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ABSTRACT

- Brain tumor classification is a crucial task to evaluate the tumors and make a treatment decision according to their classes. There are many imaging techniques used to detect brain tumors. However, MRI is commonly used due to its superior image quality and the fact of relying on no ionizing radiation. Deep learning (DL) is a subfield of machine learning and recently showed a remarkable performance, especially in classification and segmentation problems. In this paper, a DL model based on a convolutional neural network is proposed to classify different brain tumor types using two publicly available datasets. The former one classifies tumors into (meningioma, glioma, and pituitary tumor). The other one differentiates between the three glioma grades (Grade II, Grade III, and Grade IV). The datasets include 233 and 73 patients with a total of 3064 and 516 images on T1-weighted contrast-enhanced images for the first and second datasets, respectively. The proposed network structure achieves a significant performance with the best overall accuracy of 96.13% and 98.7%, respectively, for the two studies. The results indicate the ability of the model for brain tumor multi-classification purposes.

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Architecture Used In Paper

- Multi-Classification of Brain Tumor Images Using Deep Neural Network

Dataset Used In the Architecture:

- Brain Tumor dataset consists of 7020 Samples 512x512 divided into 4 classes (glioma – meningioma – notumor – pituitary) 68% for training and 32% for validation.

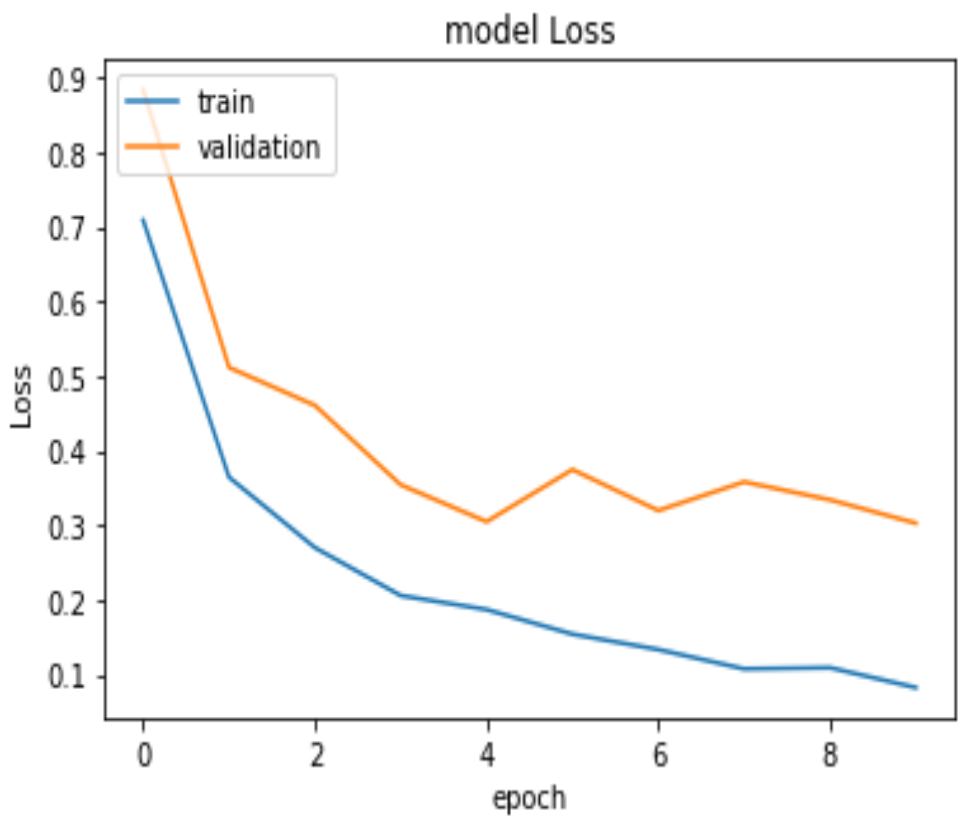
Implementation Details:

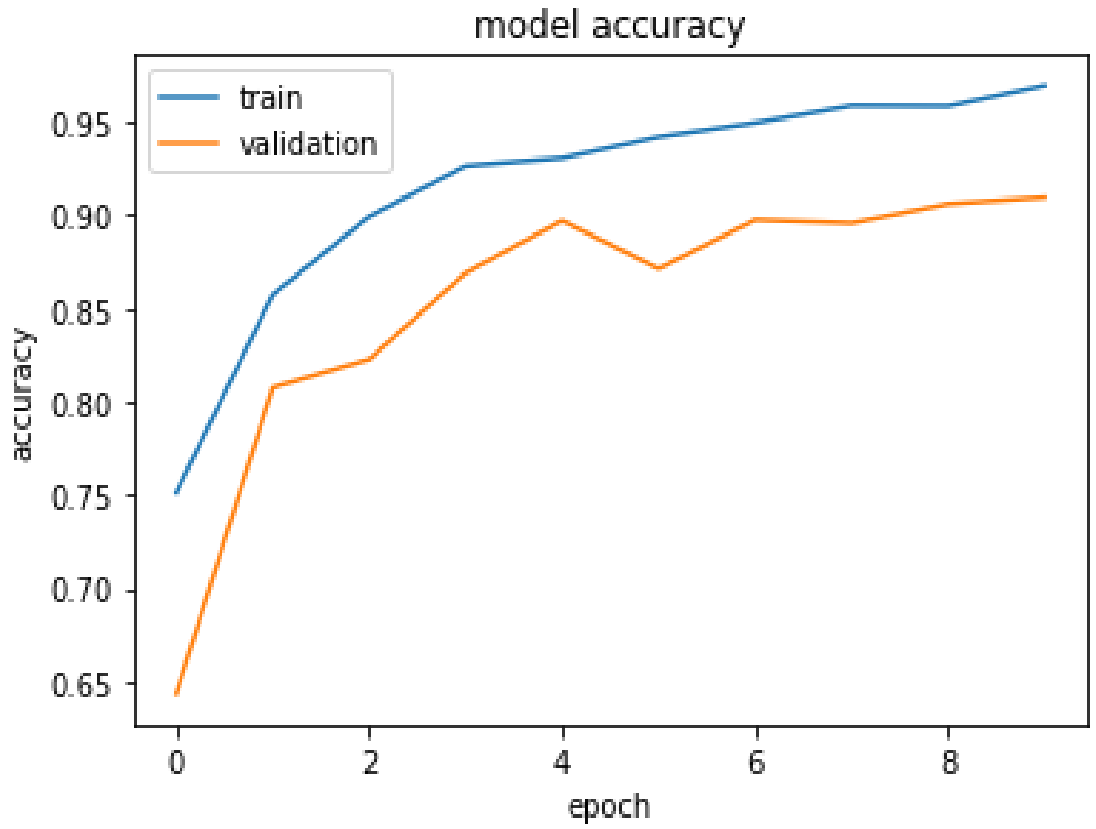
- We used the Datagenerator for the preprocessing with Rescaling of 1.0/255. , Color mode :grayscale, Target size(128,128).
- Splitted the dataset into 68% Training 32 Validation.
- Built the model with the Sequential method consists of 12 Layers (3 Conv2D , 1 BatchNormalization , 3 MaxPool2D, 2 Dropout, 1 Flatten , 2 NN)
- Filters (8,16,32)
- Kernel_size (5,3,2)
- Strides (2)
- Pool Size (2,2)
- Dropout (0.25 , 0.5)
- Padding (same)

Implementation Details:

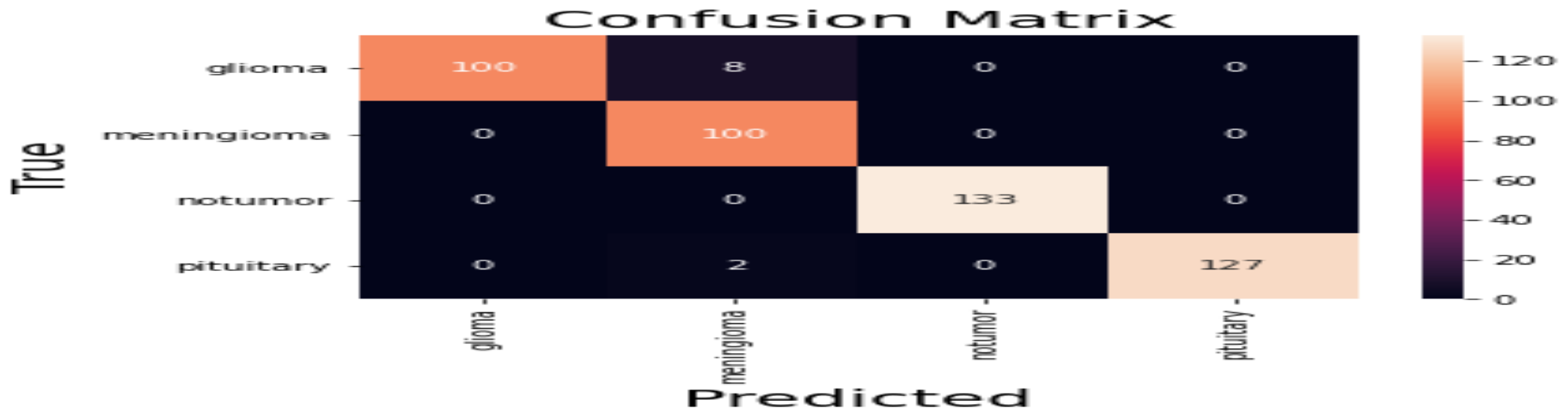
```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 128, 128, 8)       208

 batch_normalization (BatchN  (None, 128, 128, 8)      32
 ormalization)

 max_pooling2d (MaxPooling2D  (None, 64, 64, 8)        0
 )

 conv2d_1 (Conv2D)           (None, 64, 64, 16)        1168

 max_pooling2d_1 (MaxPooling  (None, 32, 32, 16)       0
 2D)

 dropout (Dropout)           (None, 32, 32, 16)        0

 conv2d_2 (Conv2D)           (None, 32, 32, 32)        2080

 max_pooling2d_2 (MaxPooling  (None, 16, 16, 32)       0
 2D)

 dropout_1 (Dropout)         (None, 16, 16, 32)        0

 flatten (Flatten)           (None, 8192)              0

 dense (Dense)               (None, 256)               2097408

 dense_1 (Dense)             (None, 4)                 1028

=================================================================
Total params: 2,101,924
Trainable params: 2,101,908
Non-trainable params: 16
```

Model results and visualization:





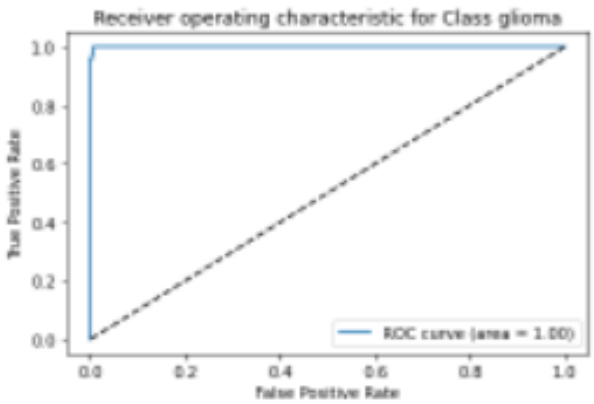
Confusion Matrix

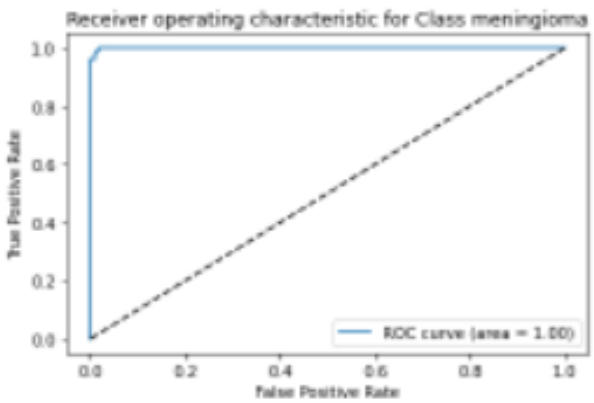


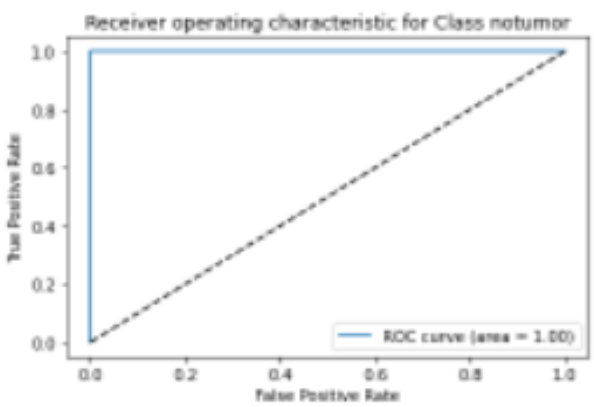
Classification Report

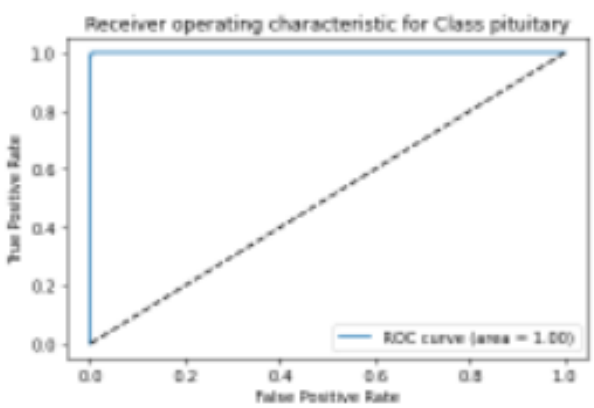
	precision	recall	f1-score	support
0	1.00	0.93	0.96	108
1	0.91	1.00	0.95	100
2	1.00	1.00	1.00	133
3	1.00	0.98	0.99	129
accuracy			0.98	470
macro avg	0.98	0.98	0.98	470
weighted avg	0.98	0.98	0.98	470

Roc Curv


Receiver operating characteristic for Class glioma
True Positive Rate
False Positive Rate
ROC curve (area = 1.00)


Receiver operating characteristic for Class meningioma
True Positive Rate
False Positive Rate
ROC curve (area = 1.00)


Receiver operating characteristic for Class notumor
True Positive Rate
False Positive Rate
ROC curve (area = 1.00)


Receiver operating characteristic for Class pituitary
True Positive Rate
False Positive Rate
ROC curve (area = 1.00)