Dhaka University Of Engineering & Technology

Department of Computer Science and Engineering

Course Code:4000

Course Tittle:Thesis and Project.

Brain Tumor Detection and Improved Classification Using Convolutional Neural Network(CNN).

Presenter

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Outline

INTRODUCTION

- In the field of Medical Image Analysis, research on Brain tumors is one of the most prominent ones
- Primary brain tumors occur in around 250,000 people a year globally ,making up less than 2% of cancers[1]

1.Ref: Louis DN, Perry A, Wesseling P, et al. The 2021 WHO Classification of Tumors of the Central Nervous System: a summary. Neuro Oncol. 2021.

INTRODUCTION

BRAIN TUMOR

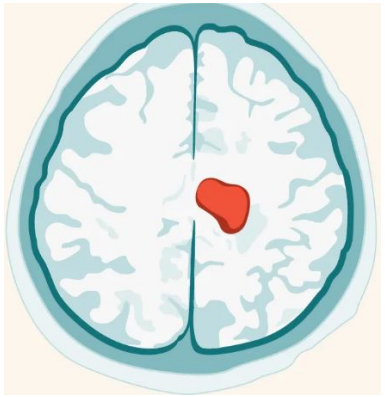


Figure 1: Brain Tumor

- Tumor cells which is undifferentiated in the image
- Cells contains abnormal nuclei
- Abnormal cells from within the brain
- Destroy healthy brain cells by invading them

INTRODUCTION

Types of Brain tumor

- Glioma.
- Meningioma.
- Pituitary etc.

INTRODUCTION

The following figure shows an example of cancerous and non-cancerous tumor.

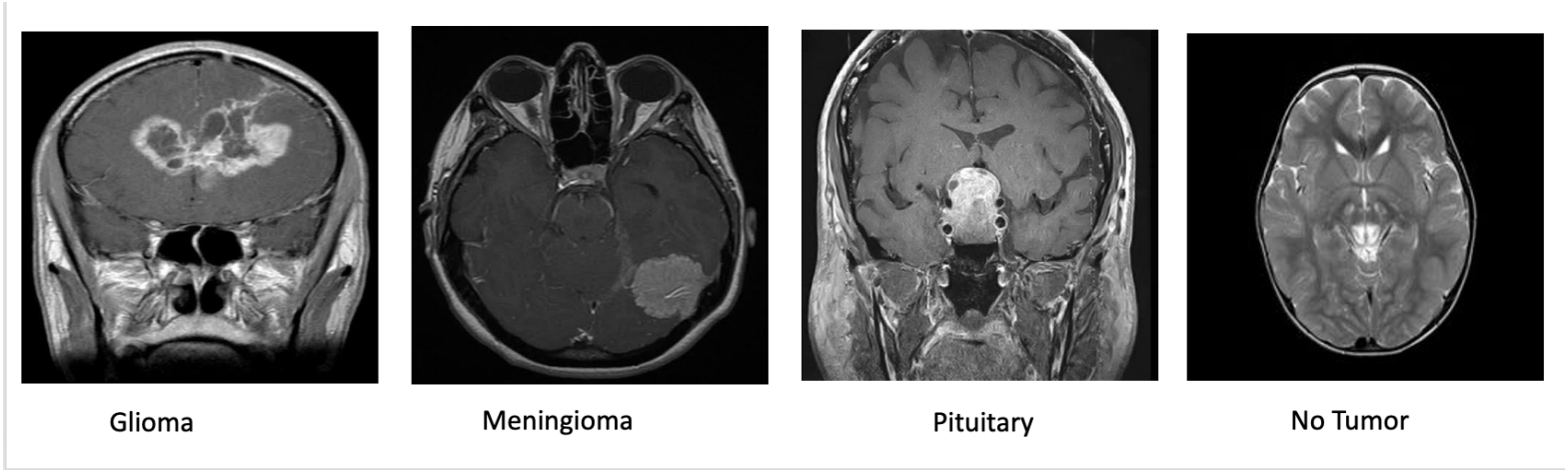


Figure 2: Different types of tumors.

INTRODUCTION

Architecture of Convolutional Neural Network CNN

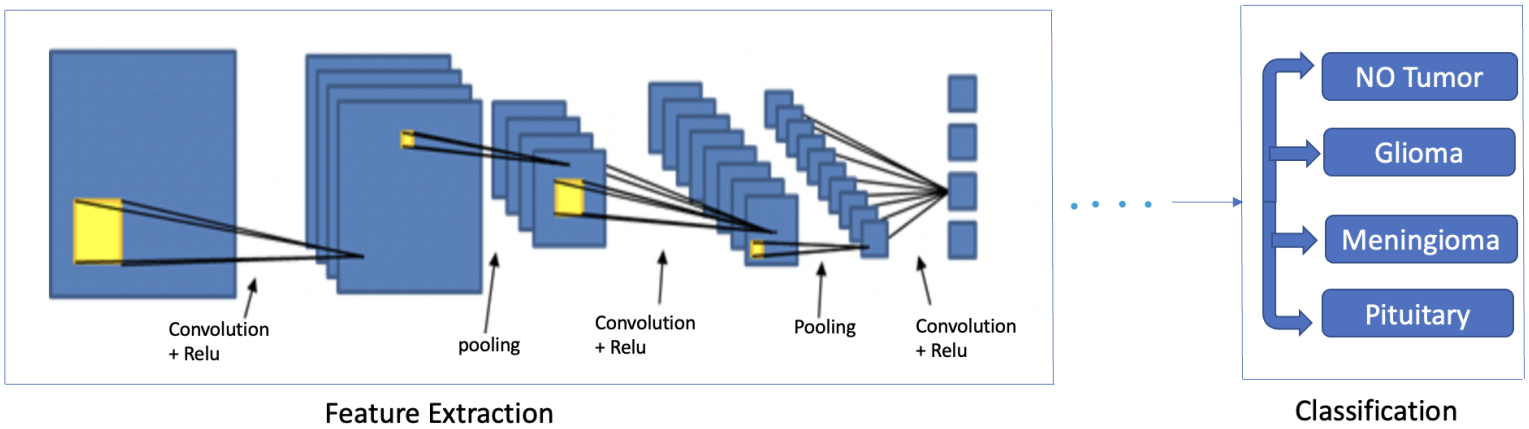


Figure 3: CNN Architecture

OBJECTIVES

- To improve the method of classification and feature extraction
- To use the CNN approach to extract features and classify brain MRI pictures

OUTCOMES

- Early detection of Brain Tumors
- Reducing the pressure on Human judgement
- Build a user Interface which can identify the cancerous cells
- Reducing the death rate by early detection

MOTIVATION

- Well adaption of automated medical image analysis in the perspective of Bangladesh
- Supporting faster communication, where patient care can be extended to remote areas

CHALLENGES

- Detecting & Classifying Different types of tumors
- Improving classification accuracy

PROBLEM

- Detection of the tumor
- Classifying different types of tumors

Related Work :

Several algorithms are analyzed for the detection of brain tumor; few are elaborated in this section:

- The supervised method (random forests) are successfully utilized to segment the brain tumor[4].
- Morphological/contextual features provide better results for brain tumor detection[2].
- Deep learning approaches are powerful because in these, highly discriminative features are extracted automatically in the form of hierarchy[3].

2.Ref: Saba, T., Mohamed, A.S., El-Affendi, M., Amin, J. and Sharif, M., 2020. Brain tumor detection using fusion of hand crafted and deep learning features. Cognitive Systems Research, 59, pp.221-230.
3.Ref: Zhao, Wenzhi, and Shihong Du. "Spectral–spatial feature extraction for hyperspectral image classification: A dimension reduction and deep learning approach." IEEE Transactions on Geoscience and Remote Sensing 54.8 (2016): 4544-4554.
4.Ref: Chao Ma, Gongning Luo, and Kuanquan Wang. Concatenated and con- nected random forests with multiscale patch driven active contour model for automated brain tumor segmentation of mr images. IEEE transactions on medical imaging, 37(8):1943–1954, 2018.

Proposed Methodology

The suggested brain tumor detection and improved classification using CNN approach includes of

- Pre-processing
- Feature extraction and
- Classificaiton

procedure for the aim of detection classifying tumors as different type glioma,meningioma,pituitary,etc from brain MRI Images.

Proposed Methodology

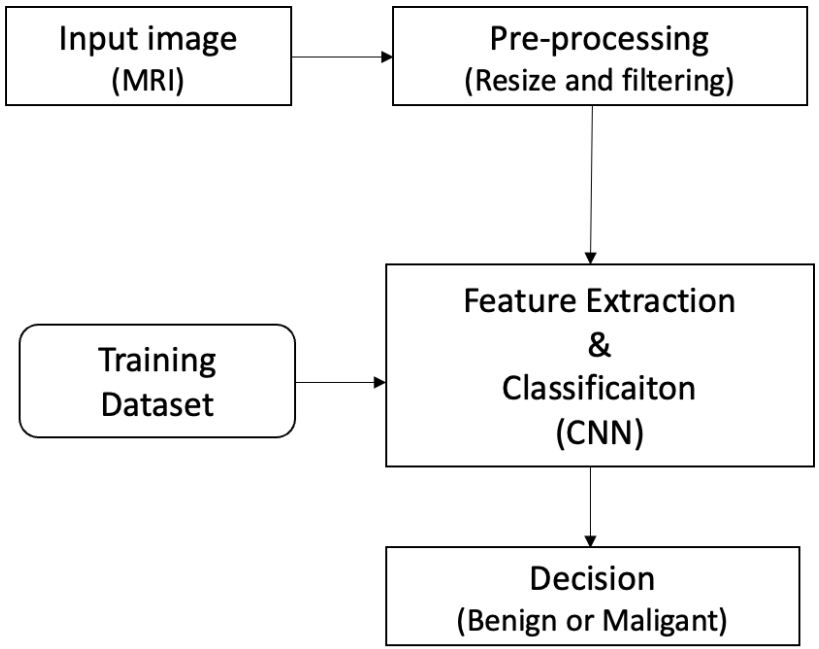


Figure 4: Our Proposed Method for brain tumor detection & classification.

Pre-processing

Image Resizing: To increase or decrease the total amount of pixels in an image, we need to resize it.In Our proposed Model at first we resize our dataset images.

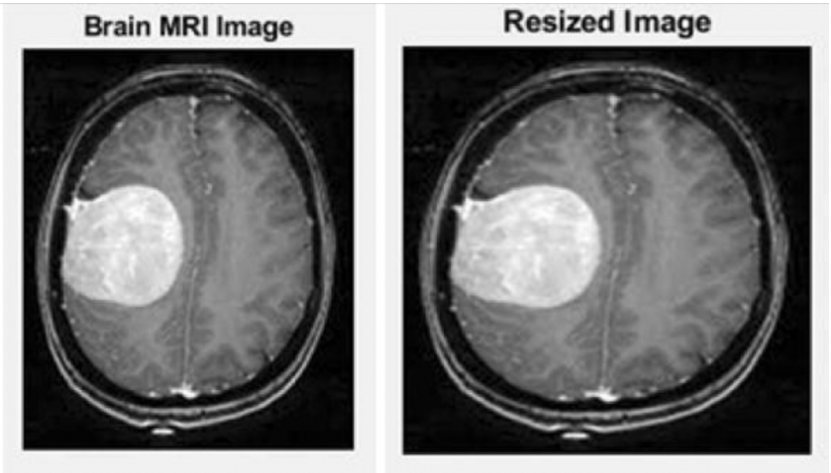


Figure 5: Image resizing

Pre-processing

Gaussian filter: This filter is known for being more organized than others in terms of keeping features and narrow borders. The Gaussian filter is ineffective at removing spontaneous (salt and pepper) noise, which necessitates the use of statistical method filters.

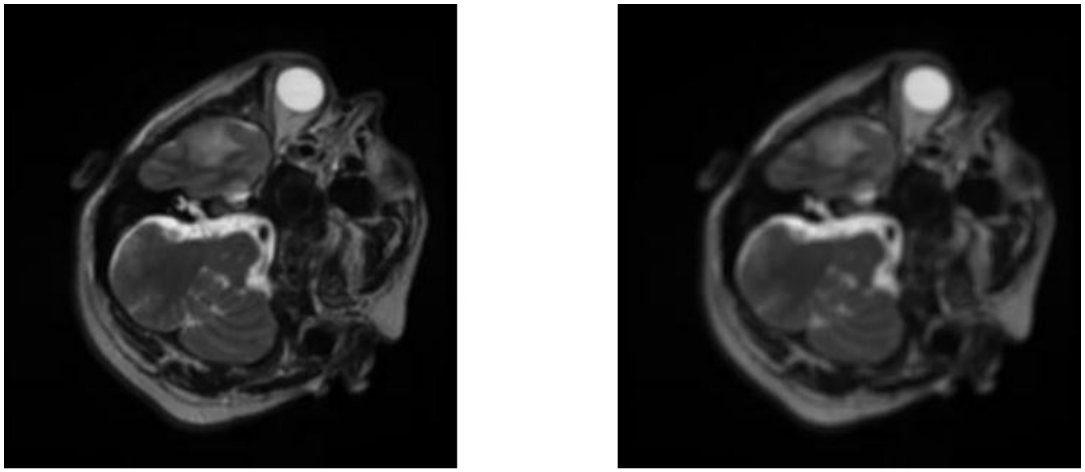


Figure 6: Exaple of Gaussian Filter Images.

Pre-processing

Data Augmentaion: We used "ImageDataGenarator"provided by keras among other technique for data augmentation.

- It replaces the original batch with the new randomly transformed batch of images
- For augmentation the following operations were applied:rescale,brightness_range,rotation_range,width_shift _range,height _shift _range,zca_whitening,featurewise_std _normalization ,samplewise _std _normalizaion

Pre-processing

Data Augmentaion Example

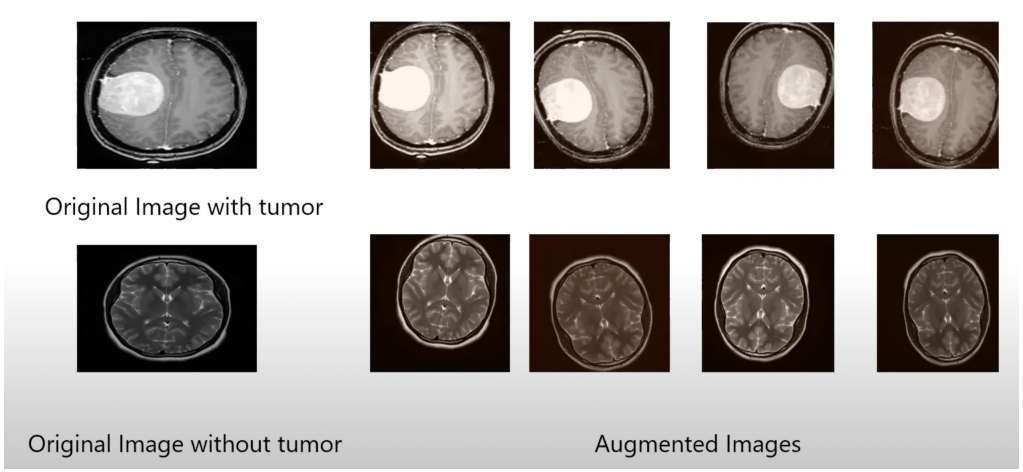


Figure 7: Example of data augmented Images.

Feature Extaction & Classificaiton

The feature extraction approach collects features from brain tumors images,for feature extraction process,the CNN approach is chosen,

- It is currently the go to model for any image related problem
- The main advantage of CNN compared to its predecessors is that it automatically detect the important features without any human supervision
- It can also share parameters, allowing the CNN model to run on any device
- Furthermore, this strategy takes less data for faster training and searches for features at their most fundamental level
- It is made up of many completely connected layers that follow a series of specific convolutions with pooling operations

Feature Extraction & classification

Our Proposed Convolutional Neural Network (CNN) Architecture

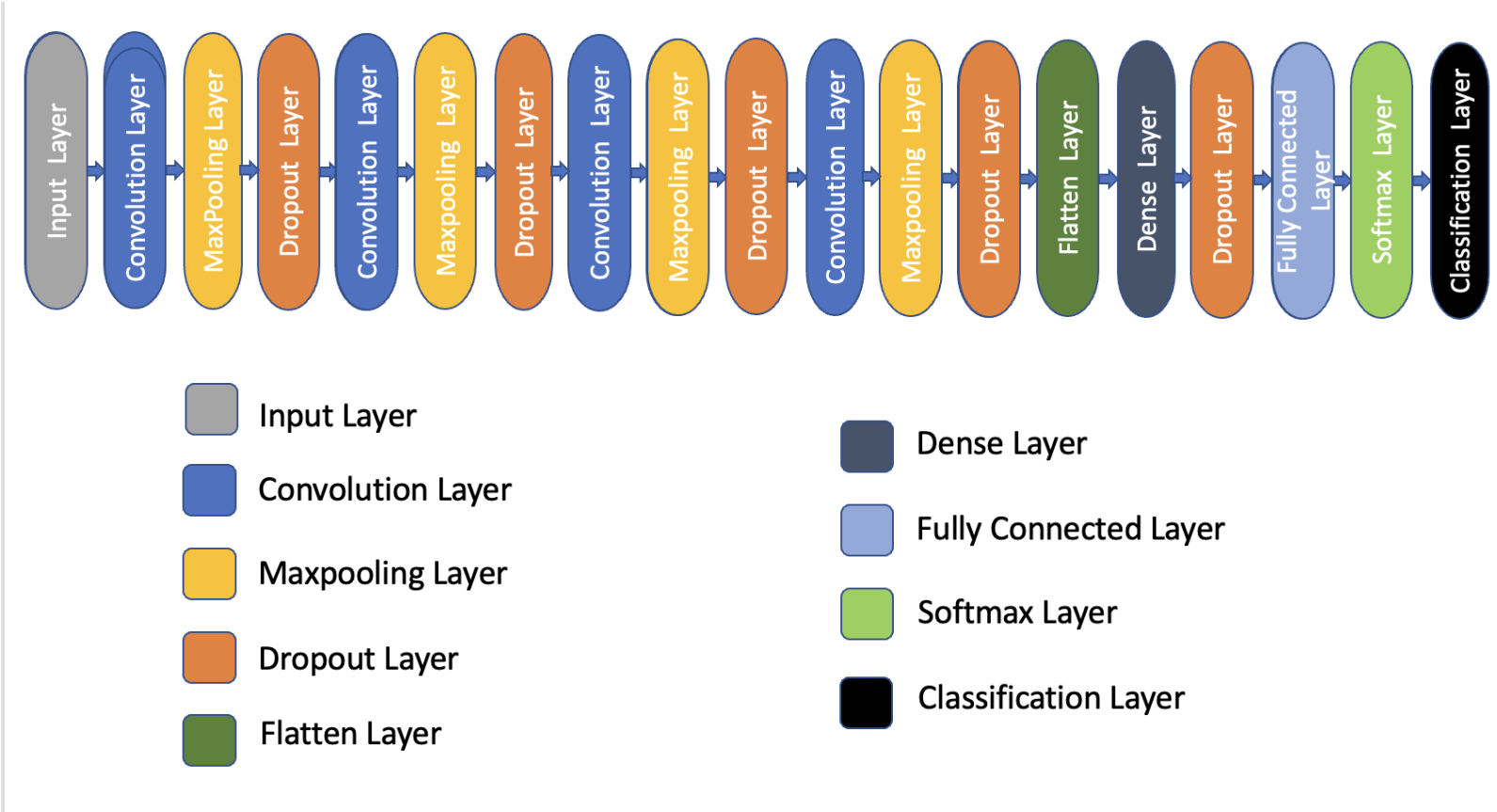


Figure 8: CNN Architecture

Feature Extraction & classification

Softmax Function: Softmax is a mathematical function that converts a vector of numbers into a vector of probabilities, where the probabilities of each value are proportional to the relative scale of each value in the vector.

- To classify the output
- Categorise the output using probability values

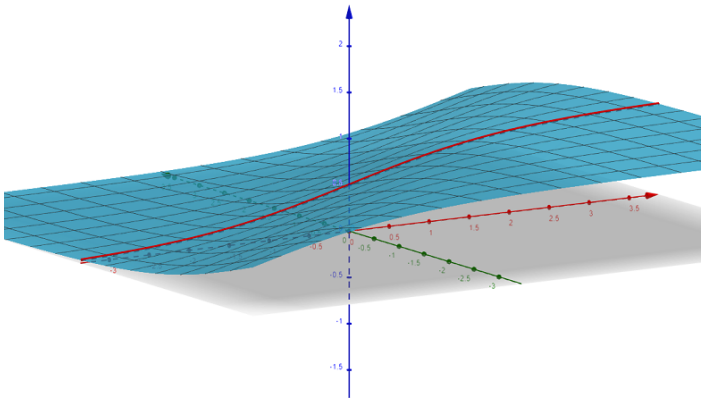


Figure 9: Softmax Function

Dataset

- Total MRI Images: 3264
- Break down into two category: Training dataset [2870]and testing dataset[394]
- All the MRI images are clinically-acquired pre-operative multimodal scans

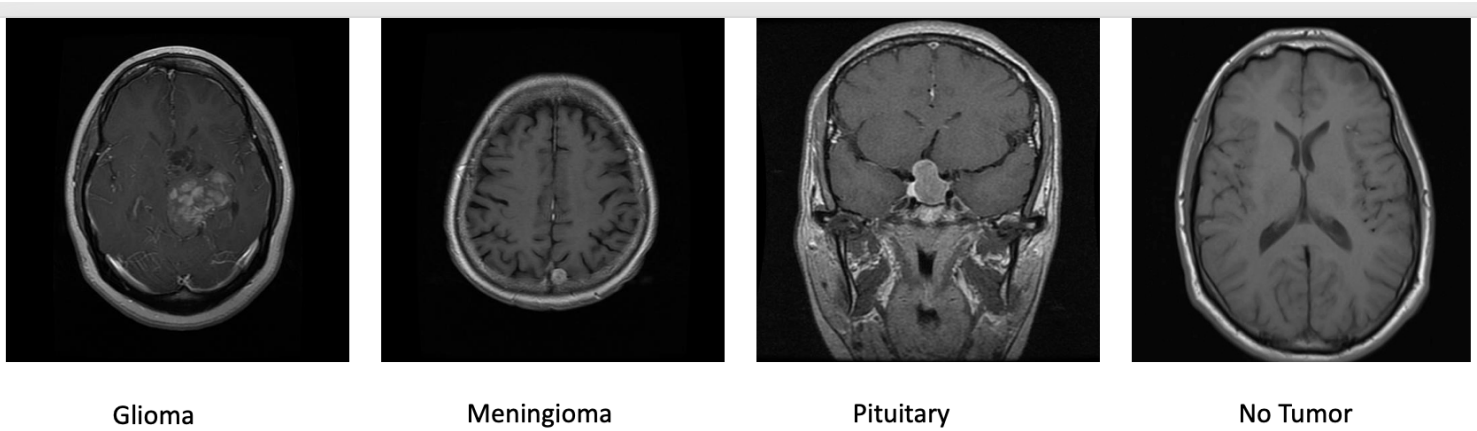


Figure 10: Sample dataset.

(URL:https://github.com/sartajbhuvaji/brain-tumor-classification-dataset)

EXPERIMENTAL RESULT

These are all about our proposed model predicted result.Our proposed method gives the 91% Accuracy where the loss accuracy is only 30%

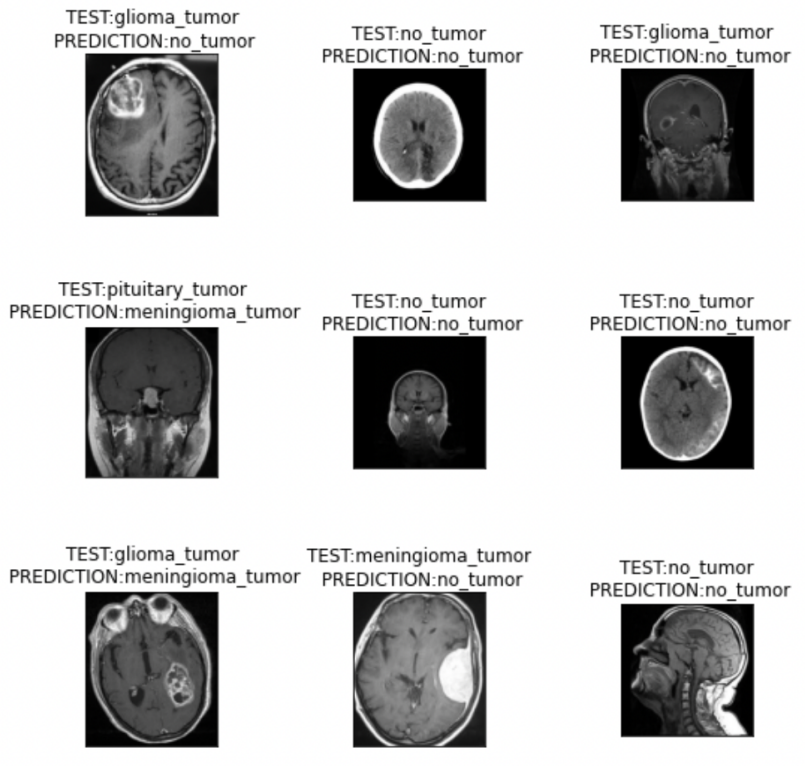


Figure 11: Some experimental result.

EXPERIMENTAL RESULT TABLE

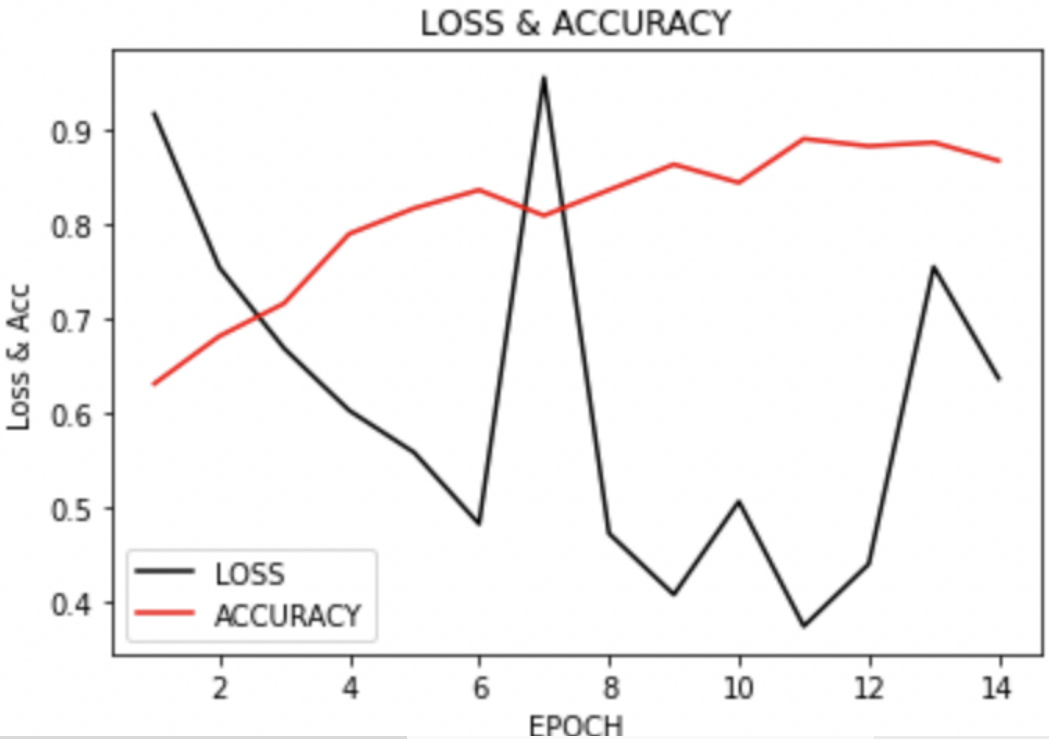
Epochs	Loss	Accuracy	Val_loss	Val_acc
1	1.1820	0.5148	0.9179	0.6318
2	0.7988	0.6761	0.7552	0.6822
3	0.667	0.7299	0.6692	0.7171
4	0.5649	0.7755	0.6035	0.7907
5	0.4746	0.8176	0.5589	0.8178
..	....	....	....	.....
.	....	....	....	.....
31	0.1642	0.9558	0.4407	0.8975
32	0.1724	0.9667	0.7557	0.8980
33	0.1724	0.9688	0.5472	0.9088

Table 1: Performance Matrix.

EXPERIMENTAL RESULT ANALYSIS CURVE

Accuracy: When the dataset is trained and compared to the test dataset, the validation accuracy is determined.

Loss: It's the total number of errors committed in each training or validation set for each example. The loss value indicates how well or poorly a model performs after each optimization iteration.



CONFUSION MATRIX

		Actual			
		Meningioma	Glioma	Pituitary	No-tumor
Predicted	Meningioma	90	10	1	5
	Glioma	4	85	0	3
	Pituitary	12	5	70	2
	No-tumor	10	0	4	96

Table 2: Confusion Matrix.

	Accuracy	Precision	Recall	f1-score	support
Meningioma	0.908	0.77	0.84	0.80	116
Glioma	0.91	0.84	0.92	0.87	101
Pituitary	0.91	0.93	0.78	0.84	106
No tumor	0.91	0.90	0.87	0.88	75

Table 3: Classificaton report our proposed method.

COMPARISION TABLE

Author's	Method	Accuracy	Details
K'Salcin	Faster R-CNN	90.66%	Ref 5
Sachdeva	PCA ANN	85.23%	Ref 6
Our model	CNN	91.06%	

Table 4: Comparision between Our model and other model .

Ref 5:Salçin, Kerem. "Detection and classification of brain tumours from MRI images using faster R-CNN." Tehnički glasnik 13.4 (2019).
Ref 6:Sachdeva, Jainy, et al. "Segmentation, feature extraction, and multiclass brain tumor classification." Journal of digital imaging 26.6: 1141-1150.

CONCLUSION

- Our Classification system can sucessfully distinguish between normal and abnormal brain MRI Images
- To classify distinct type of cancerous and non-cancerous tumors
- It can identify and classify no tumor and glioma,meningioma,pituitary etc tumors
- Our method is resilent and efficient due to the combined performance of feature extraction and classification by using large dataset
- Our experiment accuracy is better than other method

FURURE WORK

- We work in brain blood flow related disease like vertebral stenosis and vascular malformation etc
- Our further analysis concentrate on combine method that is Gabor Wavelet Transformation and Convolutional Neural Network(CNN) which is called Gabor Convolutional Neural Network(GCNN)
- To classify awider range of brain diseases
- Reducing time consumption and raising success rates

Thank you