
# Brain Tumor Detection Using MRI Scans

## A Project Report

## SmartInternz AI

**By**


| | |
|---|---|
| **Marlapalli Ritika** | **20BCB0134** |
| **Sri Krishna Aditya Kurapati** | **20BCE2321** |
| **Sumit Dutta** | **20BEE0354** |
| **Malay Rajpoot** | **20BEC0664** |

# Table of Content

# 1. INTRODUCTION :

## 1.1 OVERVIEW :

The project titled "Brain Tumor Detection using MRI Scans" aims to revolutionize the process of brain tumor detection by leveraging the power of artificial intelligence and advanced image classification techniques. Brain tumors are a significant health concern, and early detection plays a crucial role in improving patient outcomes. Magnetic Resonance Imaging (MRI) is a widely used non-invasive imaging technique that provides detailed anatomical information about the brain. However, the manual analysis of MRI scans by radiologists can be time-consuming, subjective, and prone to human errors, especially when faced with a large number of scans to evaluate.To address these challenges this project proposes the development of an automated image classification application. By utilizing Convolutional Neural Networks (CNN), a class of deep learning algorithms known for their effectiveness in image analysis, the project aims to create a robust model that can accurately detect the presence of brain tumors from MRI scans. The CNN model will be trained on a labeled dataset of MRI images, incorporating both tumor-positive and tumor-negative cases. Through extensive training and optimization, the model will learn to identify intricate patterns and features indicative of brain tumors.

## 1.2 PURPOSE:

The purpose of this project is to develop an image classification application that utilizes advanced technology to automate the detection of brain tumors from MRI scans. By implementing Convolutional Neural Networks (CNN) with the help of Python libraries such as IBM Watson Studio and Jupyter Notebook, we aim to create a robust model capable of accurately classifying MRI images. Furthermore, the integration of Flask will facilitate a user-friendly web interface, allowing patients to upload their MRI brain images for analysis by the CNN model.Through this project, we aim to streamline the detection process, reduce the burden on radiologists, minimize analysis delays, and enhance the accuracy of brain tumor diagnoses. By leveraging the power of deep learning and providing an accessible interface, we aspire to improve patient outcomes and contribute to advancements in the field of medical imaging.

# 2. LITERATURE SURVEY :

## 2.1 EXISTING PROBLEMS :

The detection of brain tumors from MRI scans is a critical task in medical science. The existing approach primarily relies on the expertise of radiologists, who manually analyze the scans to identify potential tumors. However, this process is time-consuming, subject to human error, and can be overwhelming when faced with a large number of scans. Moreover, the high workload on radiologists can lead to fatigue, which may further increase the chances of misdiagnosis or delayed analysis. This highlights the need for an automated solution that can streamline the detection process, improve accuracy, and alleviate the burden on radiologists.

Several studies have been conducted to address this problem. Some researchers have explored machine learning techniques, such as Support Vector Machines (SVM) and Random Forests, to classify MRI scans and detect brain tumors. While these approaches have shown promising results, they often require manual feature extraction and lack the ability to capture intricate patterns and complex relationships in the data. Therefore, there is a growing need for advanced deep learning methods, such as Convolutional Neural Networks (CNNs), which have demonstrated remarkable success in image classification tasks.

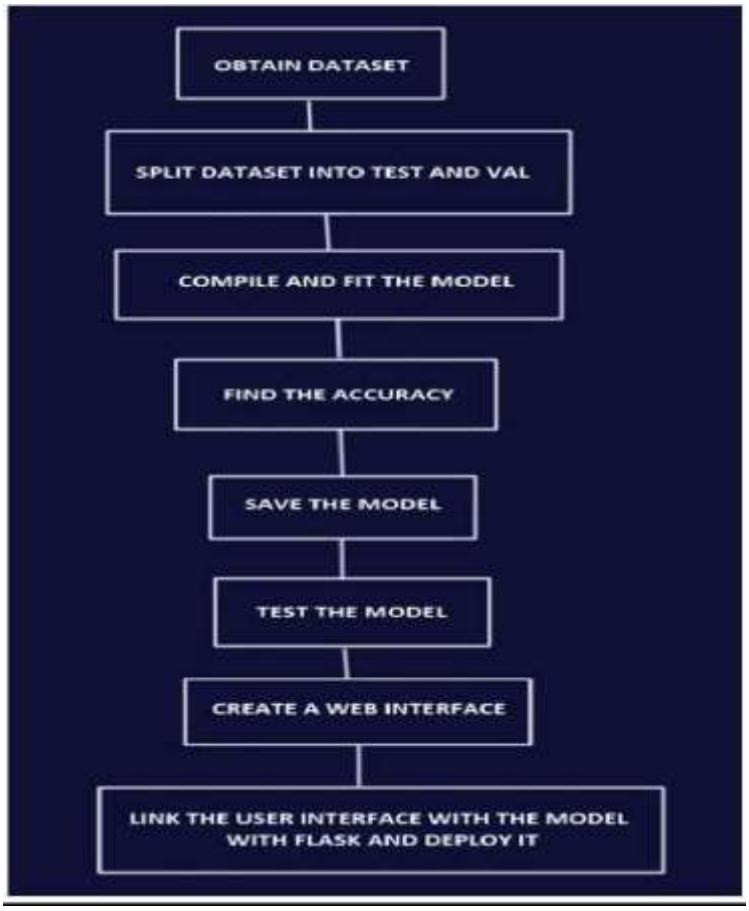
## 2.2 PROPOSED SOLUTION:

In this project, we propose a solution that leverages the power of CNNs for brain tumor detection using MRI scans. CNNs are a type of deep learning algorithm that can automatically learn and extract relevant features from images, making them well-suited for this task. By training a CNN model on a labeled dataset of MRI scans, consisting of both tumor-positive and tumor-negative cases, we aim to develop a robust classifier that can accurately distinguish between normal brain images and those containing tumors.

The proposed solution involves the implementation of the CNN model using Python libraries, such as TensorFlow and Keras, on platforms like IBM Watson Studio and Jupyter Notebook. These tools provide a comprehensive environment for model development, training, and optimization. To facilitate user interaction and seamless integration, we will utilize Flask, a lightweight web framework, to create an intuitive web interface where patients can securely upload their MRI scans for analysis. The application will provide real-time results, enabling prompt detection and identification of brain tumors.

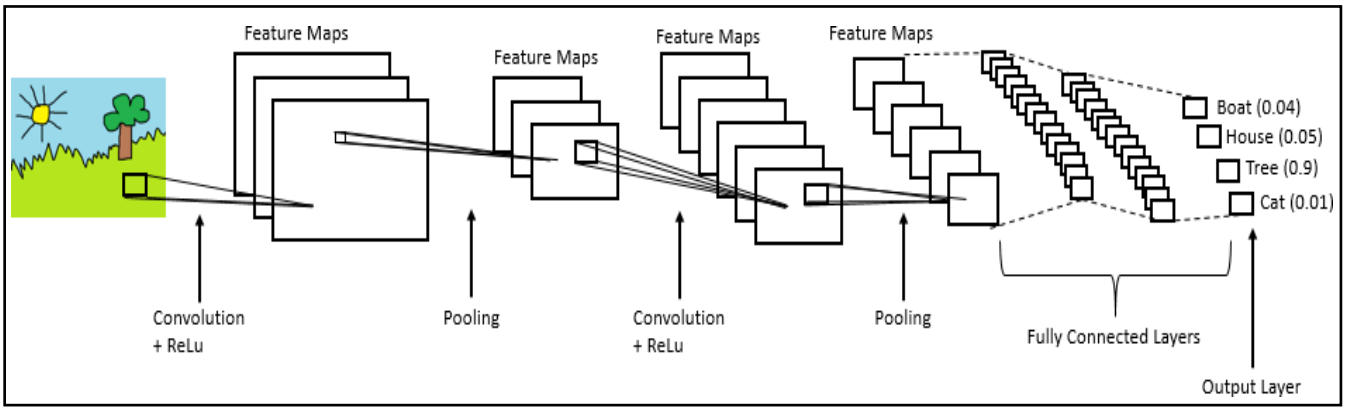
# 3. THEORITICAL ANALYSIS :

## 3.1 BLOCK DIAGRAM :




## 3.2HARDWARE/SOFTWARE DESIGNING :

Windows OS (preferably), Anaconda and IBM Watson Studio are the required software. IBM Watson studio can also be accessed using a browser. Relevant python libraries such as tensorflow, keras, ibm_watson_machine_learning and opencv2 are some basic libraries necessary to work on this project. A system with 8GB RAM and a processor with i5 core and above (7th generation +) would satisfy the requirements for building deep-learning models.

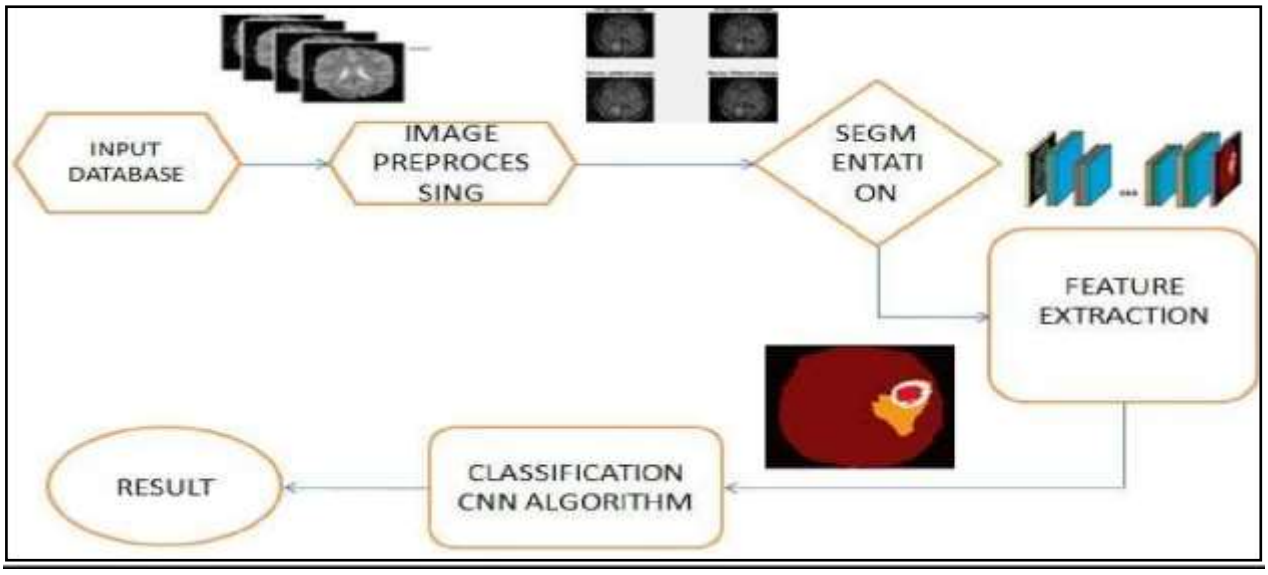



## 4. EXPERIMENTAL INVESTIGATIONS :

From our development of the project, we came to know that MRI images of Brain with tumors present have a higher contrast between the features in the images.

Using this each image was resized to 256 x 256 pixels and Convolution2D followed by a Maxpooling2D layer to form a feature map that contains the most prominent features of the images. The output layer of the model uses sigmoid function as we only have 2 mutual classes, which is Tumor Present or not present, and in accordance to this loss is measured using binary cross entropy

## 5. FLOWCHART :



# 6. RESULT :


EL INFINITO : MRI ANALYSIS
What do we do?
Brain tumors are often uncommon among people, but can pose a huge threat to the health of a living being. Tumors can arise in any age group, but the outcome need not always be grave-- especially when they are diagnosed at earlier stages and accurately with the proper equipment. El infinito MRI analysis offers the facility to promptly analyse and detect brain tumors in MRI scans, thereby reducing human error / negligence and time consumption while assuring high accuracy of results. All you have to do is upload an MRI image down below and receive AI-aided diagnosis, along with instructions regarding how to proceed with treatment / maintain a healthy lifestyle.
Choose File
No file chosen
Submit
Contact us for more details or queries:


EL INFINITO : MRI ANALYSIS
RESULTS:
According to our Artificial Intelligence-powered image processing analysis,
The MRI scan does not indicate presence of a brain tumor.
What should you do?
Consult your doctor:
Your doctor should be able to guide you further and provide insight pertaining to treatment options and suggestions.
Seek the support of kith and kin:
Although brain tumors are seldom cancerous and tend to be typically benign and easy to treat especially when diagnosed early, support from loved ones makes the process easier and less worsome.
Talk to your therapist:
It's hard going through treatment and although it may seem like emotions are best kept at bay, it may not always work -- instead of letting your worries and bottled-up emotions affect your physical and mental health, talk to a professional who can help you cope with your difficulties.
Go Back

# 7. ADVANTAGES AND DISADVANATGES :

**Advantages of the Proposed Solution:**

1. Increased Efficiency: The proposed solution automates the brain tumor detection process, reducing the workload on radiologists and improving efficiency. By leveraging Convolutional Neural Networks (CNNs), which are highly capable of learning intricate patterns and features from MRI scans, the solution can analyze a large number of scans quickly and accurately. This enables faster diagnoses and treatment planning, potentially saving valuable time in critical situations.

2. Enhanced Accuracy: Deep learning algorithms, particularly CNNs, have demonstrated remarkable accuracy in image classification tasks. By training the CNN model on a labeled dataset of MRI scans, the proposed solution can learn from a wide range of tumor-positive and tumor-negative cases, improving its ability to accurately detect brain tumors. This can help minimize the risk of misdiagnosis and provide more reliable results to patients and healthcare professionals.

**Disadvantages of the Proposed Solution:**

1. Dependency on Data Quality: The performance of the proposed solution heavily relies on the quality and diversity of the training data. If the training dataset is limited in size or lacks representative samples, it may affect the accuracy and generalization capability of the CNN model. Obtaining a well-curated and diverse dataset can be a challenging and time-consuming task, requiring expert labeling and verification.

2. Potential False Positives and Negatives: Like any automated system, there is a possibility of false positives and false negatives in the brain tumor detection results. Although CNNs are highly accurate, certain factors such as image artifacts, variations in tumor appearances, or limitations in the training data can lead to misclassifications. It is important to consider the limitations of the model and the need for validation and follow-up by medical professionals to ensure accurate diagnoses.

## 8. APPLICATIONS :

The proposed project on brain tumor detection using MRI scans has several potential applications in the field of medical imaging and healthcare. Some of the key applications include:

1. Early Diagnosis and Treatment Planning: Early detection of brain tumors is crucial for timely medical intervention. By providing an automated and accurate tumor detection system, the proposed solution can aid in the early diagnosis of brain tumors. This enables healthcare professionals to initiate appropriate treatment plans promptly, potentially leading to improved patient outcomes and survival rates.

2. Radiologist Assistance and Workload Reduction: The proposed solution can serve as a valuable tool for radiologists, assisting them in their day-to-day tasks. By automating the initial screening and detection process, the solution can alleviate the burden on radiologists, allowing them to focus on more complex cases and provide more personalized patient care. This can enhance efficiency, reduce analysis time, and improve the overall workflow in radiology departments.

## 9. CONCLUSION:

In conclusion, the project on brain tumor detection using MRI scans offers a promising solution to the challenges faced in the field of medical imaging. By leveraging the power of Convolutional Neural Networks (CNNs) and advanced image classification techniques, the proposed solution aims to automate and optimize the detection of brain tumors. The advantages of increased efficiency and enhanced accuracy make it a valuable tool for early diagnosis and treatment planning.

Through the development of a user-friendly web interface, the project also emphasizes accessibility, allowing patients to conveniently upload their MRI scans for analysis. While there may be certain limitations and potential challenges associated with data quality and false positives/negatives, these can be addressed through careful dataset curation, ongoing model improvement, and expert validation.

## 10. FUTURE SCOPE :

Some of the challenges faced in working with AI especially in time and result-sensitive domains such as medicine include: slight inaccuracies, incorrect analysis when presented with an input completely different from that encountered in the training set.

The first inhibiting factor is the access to large high quality labelled datasets for training.A technique called augmentation could be able to help solve that problem. Using augmentation, scientists are able to double, triple, or even quadruple datasets by modifying the available images in a way that new images are created, which still show the same characteristics, but are slightly different and, therefore, seen as “new training material” by the neural network

## 11. BIBLIOGRAPHY :

https://towardsdatascience.com/building-a-convolutional-neural-network-cnn-in-keras-329fbbadc5f5

https://smartinternz.com/

https://ieeexplore.ieee.org/abstract/document/7976880

https://www.sciencedirect.com/science/article/abs/pii/S1568494616301235

https://developer.ibm.com/patterns/image-classification-using-cnn-in-keras/

https://www.sciencedirect.com/science/article/abs/pii/S0730725X19300347

https://ieeexplore.ieee.org/abstract/document/7976880

https://www.sciencedirect.com/science/article/abs/pii/S1568494616301235

# APPENDIX :

## Source Code :

app.py

```
import numpy as np
import os
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
import tensorflow as tf

from flask import Flask , request, render_template, flash, redirect
from werkzeug.utils import secure_filename
from gevent.pywsgi import WSGIServer

app = Flask(__name__)
model = load_model(r"C:\Users\RITIKA\Downloads\SI-GuidedProject-4596-1626951146-
main\SI-GuidedProject-4596-1626951146-main\Brain_Tumor.h5")

@app.route('/')
def index():
    return render_template('mri_ui.html')

@app.route('/mri_redirect',methods = ['POST'])
def upload():
    if request.method == 'POST':

        f = request.files['image']

        #print("current path")
        basepath = os.path.dirname(_file_)
        #print("current path", basepath)
        filepath = os.path.join(basepath,'uploads',f.filename)
        print("upload folder is ", filepath)
        f.save(filepath)

        img = image.load_img(filepath,target_size = (256,256))
        x = image.img_to_array(img)
        x = np.expand_dims(x,axis =0)
        preds = model.predict(x)

        print("prediction",preds)

        if(preds>0.5):
            text=" The MRI scan indicates presence of a brain tumor. "
        else:
```

```
            text=" The MRI scan does not indicate presence of a brain tumor. "

        return render_template('mri_redirect.html', prediction_text=text)

if__name__== '__main__':
    app.run(debug = True, threaded = False)
```

mri_ui.html :

```
<html><head>
<title> Mainpage
</title>
<link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-
awesome/4.7.0/css/font-awesome.min.css">
<style>

@keyframes bgcolor {
    0% {
        background-color: powderblue;
    }
    30%{
  background-color: powderblue;
    }

    100% {
        background-color: #cce2cb;
    }
}

body {
    -webkit-animation: bgcolor 20s infinite;
    animation: bgcolor 10s infinite;
    -webkit-animation-direction: alternate;
    animation-direction: alternate;

}

label {
  background-color: #ffd3d5;
  color: black;
  padding: 0.5rem;
  font-family: sans-serif;
  border-radius: 0.3rem;
  cursor: pointer;
  margin-top: 1rem;
}
```

```
#file-chosen{
  margin-left: 0.3rem;
  font-family: sans-serif;
}
.button {
  background-color: #ffd3d5;
  color: black;
  padding: 0.5rem;
  font-family: sans-serif;
  font-size: 15px;
  border-radius: 0.3rem;
  cursor: pointer;
  margin-top: 0 rem;
  border: none;

}

.column {
  float: left;
  width: 50%;
}

.row:after {
  content: "";
  display: table;
  clear: both;
}


</style>
<body style="background-color:rgb(239, 243, 244);">



<script type="text/javascript">
          function displayNextImage() {
              x = (x === images.length - 1) ? 0 : x + 1;
              document.getElementById("img").src = images[x];
          }

          function displayPreviousImage() {
              x = (x <= 0) ? images.length - 1 : x - 1;
              document.getElementById("img").src = images[x];
          }

          function startTimer() {
              setInterval(displayNextImage, 5000);
          }
```

```
        var images = [], x = -1;
        images[0] = "https://www.neurologyadvisor.com/wp-
content/uploads/sites/10/2021/07/brain.tumor_.MRI_G_1088377588-860x744.jpg";
        images[1] = "https://www2.mhsi.us/blog/wp-content/uploads/2021/06/BrainTumor-
1250205787.jpg";
        images[2] = "https://lmimirror3pvr.azureedge.net/static/media/7961/354ec96e-
a32c-440e-90ed-d3f30d02245c/diagnosis-machine_960x540.jpg";
    images[3] = "https://encrypted-
tbn0.gstatic.com/images?q=tbn:ANd9GcQwhh5YjtirxkpzHdT7tGSUN1lCosz9lV7hVr02bwijG2Z3moPbs
I07tb4BXhirZ9l7qEM&usqp=CAU"
    images[4] = "https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcReArAbjbi8-
oHZpA0XC8AP_CLMG8C3UgqhkQbaY1NQAz_yQOHHte1dZ1IRO-4RSi8RNvs&usqp=CAU"

</script>


</head>
<body onload="startTimer()"><center>
<h1 style="font-family:Arial, Helvetica, sans-serif;font-weight:
bold;color:black;"><i>EL INFINITO : MRI ANALYSIS </i></h1><br>
<div class="row">
<div class="column">
<img id="img" src="https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcReArAbjbi8-
oHZpA0XC8AP_CLMG8C3UgqhkQbaY1NQAz_yQOHHte1dZ1IRO-4RSi8RNvs&amp;usqp=CAU"  width="600"
height="450">
</div>
<div class="column">
<center><p style="font-size:25px; font-family:Arial, Helvetica, sans-serif;font-weight:
bold; color:black;"><i>What do we do?</i></p>
<p style="font-size:17px;font-family:Arial, Helvetica, sans-serif; color:rgb(0, 8,
0);"> Brain tumors are often uncommon among people, but can pose a huge threat to the
health of a living being.
Tumors can arise in any age group, but the outcome need not always be grave--
especially when they are diagnosed at earlier stages and accurately with the
proper equipment. El infinito MRI analysis offers the facility to promptly analyse and
detect brain tumors in MRI scans, thereby reducing human error /
negligence and time consumption while assuring high acuracy of results. All you have to
do is upload an MRI image down below and receive
AI-aided diagnosis, along with instructions regarding how to proceed with treatment /
maintain a healthy lifestyle.
</p>
<div class="row"><center>
<form action="http://localhost:5000/mri_redirect" id="upload-file" method="POST"
enctype="multipart/form-data">
<table cellpadding="10px" cellspacing="20px" style="color:red;">
<tbody><tr><td>Upload an MRI image here: </td><td align="left"><input type="file"
id="actual-btn" name="image" id="image" accept=".png, .jpg, .jpeg" hidden/>
<label for="actual-btn">Choose File</label>
```

```
<span id="file-chosen">No file chosen</span>
<script>

const actualBtn = document.getElementById('actual-btn');

const fileChosen = document.getElementById('file-chosen');

actualBtn.addEventListener('change', function(){
  fileChosen.textContent = this.files[0].name
})

</script>

</td></tr>
<tr><td></td><td align="left"> <button class="button" >Submit</button></td></tr>
</tbody></table>
</form>
</center>
</div>
</center>
</div>
</div>
<br>
<footer style="background-color:#ffd3d5;">
<h2 align="left" class="fontsize18 gouthammedium wtcolor">  Contact us for
more details or queries: </h2>
<p align="left" style="font-size:17px; color:#1a1a1a;"><i>
 Marlapalli Ritika -20BCB0134
 <br> Sai Krishna Aditya Kurapati -20BCE2321
 <br>  Sumit Dutta -20BEE0354
 <br>  Malay Rajpoot -20BEC0664
 <br>
 <br>
</i></p>
</footer>
</div>
```