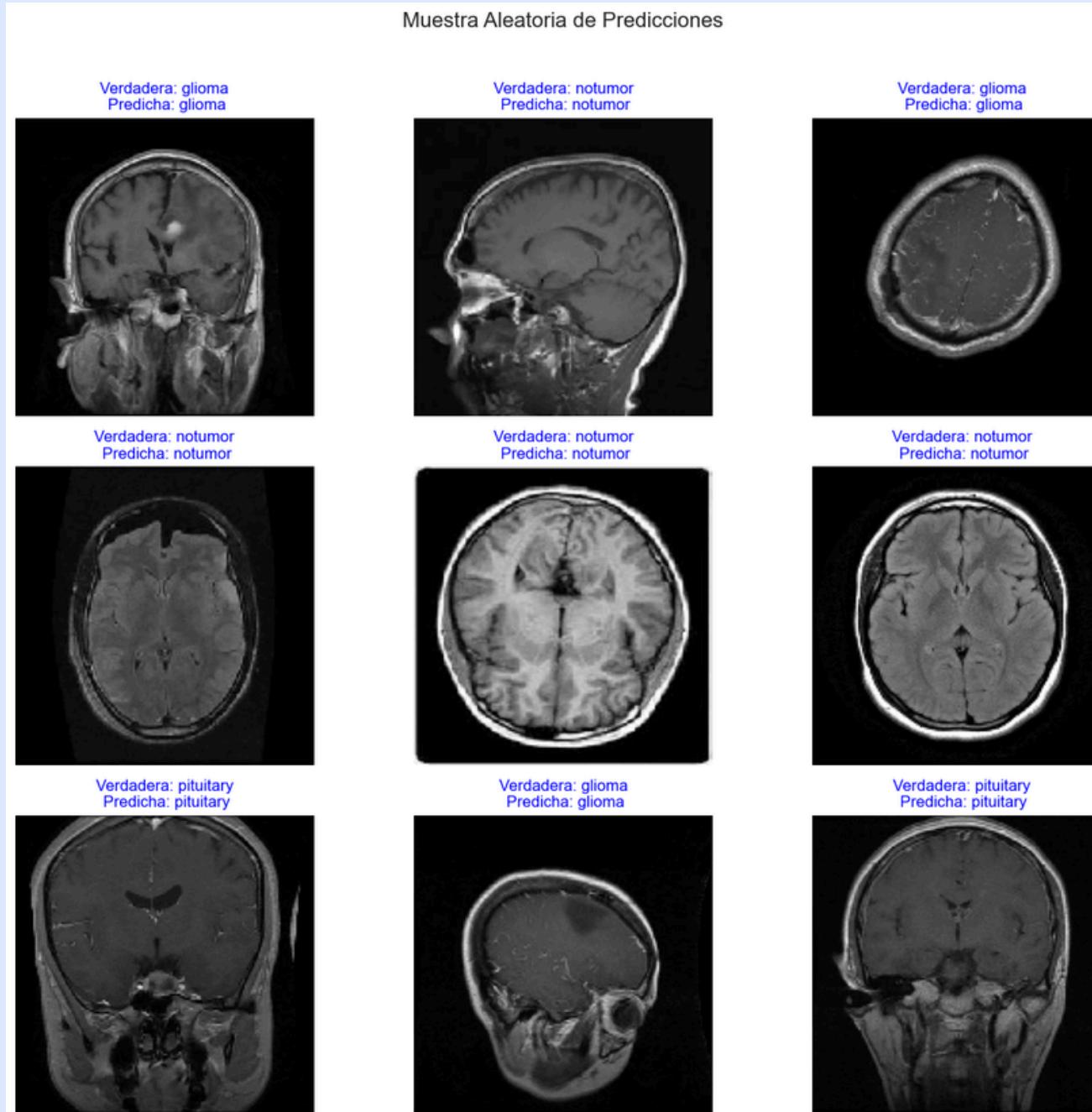
	precision	recall	f1-score
glioma	0.99	0.96	0.97
meningioma	0.95	0.97	0.96
notumor	0.98	1.00	0.99
pituitary	1.00	0.99	1.00



Final results

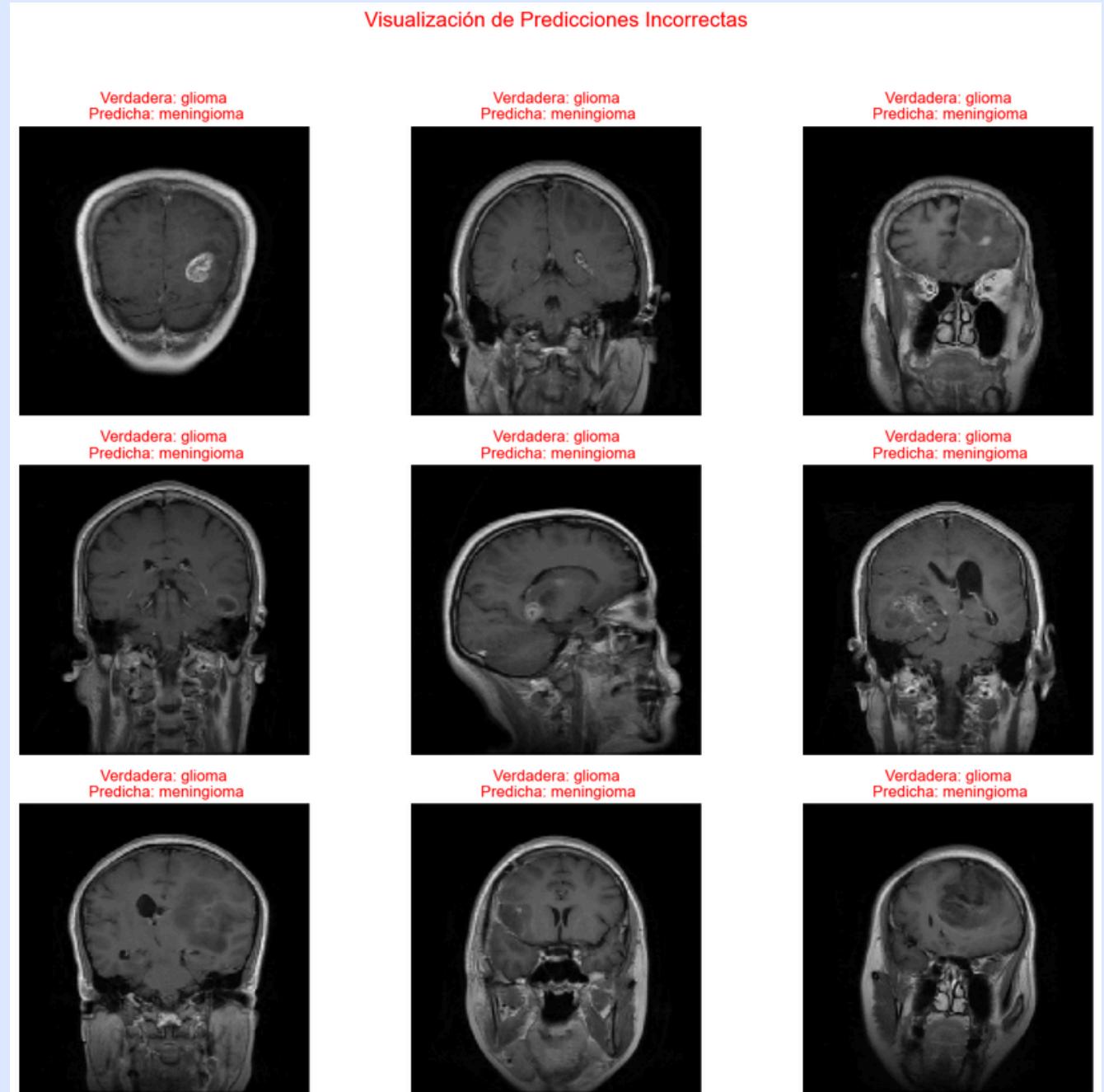
Correct Prediction

Muestra Aleatoria de Predicciones



Incorrect Prediction

Visualización de Predicciones Incorrectas



**THANKS
4 YOUR
ATTENTION**