VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JNANA SANGAMA, BELAGAVI – 590 018

An Internship Project Report on

"BRAIN TUMOR DETECTION"

Submitted in partial fulfillment of the requirements as a part of the

AI/ML INTERNSHIP

(NASTECH)

For the award of degree of

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Submitted by

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CERTIFICATE

This is to certify that the mini project report entitled ***BRAIN TUMOR DETECTION*** has been successfully completed by **RAKSHITHA K** bearing USN **1RN19CS109** and **S H KISHORE KUMAR**USN **1RN19CS118**, presently VI semester students of RNS Institute of Technology in partial fulfillmentof the requirements as a part of the ***AI/ML Internship (NASTECH)*** for the award of the degree of ***Bachelor of Engineering in Computer Science and Engineering*** under ***Visvesvaraya Technological University, Belagavi*** during academic year **2021 – 2022**. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the report and deposited in the departmental library. The mini project report has been approved as it satisfies the academic requirements as a part of Mobile.

Mr. Karanam Sunil Kumar	**Dr. Kiran P**
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Associate Professor As	

External Viva

Name of the Examiners	**Signature with date**
1. _____	_____
2. _____	_____

ABSTRACT

The formation of aberrant cells in the brain, some of which may progress to cancer, is known as a brain tumor. Many health organizations have recognized brain tumor as the second foremost dispute that causes a large number of human deaths all around the world. Identification of brain tumor at a premature stage offers an opportunity of effective medical treatment. Magnetic Resonance Imaging (MRI) scans are the most common tool for detecting brain tumors. Information on aberrant tissue growth in the brain is identified using MRI imaging. The Machine Learning and Deep Learning algorithms are used to detect brain tumors. The diagnosis of a brain tumor is done quickly and accurately. Accuracy aids in the delivery of treatment to patients. The radiologist can also benefit from these predictions making snap judgments. A self-defined Convolutional Neural Network (CNN) is used in this project. In CNN (convolutional neural network), convolutional is name of mathematical linear operation. The dimension of the image is reduced at each layer of CNN without the loss of information needed for training. Different processing like convolve, maxpooling, droupout, flatten and dense are applied for creating the model. When the MRI images, when subjected to the algorithm detect if brain tumor is present or not.

ACKNOWLEDGMENT

The fulfillment and rapture that go with the fruitful finishing of any assignment would be inadequate without the specifying the people who made it conceivable, whose steady direction and support delegated the endeavors with success.

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INTRODUCTION

1.1 ORGANIZATION/INDUSTRY

1.1.1 COMPANY PROFILE

NASTECH is formed with the purpose of bridging the gap between Academia and Industry Nastech is one of the leading Global Certification and Training service providers for technical and management programs for educational institutions. We collaborate with educational institutes to understand their requirements and form a strategy in consultation with all stakeholders to fulfill those by skilling, reskilling and upskilling the students and faculties on new age skills and technologies.

1.1.2 DOMAIN/TECHNOLOGY

The domain chosen for our project is AI/ML. Machine learning, the fundamental driver of AI, is possible through algorithms that can learn themselves from data and identify patterns to make predictions and achieve your predefined goals, rather than blindly following detailed programmed instructions, like in traditional computer programming. This technology allows the machine to perceive, learn, reason and communicate through observation of data, like a child that grows up and acquires knowledge from examples. Machines also have the advantage of not being limited by our inherent biological limitations. With machine learning, manufacturing companies have increased production capacity up to 20%, while lowering material consumption rates by 4%.

Nowadays, the revolutionary AI technology evolved from rule-based expert systems to machine learning and more advanced subcomponents such as deep learning (learning representations instead of tasks), artificial neural networks (inspired by animal brains) and reinforcement learning (virtual agents rewarded if they made good decisions).

The AI can master the complexity of the intertwining industrial processes to enhance the whole flow of production instead of isolated processes. This enormous cognitive capacity gives the AI the ability to consider the spatial organization of plants and the timing constraints of live production. Another key advantage is the capability of AI algorithms to think

probabilistically, with all the subtlety this allows in edge cases, instead of traditional rule-based methods that require rigid theories and a full comprehension of problems.

1.1.3 Department

R.N.Shetty Institute of Technology (RNSIT) established in the year 2001, is the brain-child of the Group Chairman, Dr. R. N. Shetty. The Murudeshwar Group of Companies headed by Sri. R. N. Shetty is a leading player in many industries viz construction, manufacturing, hotel, automobile, power & IT services and education. The group has contributed significantly to the field of education. A number of educational institutions are run by the

R. N. Shetty Trust, RNSIT being one amongst them. With a continuous desire to provide quality education to the society, the group has established RNSIT, an institution to nourish and produce the best of engineering talents in the country. RNSIT is one of the best and top accredited engineering colleges in Bengaluru.

1.2 PROBLEM STATEMENT

1.2.1 Existing System and their Limitations

The Existing system describes the cellular automation of segmentation. The technique is used to interactive multi label segmentation for N dimensional images. It segments the areas which are more difficult to segment. The method is iterative, giving feedback to the user while the segmentation is computed.

1.2.2 Proposed Solution

Classification applied through an algorithm, Convolutional neural networks which will identify the if tumor is present or not.

1.2.3 Program formulation

We will be using Brain MRI Images for Brain Tumor Detection that is publicly available on Kaggle. We will first pre-process the images, build the model using simple custom layers convolutional neural networks and then evaluate it. At last, we will compute some prediction by the model and compare the results.

Chapter 2

REQUIREMENT ANALYSIS, TOOLS &TECHNOLOGIES

2.1 Hardware and Software Requirements

2.1.1 Hardware Requirements:

Processor	: Any Processor above 500 MHz
RAM	: 512Mb
Hard Disk	: 4 GB
Input device	: Standard Keyboard and Mouse
Output device	: High Resolution Monitor

2.1.2 Software Requirements:

Operating system	: Windows 10
IDE	: Google Colab

2.2 Tools/Languages/Platforms

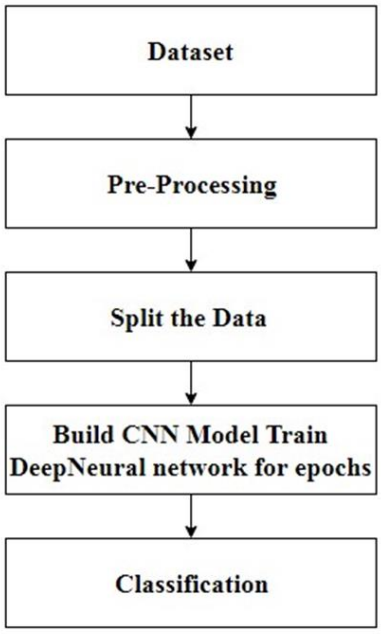
- Python(Numpy, Pandas, Keras, PIL, Matplotlib, streamlit)

CHAPTER 3

3.1 Problem Statement

The main aim of this project is to develop an automated system to detect tumor in the brain using a deep learning, Convolutional Neural Network.

Proposed System:



The proposed system has mainly five modules. Dataset, Pre-processing, Split the data, Build CNN model train Deep Neural network for epochs, and classification. In dataset we can take multiple MRI images and take one as input image. In pre-processing image to encoded the label and resize the image. In split the data we set the image as 80% Training Data and 20% Testing Data. Then build CNN model train deep neural network for epochs. Then classified the image as yes or no if tumor is positive then it returns yes and the tumor is negative the it returns no.

3.2 Algorithm

Convolutional Neural Network

Convolutional Neural Network is a well-ordered technique in the field of the medical image process. A convolutional neural network (CNN) could be a type of artificial neural network works in image recognition and process that's specifically designed for method component knowledge. CNN is a powerful image processing, computing method that use deep learning to perform each generative and descriptive tasks, typically exploitation machine vision that has image and video recognition, together with recommender systems and linguistic communication process (NLP). A neural network could be a combination of system of hardware and computer code similar to the operation of neurons within the human brain. Artificial neural networks are not ideal for the image process. A CNN uses a system very like a multilayer view-point that has been designed for reduced process necessities. The removal of limitations and increase in potency for image process ends up in a system which is way more effective, easier to train data for image process and linguistic communication process. In our 9 layer CNN model, there are fourteen stages, as well as the hidden layers, which provide us with the foremost outstanding result for the apprehension of the tumor.

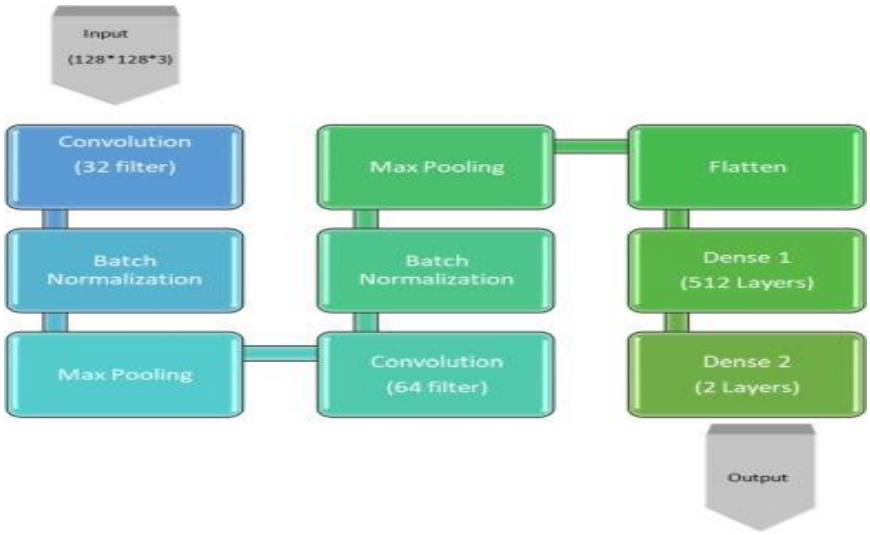


Figure 3.2.1 Proposed methodology for tumor detection using 9-Layer Convolutional Neural Network.

3.3 Libraries

- Pandas
- Numpy
- Sklearn
- Keras
- Matplotlib
- PIL

3.4 Data Processing

1) Data Set

The data set consists of two different folders that are Yes or No obtained from Kaggle. Both the folders contain different MRI images of the patients. Yes, folder has patients that have brain tumors whereas No folder has MRI images of patients with no brain tumor. There are a total of 512 images.

2) Encoding using OneHotEncoder

```
encoder = OneHotEncoder()
encoder.fit([[0], [1]])
```

3) Converting Images into Numpy arrays and Resizing:

```
 img = img.resize((128,128))
 img = np.array(img)

 if(img.shape == (128,128,3)):
        data.append(img)
result.append(encoder.transform([[0]]).toarray())
data = np.array(data)
result = np.array(result)
result = result.reshape(139,2)
```

4) Splitting the data set into train and test

```
x_train,x_test,y_train,y_test = train_test_split(data, result, test_size=0.2, shuffle=True,
random_state=0)
```

5) Building the Model

In our proposed technique we have taken a complete variety of pictures as input and converted all the images into constant size 128*128*3 to form them unvaried dimensions. We tend to create a convolutional kernel that is convoluted with the input layer administering with thirty-two convolutional filters of size 2*2 every with the support of three channel tensors. We tend to used ReLU because of the activation function. The corrected linear activation function or ReLU could be a piecewise linear operate which will output the input directly if it is positive, otherwise, it will output zero. Next, we have applied batch normalization. Batch normalization (also referred to as the batch norm) could be a technique that not only creates neural networks quicker and additional stability through normalization of the layers' inputs by re-centering and re-scaling. we have used a 2*2 Max pooling operation [16] that selects the maximum element from the range of the feature map covered by the filter. So, the output after the max-pooling layer would be a feature map containing the most important features of the previous feature map. After this stage, we again used 64 filter convolutional, batch normalization, max-pooling methods before doing the flattening. We proposed two dense layers where the first dense layer has 512 hidden layers and 2nd dense layer has the final 2 layers. In the final layer, we used softmax as an activation function, as it is giving more accuracy than others. Again we used “categorical_crossentropy” as loss function and RMSProp (Root Mean Squared Propagation, or RMSProp, is an extension of gradient descent and Adaptive Gradient Algorithm version of gradient descent that uses a decaying average of partial gradients in the adaptation of the step size for each parameter.) as optimizer.

```
model = Sequential()

model.add(Conv2D(32, kernel_size=(2, 2), input_shape=(128, 128, 3), padding = 'Same'))
model.add(Conv2D(32, kernel_size=(2, 2),  activation ='relu', padding = 'Same'))


model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Dropout(0.25))

model.add(Conv2D(64, kernel_size = (2,2), activation ='relu', padding = 'Same'))
model.add(Conv2D(64, kernel_size = (2,2), activation ='relu', padding = 'Same'))

model.add(BatchNormalization())
model.add(MaxPooling2D(pool_size=(2,2), strides=(2,2)))
model.add(Dropout(0.25))

model.add(Flatten())

model.add(Dense(512, activation='relu'))
model.add(Dropout(0.5))
    model.add(Dense(2, activation='softmax'))


    model.compile(loss = "categorical_crossentropy", optimizer='Adamax')
```

Chapter 4

OBSERVATION AND RESULTS

4.1 Training Code

```
history = model.fit(x_train, y_train, epochs = 30, batch_size = 40, verbose = 1,validation_data
 = (x_test, y_test))
```

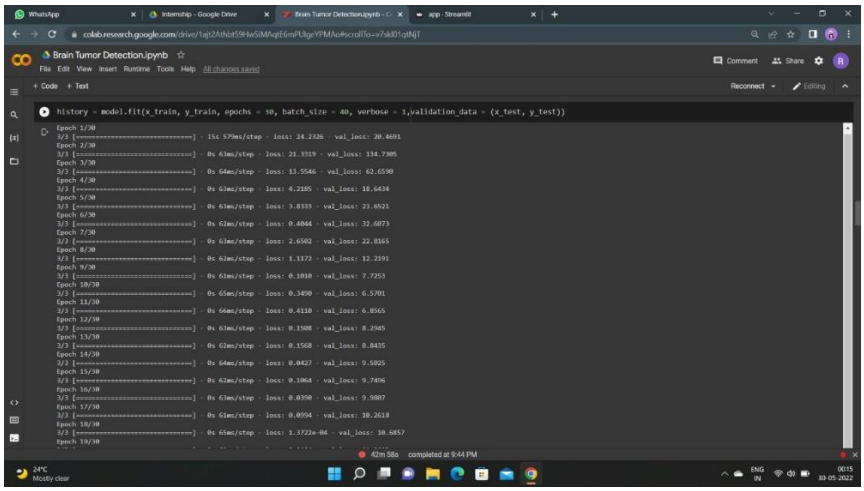


Figure 4.1.1 Training the model using 30 epocs

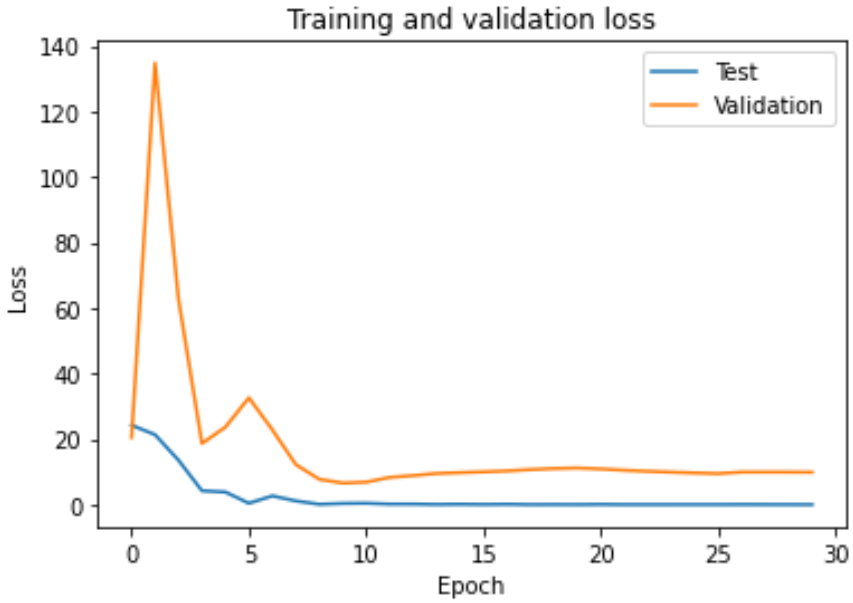


Figure 4.2.2 Training v/s Validation Loss

4. 2 RESULTS SNAPSHOTS

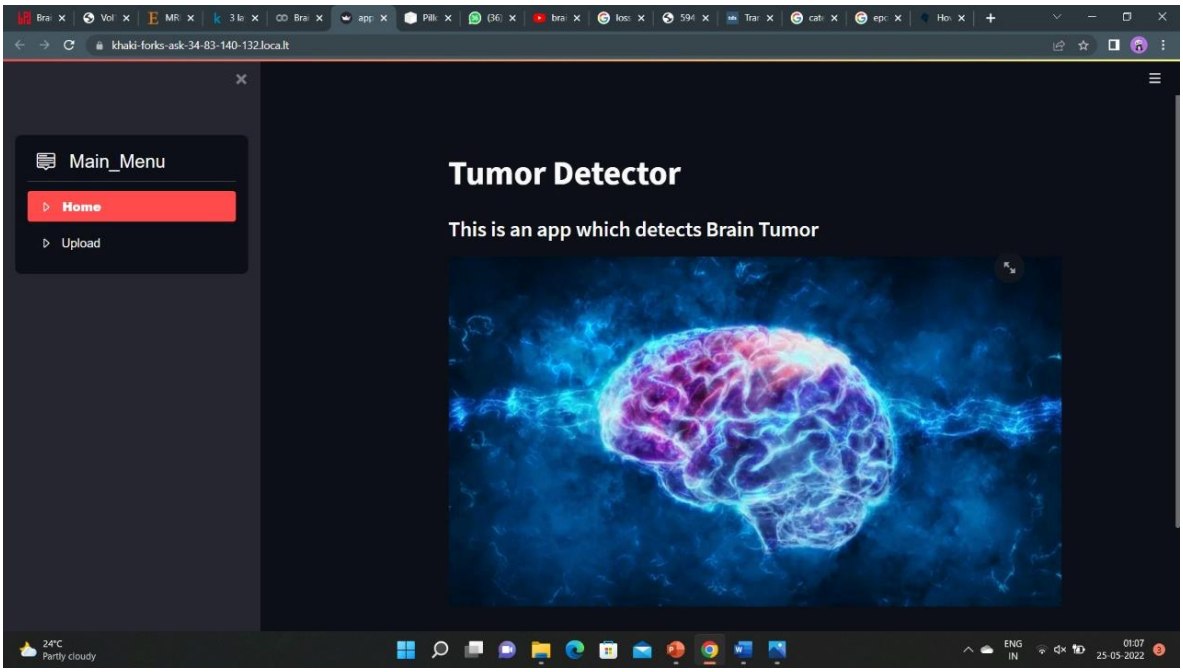


Figure 4.2.1

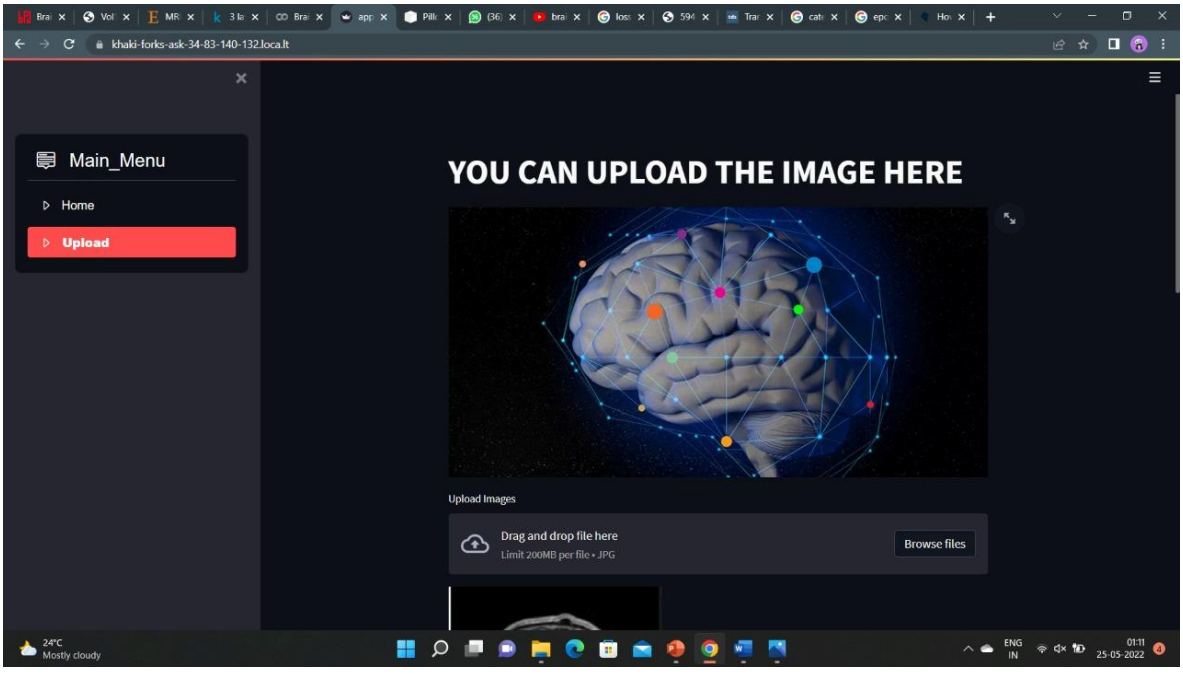


Figure 4.2.2

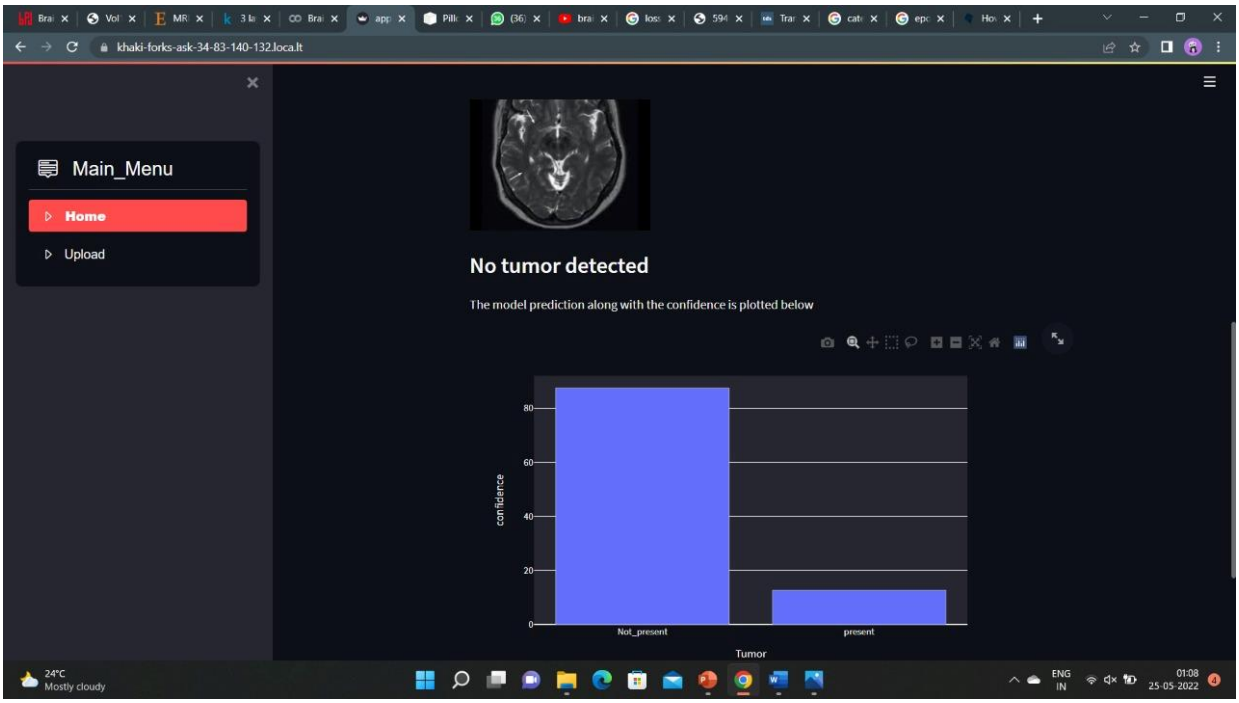


Figure 4.2.3

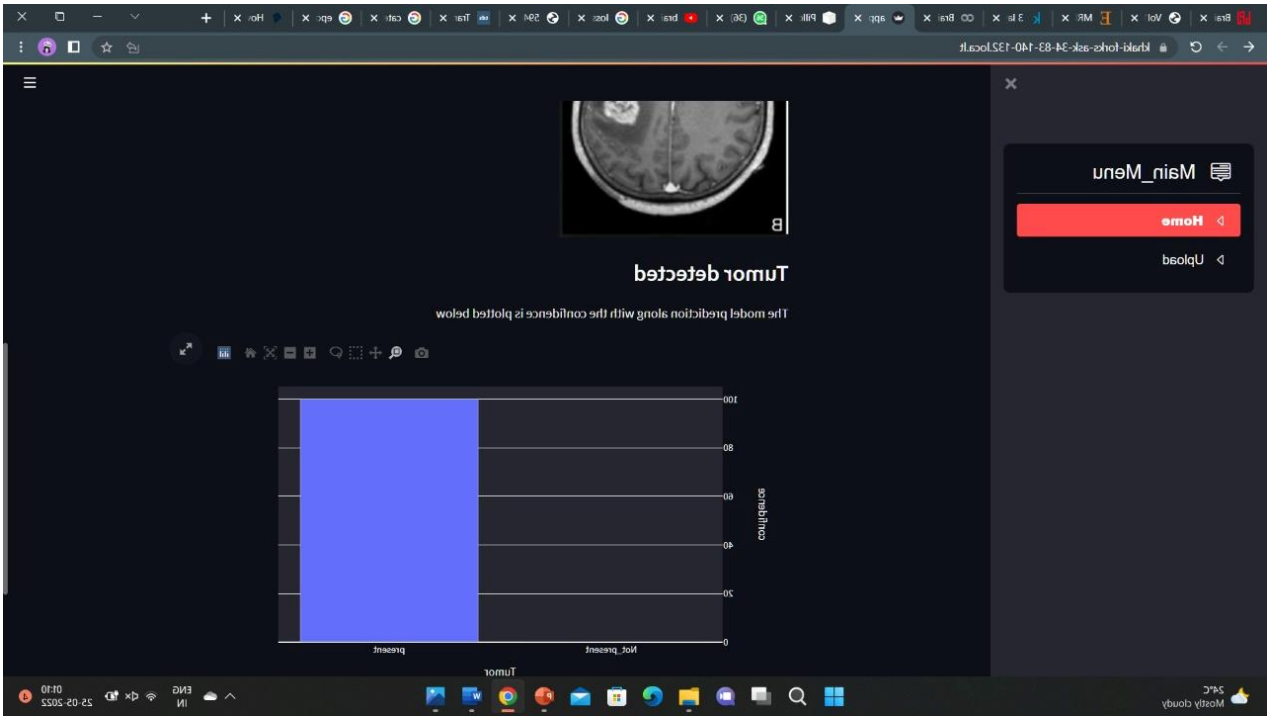


Figure 4.2.4

Figures 4.2.1, 4.2.2, 4.2.3 Shows the snapshot of the final result of our recommendation system launched using streamlit.

Chapter 5

CONCLUSION AND FUTURE ENHANCEMENT

5.1 Conclusion

- The main goal of this research work is to design efficient automatic brain tumor classification with high accuracy, performance and low complexity.
- a convolution neural network based classification is introduced in the proposed scheme.
- The classification results are given as tumor or normal brain images.
- CNN is one of the deep learning methods, which contains sequence of feed forward layers. Also python language is used for implementation.
- Finally, the Gradient decent based loss function is applied to achieve high accuracy. The training accuracy and validation loss are calculated. The training accuracy is 97.5%. The validation accuracy is high and validation loss is very low.
-

5.2 Future Enhancement

It is observed on extermination that the proposed approach needs a vast training set for better accurate results; in the field of medical image processing, the gathering of medical data is a tedious job, and, in few cases, the datasets might not be available. In all such cases, the proposed algorithm must be robust enough for accurate recognition of tumor regions from MR Images. The proposed approach can be further improvised through in cooperating weakly trained algorithms that can identify the abnormalities with a minimum training data and also self-learning algorithms would aid in enhancing the accuracy of the algorithm and reduce the computational time

Chapter 6

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