Classification Of Brain Tumours Types Based On MRI Images Using Mobilenet

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Introduction

- MRI helps to detects soft tissue abnormalities, including brain tumors.
- Deep learning techniques has high role in this.
- MobileNet is a CNN model.
- It has high accuracy and computational efficiency.
- MobileNet helps to classify different types of brain tumors based on MRI images.
- This test has 94% of Accuracy.
- The version of MobileNet used for this is MobileNet V2 140×224 .

Keywords

- Brain tumour
- MRI
- Mobilenet
- Deep Learning
- Transfer Learning
- Classification

Related works

- Brain tumour.
- Deep learning and brain tumours(CNN).
- Automated brain tumour segmentation(DCNN).
- Health informatics and deep leaning (SVM,GBM) .

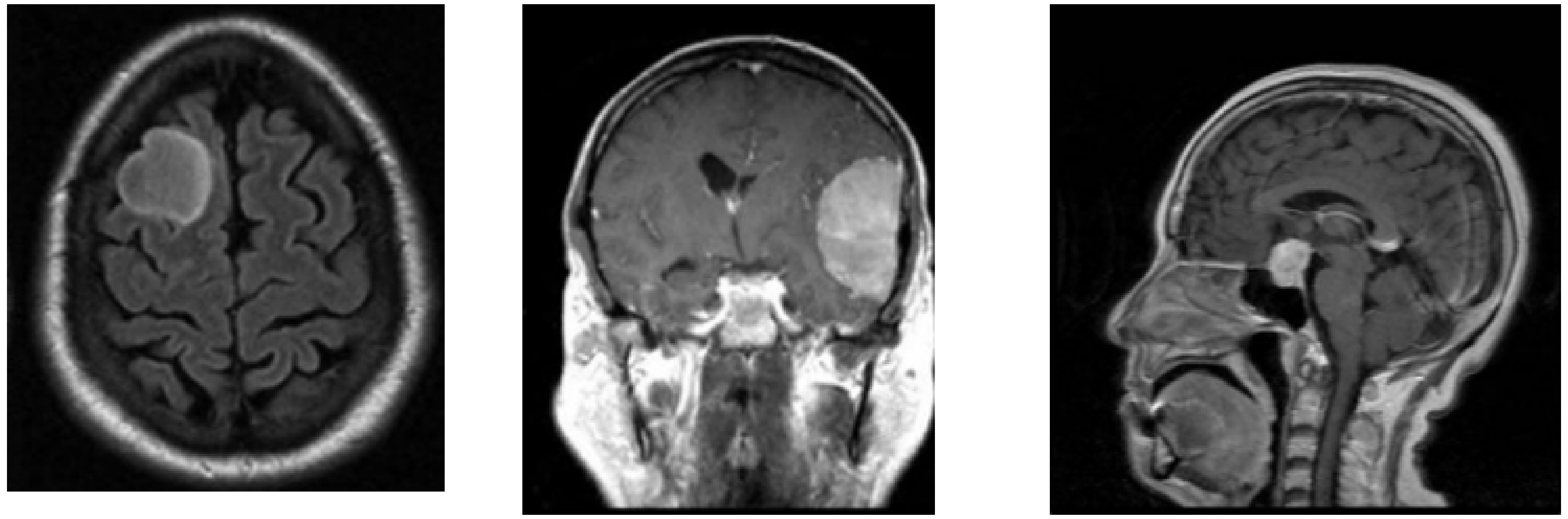


Fig. 1. Sample brain tumours image MRI

Methodology

- Dataset
- Transfer Learning
- MobileNet
- Experiment

1. Dataset

- Three different Brain tumour MR images are used.
- Every image is having a size of 512 x 512 pixels with 2475 images.
- We divide the dataset into 80% training, 10% validation, and 10% testing

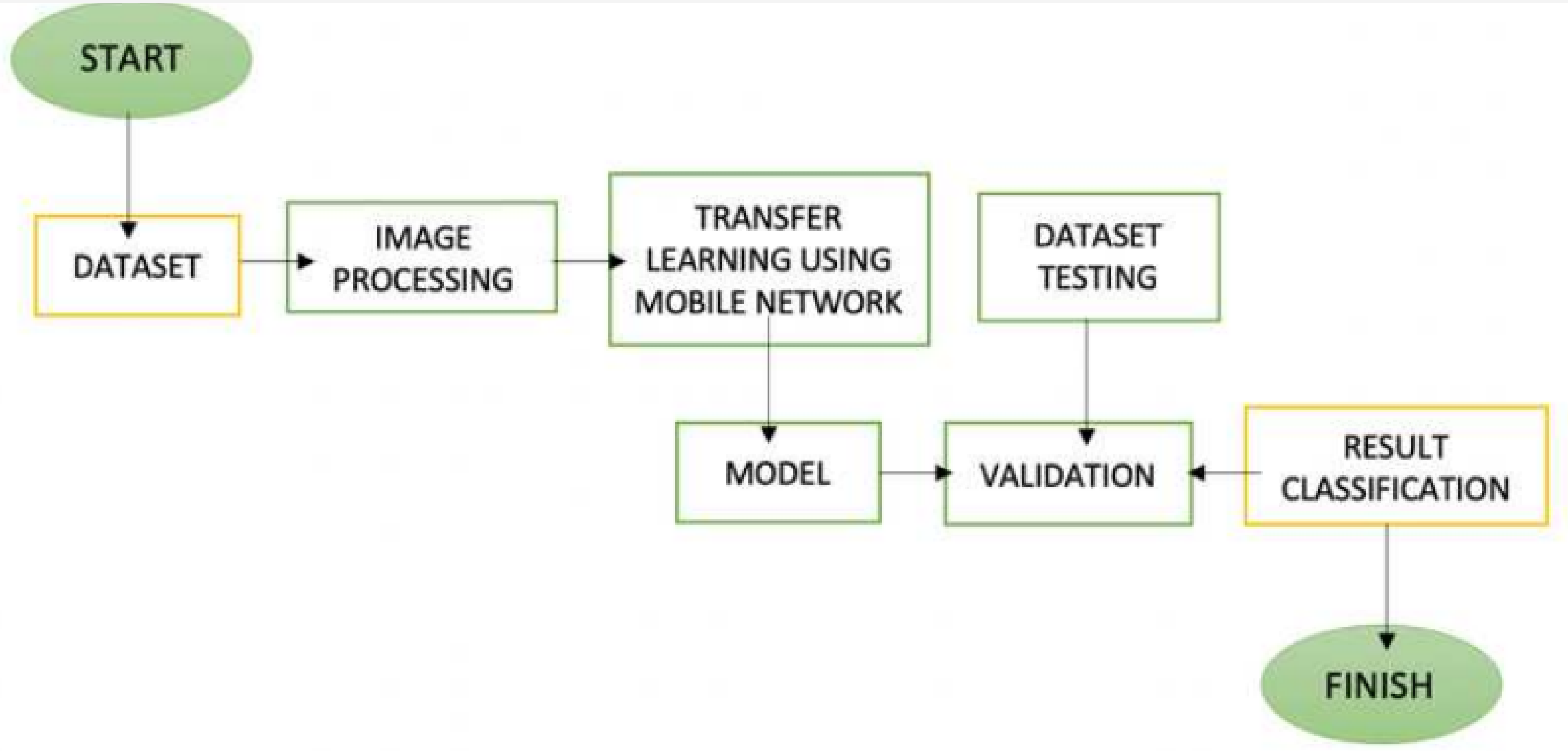


Figure 2.Show flow diagram

TABLE 1. LIST THE NUMBER OF DIVIDED DATASETS.

Class	**Total**	**Training 80%**	**Validation 10%**	**Testing 10%**
Glioma	826	676	75	75
Meningioma	822	674	74	74
Pituitary	827	677	75	75
Sub Total	**2475**	**2027**	**224**	**224**

2.Transfer Learning

- It uses a previously trained model.
- Neural Network takes more time for training data.
- It uses small training data for studying
- One technique is to transfer knowledge of other pre-trained neural network models into a model.
- This is also know as self-taught learning.

3.MobileNet

- One of the CNN architecture.
- It divides convolution into depthwise convolution and pointwise convolution.
- It utilizes Batch Normalization (BN) and Rectified-Linear units (ReLU).

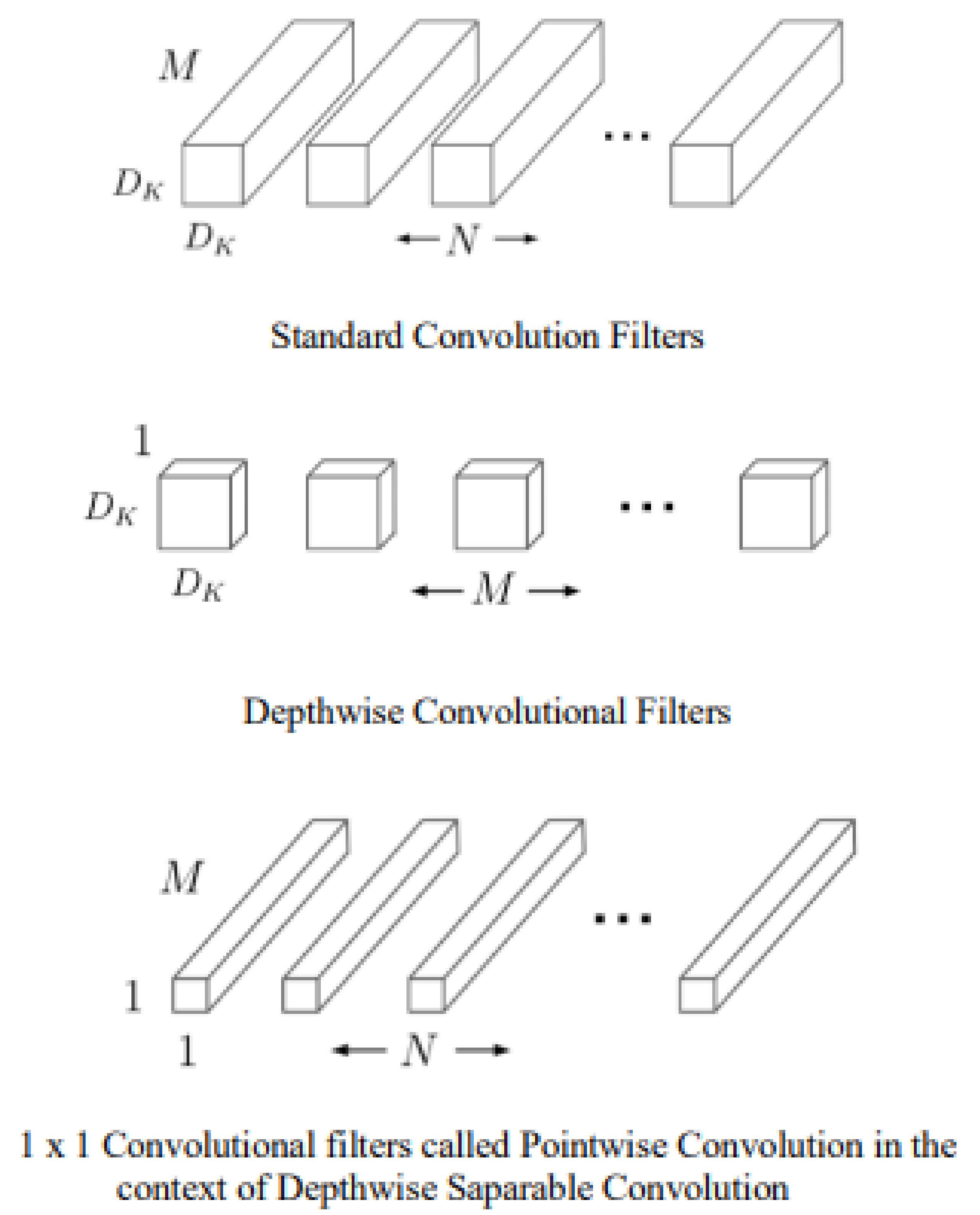


Figure 3. Convolution standard

- Left side Standard convolutional layer with the batch norm and ReLU.
- The structure of MobileNet divided parts into deep separable convolutions .
- It is easy to explore the network topology to a better network.

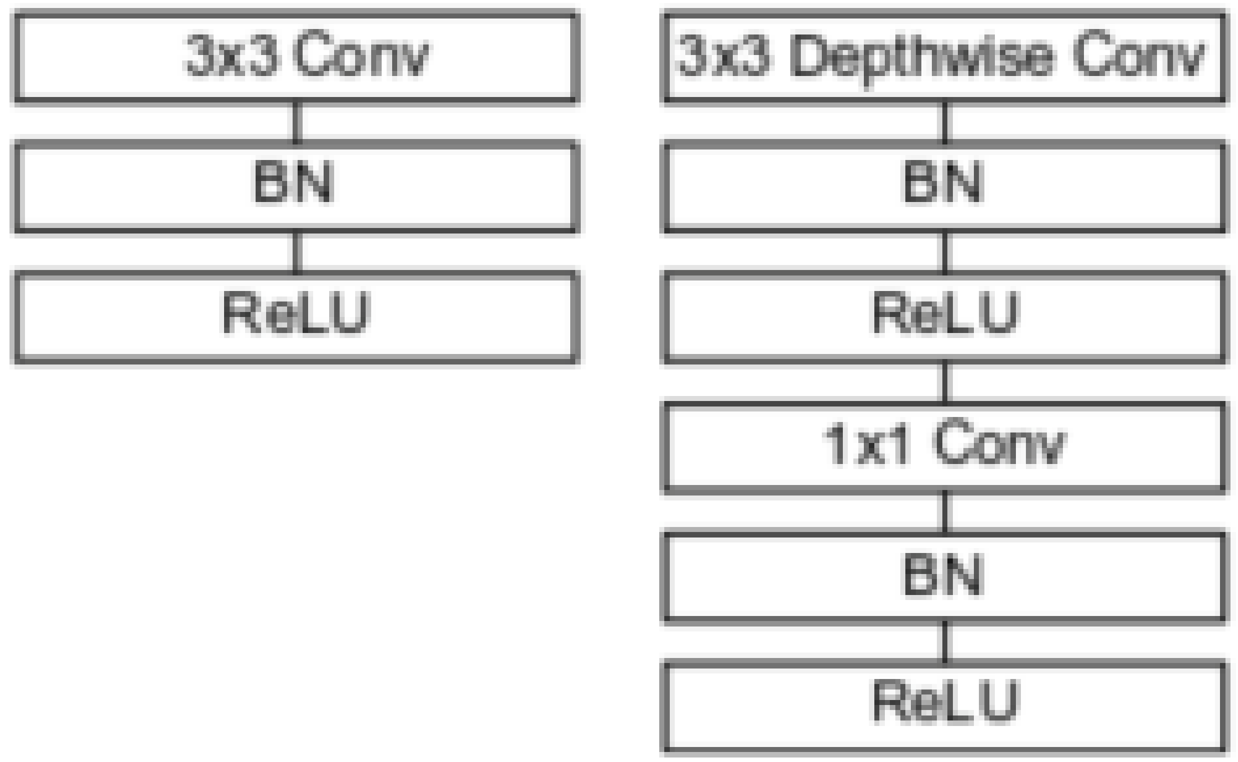


Figure 4. Convolution layer

TABLE 2. DEFAULT INPUT IMAGES OF MOBILENETV2.

Model	Input size
Mobilenet V2	100 x 224
Mobilenet V2	130 x 224
Mobilenet V2	140 x 224

- MobileNetV2 still uses depthwise and pointwise convolution.
- MobileNetV2 adds two new features:

  linear bottlenecks and

  shortcut connections between bottlenecks

MobileNetV2

- Inverted Residual Structure.
- Depthwise Separable Convolutions.
- Bottleneck Design.
- Linear Bottlenecks.

4.Experiment

- It is compiled using the Python programming language.
- Use transfer learning with the latest CNN model, r Mobilenet.
- Use mobilenet_v2_140_224 with a batch_size of 32
- This experiment uses 25 training epochs and momentum with a learning rate of 0,01.
- 80% training data, 10% validation and 10% testing

TABLE 3.MOBILENETV2 ARCHITECTURE

Input	Operator	*t*	*c*	*n*	*s*
224^2 x 3	Conv2d	-	32	1	2
112^2 x 32	Bottleneck	1	16	1	1
112^2 x 16	Bottleneck	6	24	2	2
56^2 x 24	Bottleneck	6	32	3	2
28^2 x 32	Bottleneck	6	64	4	2
14^2 x 64	Bottleneck	6	96	3	1
14^2 x 96	Bottleneck	6	160	3	2
7^2 x 160	Bottleneck	6	320	1	1
7^2 x 320	Conv2d 1x1	-	1280	1	1
7^2 x 1280	Avgpool 7 x 7	-	-	1	-
1 x 1 x 1280	Conv2d 1x1	-	k	-	

Result and Descussion

- It test the medical image classification network using the Mobilenet model.
- Encountered an error while we were fine-tuning the model.
- get maximum accuracy results on Mobilenet_v2_140_224.

TABLE 4. COMPARISON OF TRAINING ACCURACY AND TESTING ACCURACY

Model	Fine Tuning	Accuracy Testing (%)	Accuracy Training (%)
Mobilenetv2 100 x 224	True	90	98.60
Mobilenetv2 100 x 224	False	82	79.45
Mobilenetv2 130 x 224	True	91	100
Mobilenetv2 130 x 224	False	86	83.91
Mobilenetv2 140 x 224	**True**	**94**	**100**
Mobilenetv2 140 x 224	False	81	76.44

TABLE 5. SHOWS CONFUSION MATRIX OF THE CLASS DATASET.

Class	Precision	Recall	F1-Score
Glioma	91%	95%	93%
Meningioma	93%	89%	91%
Pituatitary	99%	99%	99%

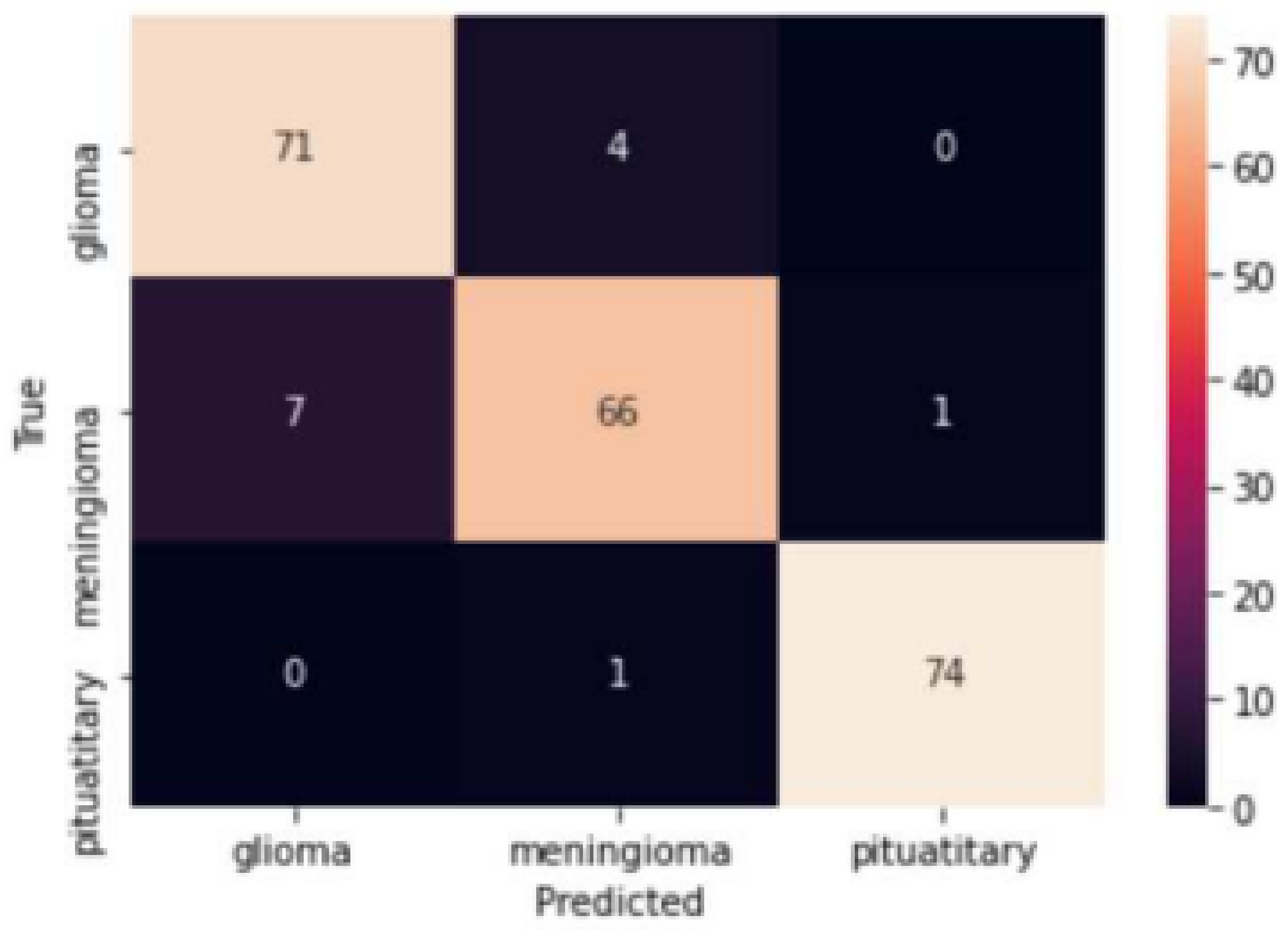
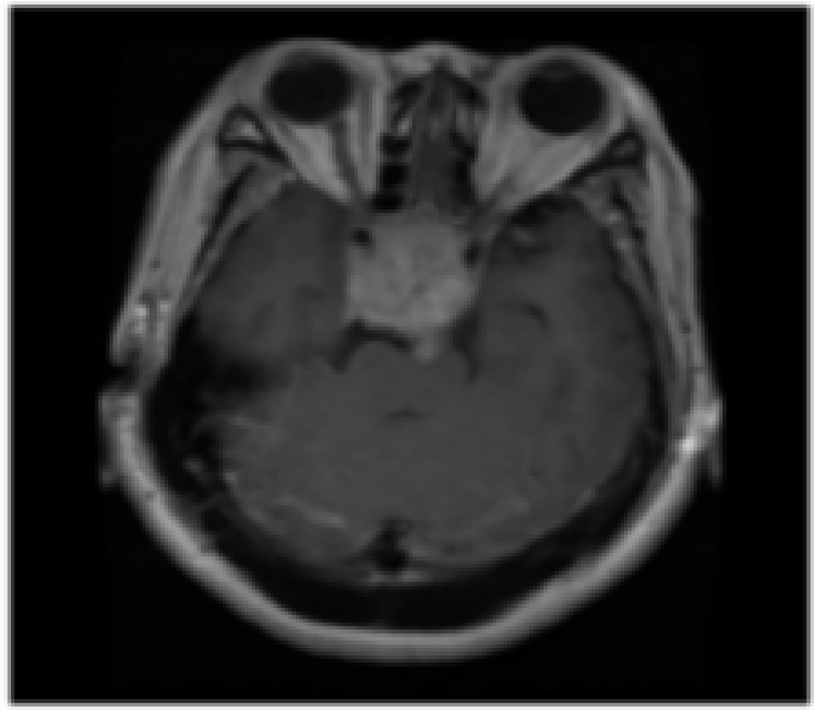
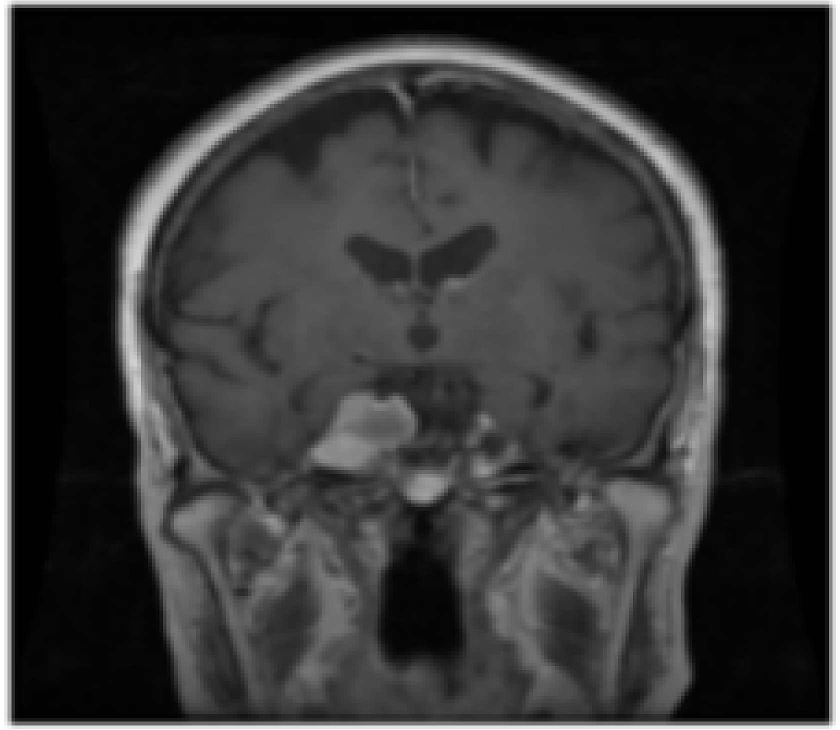


Figure 5. Show maps of confusion matrix.



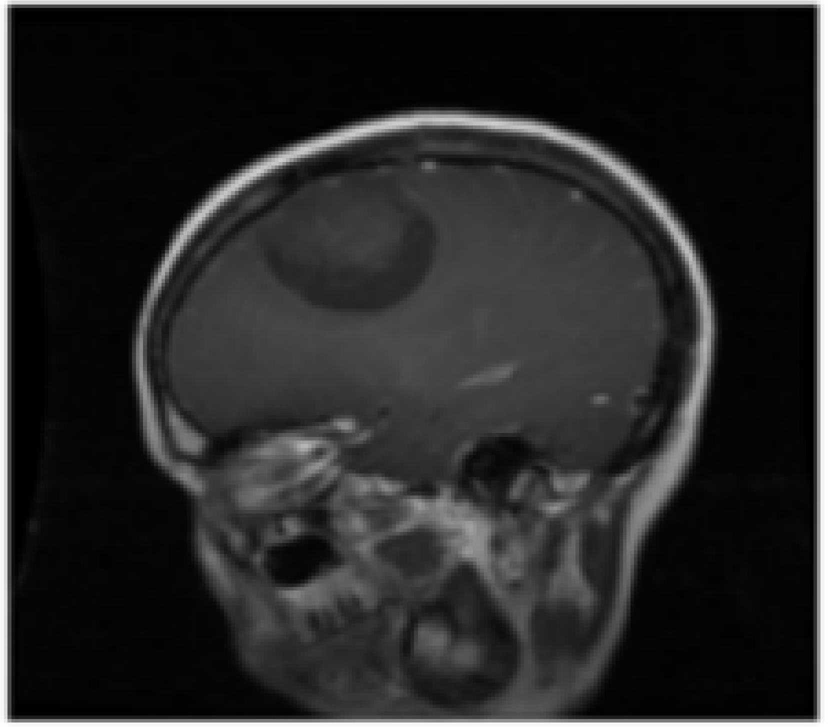
True label : Pituitary

Predicted label : Pituitary



True label : Meningioma

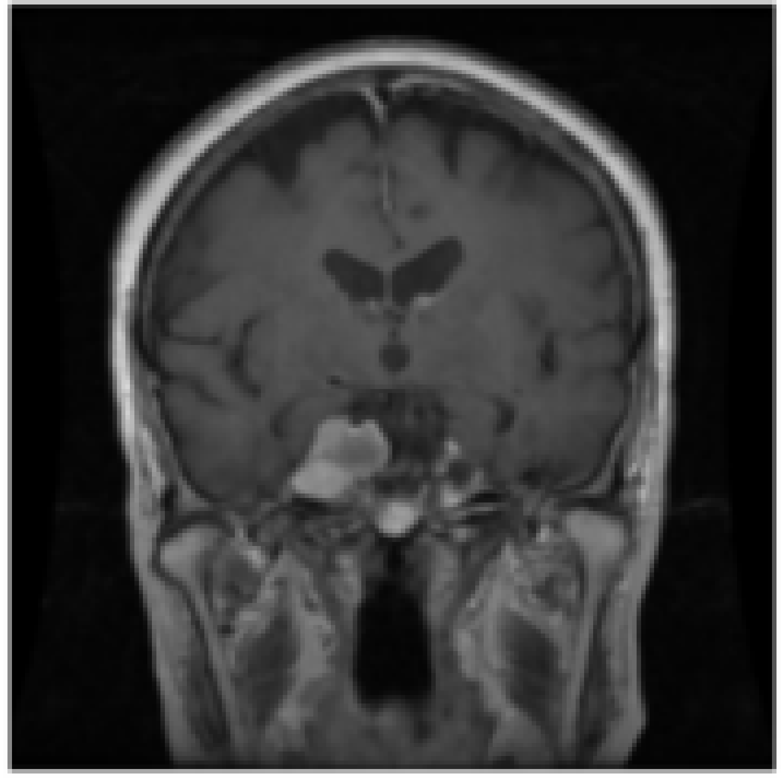
Predicted label : Meningioma



True label : Glioma

Predicted label : Glioma

Figure 6. Show training accuracy data testing



True label: meningioma
Predicted label: pituitary

Figure 7. Prediction model error test

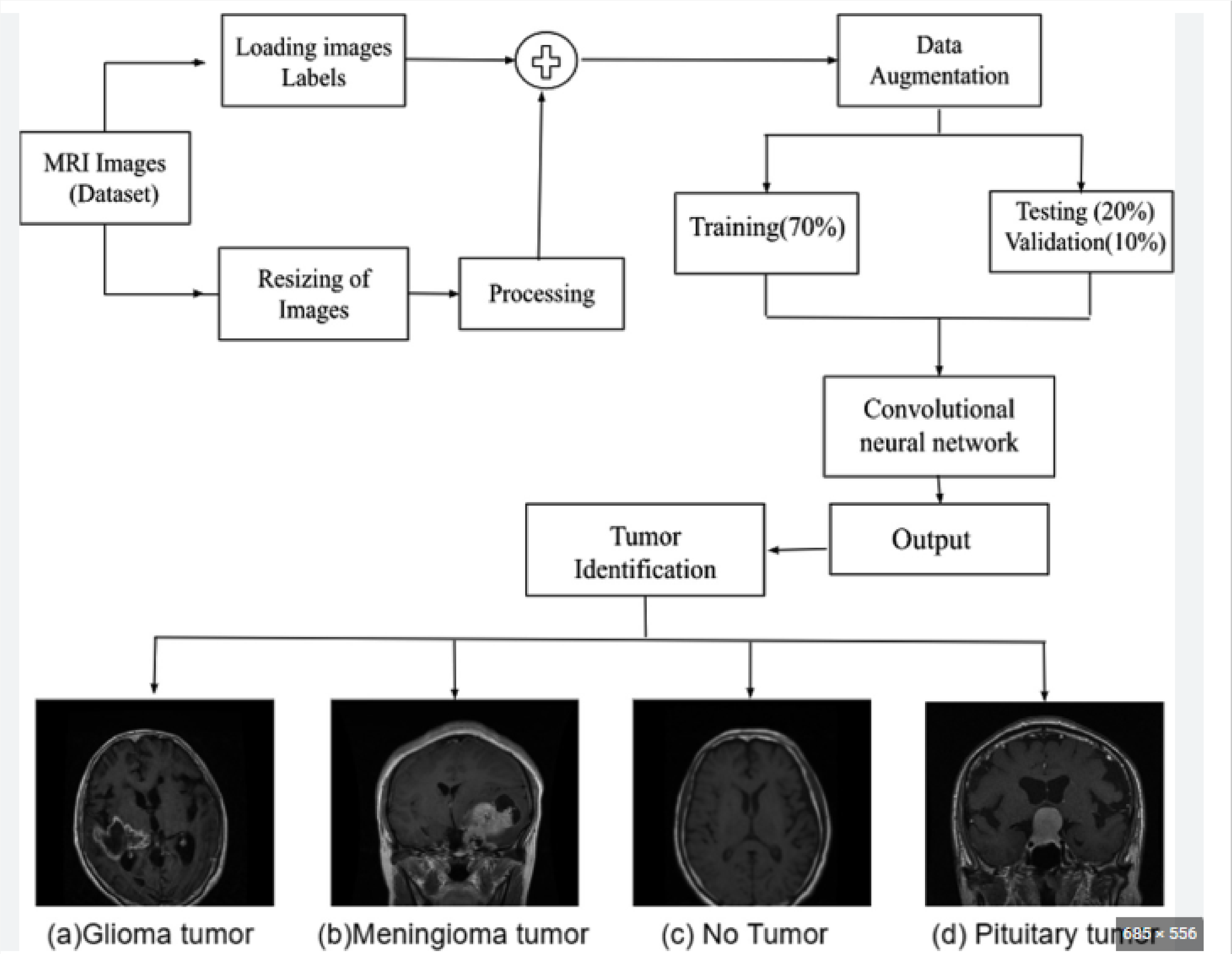


Figure. 8 https://link.springer.com/chapter/10.1007/978-981-99-0969-8_388
Brain tumour recognition and classification using CNN Model.

Advantages

- Use of Mobilenet for brain tumor classification resulted in high accuracy.
- CNN architecture that can overcome the need for excess computing resources.
- The use of transfer learning was beneficial for improving performance in the deep learning area.

Disadvantages

- Encountered an error while fine-tuning the Mobilenet_v2_100_224 model.
- The size of the input from the efficient network causes different time consumption in training.
- Some images that the model could not detect.

Conclusion

- MobilenetV2 140 x 224 architecture to improve classification accuracy.
- It improves the overall prediction of accuracy.
- It achieved high accuracy of 94%.
- Transfer learning helpful for the classification to improve better performance in the deep learning area.

Thank you!