ECSA-9

9th International Electronic Conference on Sensors and Applications

Multiclass Classification of Brain Tumors with Various Deep Learning Models

Fatih Uysal [1] · fatih.uysal@kafkas.edu.tr
Metehan Erkan [2] · metehan.erkan@gazi.edu.tr

[1] Department of Electrical and Electronics Engineering, Faculty of Engineering and Architecture, Kafkas University, Kars TR 36100 , Turkey
[2] Department of Electrical and Electronics Engineering, Faculty of Engineering, Gazi University, Ankara TR 06570, Turkey

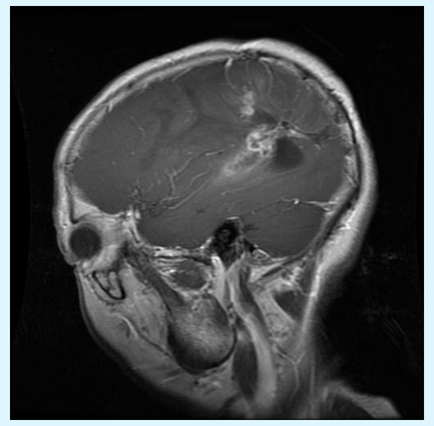
CONTEXT

Brain Tumors

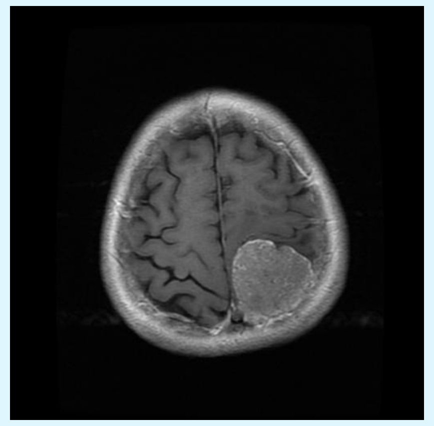
Primary & Secondary

Malignant & Benign

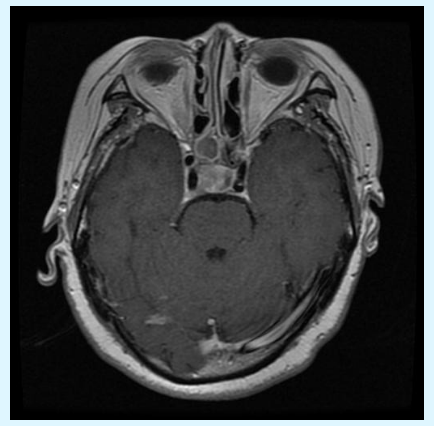
Multiclass Image Classification



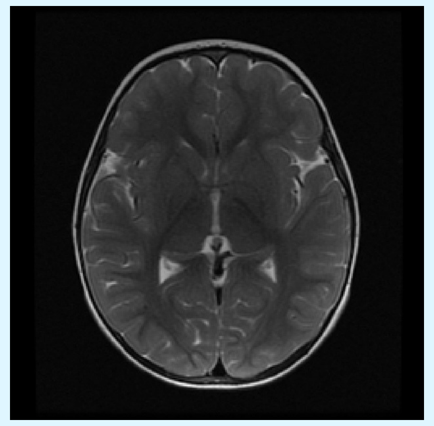
Glioma Tumor



Meningioma Tumor



Pituitary Tumor



No Tumor

Open-Source
Kaggle
Brain Tumor
Datasets

ResNet
RegNet
Vision Transformer

RELATED WORKS

Researcher	Classification Type	Model Used	Accuracy	Dataset
Rajat et. al.	Binary	AlexNet	99.04%	TCIA
Jianfeng et. al.	Multiclass	VGG19	94.82%	CE-MRI
Javed et. al.	Multiclass	Inceptionresnet v2	98.91%	Kaggle
Arshia et. al.	Multiclass	VGG16	98.69%	Figshare
Mohamed et. al.	Binary	MobileNet v2	98.24%	Custom Ds.

DATASETS

Dataset	Train Split	Validation Split	Test Split	Total
Dataset 1	2528 (80%)	316 (10%)	316 (10%)	3160
Dataset 2	5619 (80%)	702 (10%)	702 (10%)	7023

4 Classes

No Tumor
Meningioma
Glioma
Pituitary

Various Sizes

Random Split

MODELS

ResNet RegNet Vision Transformer

Fully Connected Layers (Heads) customized
Output Features = Number of Classes

RESULTS

DATASET 1 (without CLAHE)

Model	Accuracy
ResNet50	**95.253%**
RegNetY_16GF	93.354%
ViT_L_16	**95.253%**

DATASET 1 (with CLAHE)

Model	Accuracy
ResNet50	94.937%
RegNetY_16GF	**96.519%**
ViT_L_16	95.57%

DATASET 2 (without CLAHE)

Model	Accuracy
ResNet50	**99.43%**
RegNetY_16GF	99.145%
ViT_L_16	99.003%

DATASET 2 (with CLAHE)

Model	Accuracy
ResNet50	**99.288%**
RegNetY_16GF	**99.288%**
ViT_L_16	98.86%

CONCLUSION

In the scope of this work, MR brain images are classified with various deep learning models, and it is observed that the Contrast Limited Adaptive Histogram Equalization (CLAHE) preprocess has positive effects on some of the models and datasets. Classification results are highly dependent on used dataset and deep learning model.

In future work, a hybrid system can be developed to assist physicists who are working in this field. Machine learning (ML) algorithms can be an addition to deep learning models in this system.