BRAIN TUMOR DETECTION FROM MRI IMAGES

(Using Convolutional Neural Network)

Developed by: Uppula Gnaneshwari,Nikhitha Sripada,Navya Rumandla,Harish Manchupelly
Smart Bridge-Remote Summer Internship Program

1. INTRODUCTION

A brain tumor is a mass or growth of abnormal cells in your brain.Tumor is defined as the abnormal growth of the tissues.Many types of brain tumors exist.Some of them are noncancerous (benign), and some are cancerous (malignant).It has become the most commonly occuring malignancy among human being. In recent times, the introduction of information technology and e-health care system in the medical field helps clinical experts to provide better health care to the patient.Brain tumor is the major cause for the increase in mortality among children and adults.MRI imaging plays an important role in brain tumor for analysis,diagnosis and treatment planning.It is helpful to doctor for determining the previous steps of brain tumor . The detection of brain tumor using MRI images is a challenging task because of the complex structure of the brain. MRI images provide better results than CT scan and X-ray because it is an advanced medical imaging technique and it uses powerful magnets to produce high resonance images of all parts of the body.These MRI images can be processed and one can detect the brain tumor using image precessing technique by forming an automatic detection process using algorithms because the manual detection of tumor from MRI images may give human error.In this project our focus will be mainly to improve the exising approaches of images processing or to design a better approach for the detection of the tumor.

1.1 Overview

Now a days, brain tumours are leading to a very short life expectancy in their highest grade.The analysis of risk in tumors need to examine and detect in proper way to diagnose and treat the patients. So these model proposes fully automatic segmentation of brain tumour using convolutional neural network. Further, it uses high grade brain images from training. The suggested work accomplishes brain tumour segmentation using tensor flow, in which the anaconda frameworks are used to implement high level mathematical functions. The survival rates of patients are improved by early diagnosis of brain tumour. Data Mining is one of the most motivating and vital area of research with the aim of extracting information from

tremendous amount of accumulated data sets. Here a new model for classifying tumor in brain by using Machine Learning concepts. The model has been built using brain tumor with mri images to predict the status of brain whether the person is effected by tumor or not. We used CNN algorithm for building this model.By using the algorithm a Flask model has been implemented and tested.Model has been discussed and a full comparison between algorithms and a full comparison between algorithms was conducted.Convolutional Neural networks was selected as best algorithm based on accuracy.

1.2 Purpose

Our aim from the project is to make use of CNN from python to extract the libraries for deep learning for the brain tumor detection with MRI images.Secondly, In this study, to improve the performance and reduce the complexity involves in the medical image segmentation process.The experimental results of proposed technique should be evaluated and validated for performance and quality analysis on magnetic resonance brain images, based on accuracy And in the end, to predict whether the person is effected by tumor or not using machine learning algorithms.

2.LITERATURE SURVEY

For building a model , To detect the tumor cells in the brain with mri images,we use deep learning algorithms for prediction. So the techniques include classification, clustering, random forest, prediction and sequential patterns, neural networks, regression etc. To develop a model that can classify the large data of records, we are using Classification as the technique to train the model in order to predict the outcome.

2.1 Existing Problem

The previous models may have wrong predictions of the uploaded image,and it may take lot of time to predict the image,whereas this model has 94% accuracy (i.e., a good trained model)than any other model already proposed.In this model we used deep learning algorithm named Convolutional Neural Network which gives accuracy more than 90% of the previous predicted problem and there is a user friendly interface to predict the result,and lot of the previous models haven't include the UI which is understanding and convenient for the users.

2.2 Proposed Solution

Deep Learning (Convolutional Neural Network)

In deep learning, a convolutional neural network is a class of deep neural networks, most commonly applied to analyzing visual imagery.It is the most popular neural network model being used for image classification problem.CNNs are regularized versions of perceptrons,it means each neuron in one layer is connected to all neurons in next layer.CNNs take a different approach towards regularization: they take advantage of the hierarchical pattern in data and assemble more complex patterns using smaller and simpler patterns. Therefore, on the scale of connectedness and complexity, CNNs are on the lower extreme.

1.Creating a dataset using train and test folders(images).

2.Importing the libraries.

3.Preprocess the dataset(reading data).

4.Initialize the model

5.Add convolutional layer.

6.Add pooling layers.

7.Add flatten layer

8.Add dense layer.

9.Configure the learning.

10.fit()

11. Saving the model.

12. Predicting the image

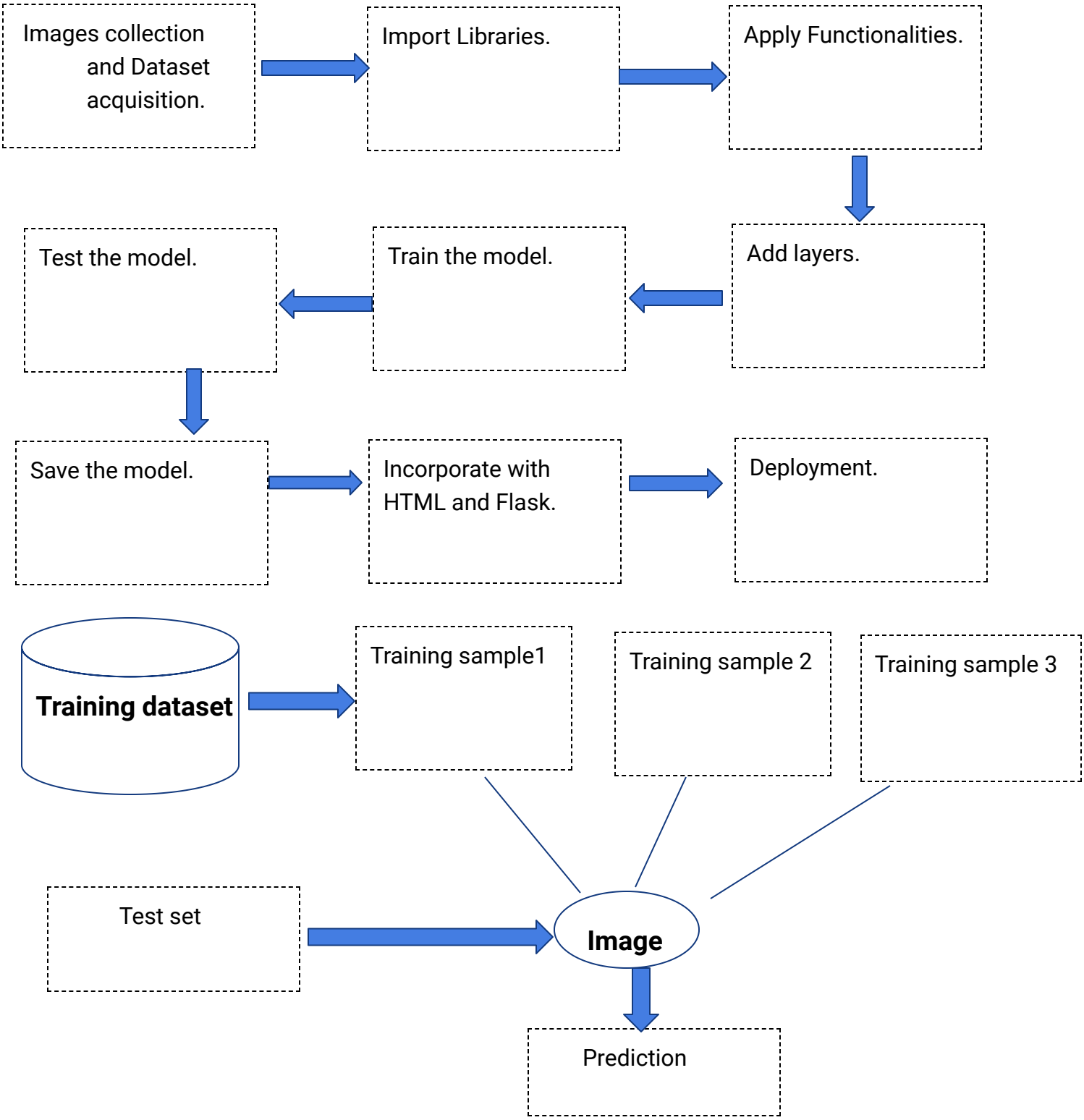
We also created an UI using the Flask for the brain tumor recognition.This UI will allow the users to check whether they are suffering with tumor or not.It can be done just by uploading the MRI image of their brain.This is a friendly and easily understandable interface.

3.THEORETICAL ANALYSIS

While selecting the algorithm that gives an accurate prediction we gone through a lot of algorithms which gives the result abruptly accurate and from them we selected only one algorithm for our problem that is Convolutional Neural Network.This a very simple and most commonly used algorithm to predict the images.

In this algorithm,firstly we will train the machine with different images using CNN layers.Then we will configure the model and save the model and predict it.In order to find the test accuracy we have to give some images and check whether the result predicted is correct or not. If the accuracy of the trained model is between 85-94% then it is said to be well trained.We can train the model again and again to increase the accuracy.

3.1 Block Diagram



3.2 Software Desigining

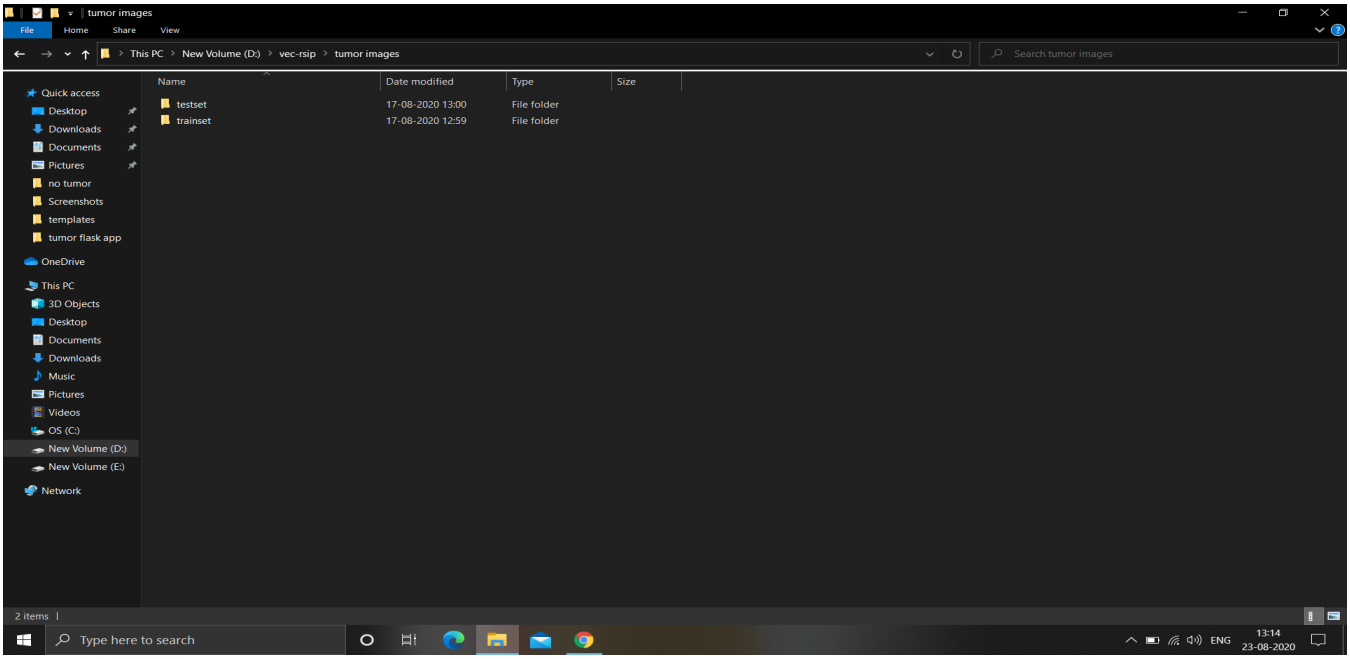
- Jupyter Notebook Environment
- Spyder Ide
- Deep Learning Algorithms
- Python (pandas, numpy)
- HTML
- Flask

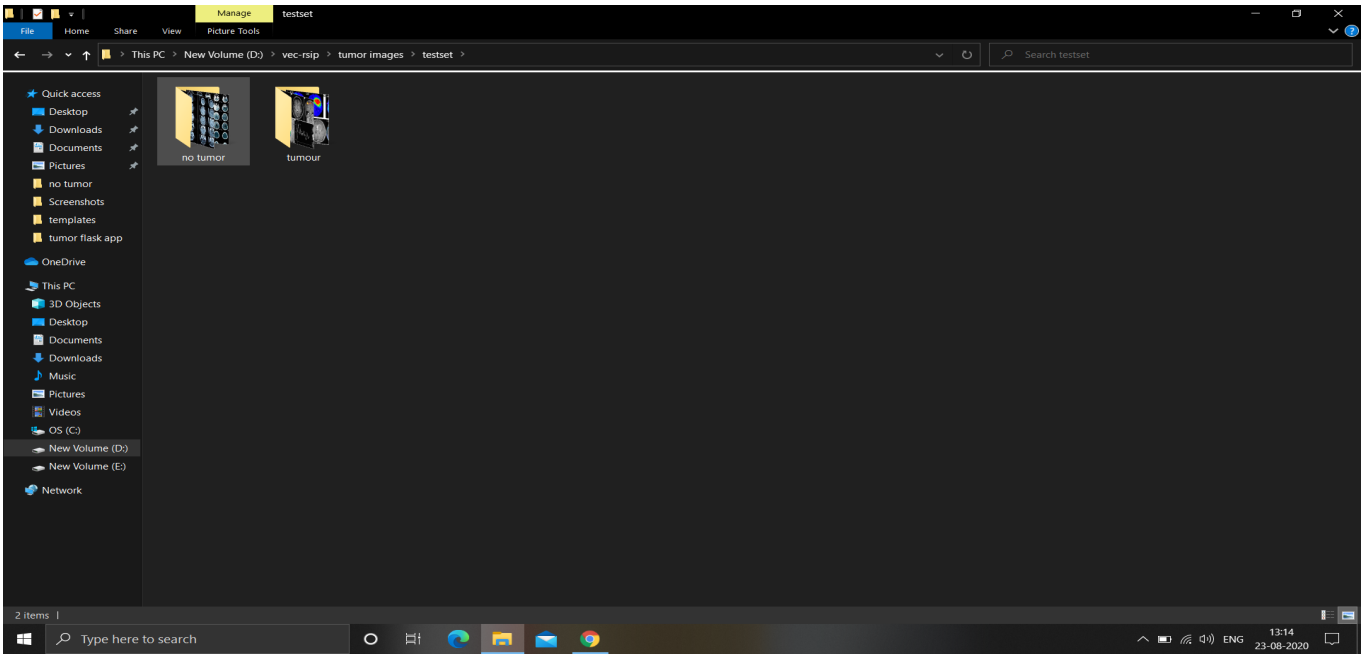
We developed this model, the Brain Tumor detection with MRI Images by using the Machine Learning algorithms with highly interpreted Python programming language. for the training the algorithms, we used the Jupyter Notebook environment of the Anaconda package manager and the Spyder IDE.

For creating an user interface for the prediction,we used the Flask. Flask is a lightweight WSGI web application framework. It is designed to make getting started quick and easy, with the ability to scale up to complex applications. Python web application frameworks.It directly provides all functions from the pre-existing third party libraries, so,database abstraction layer,form validation, or any other components are not required. And Flask is also a scripting language to create a webpage in HTML by creating the templates to use in the functions of the Flask and HTML.

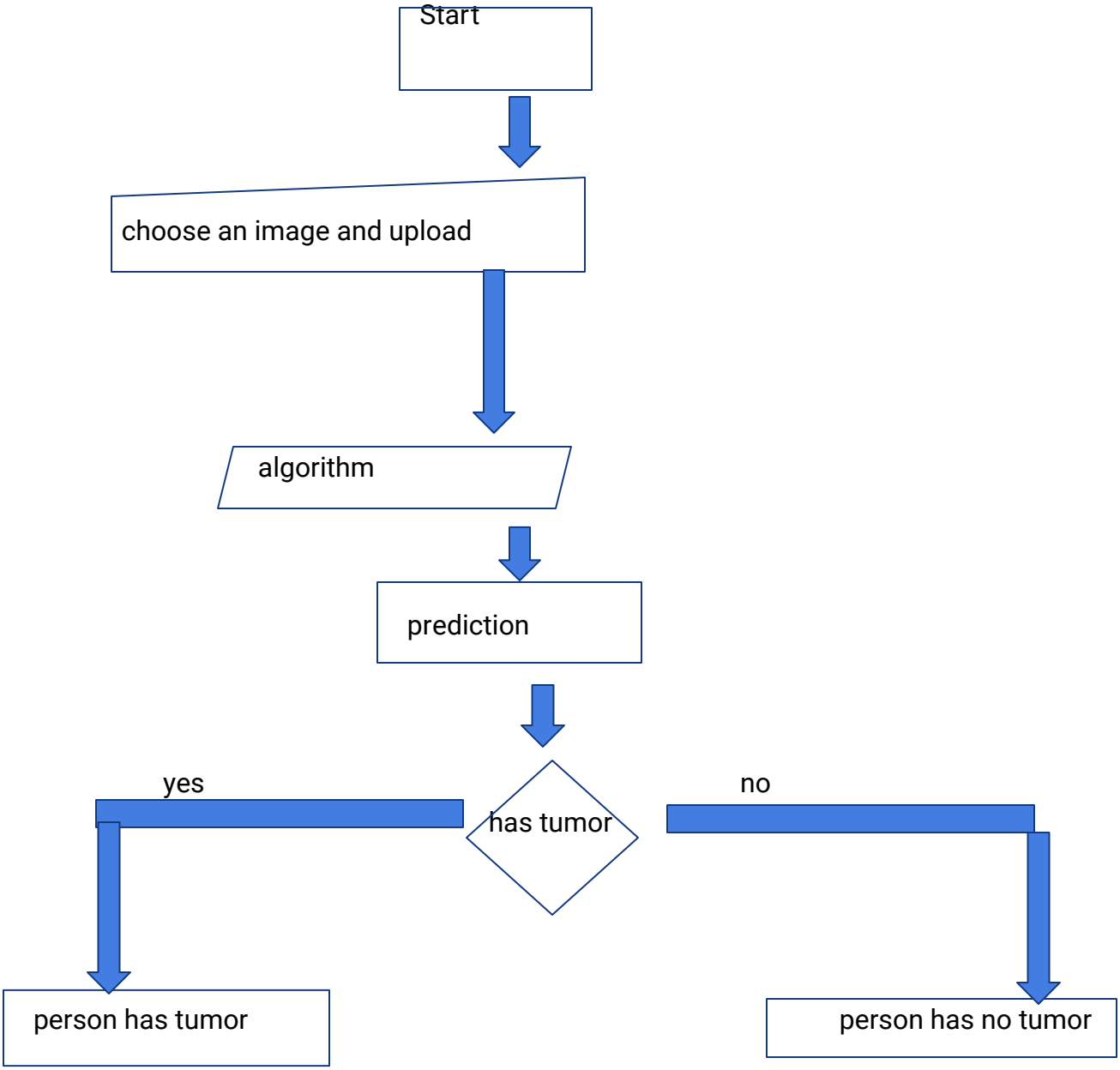
4.EXPERIMENTAL INVESTIGATION

In this paper,the dataset we used is created by downloading pictures of tumor and non-tumor images of brain.The dataset is named as tumor images,it consists of 2 sub-folders (trainset,testset).Each sub-folder consists of tumor and non-tumor images folders.Each tumor and non-tumor floders consists of 200 images.


tumor images
File Home Share View
This PC > New Volume (D:) > vec-rsip > tumor images
Search tumor images
Quick access
Desktop
Downloads
Documents
Pictures
no tumor
Screenshots
templates
tumor flask app
OneDrive
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
OS (C:)
New Volume (D:)
New Volume (E:)
Network
Name
Date modified
Type
Size
testset
17-08-2020 13:00
File folder
trainset
17-08-2020 12:59
File folder
2 items
Type here to search
ENG
13:14
23-08-2020

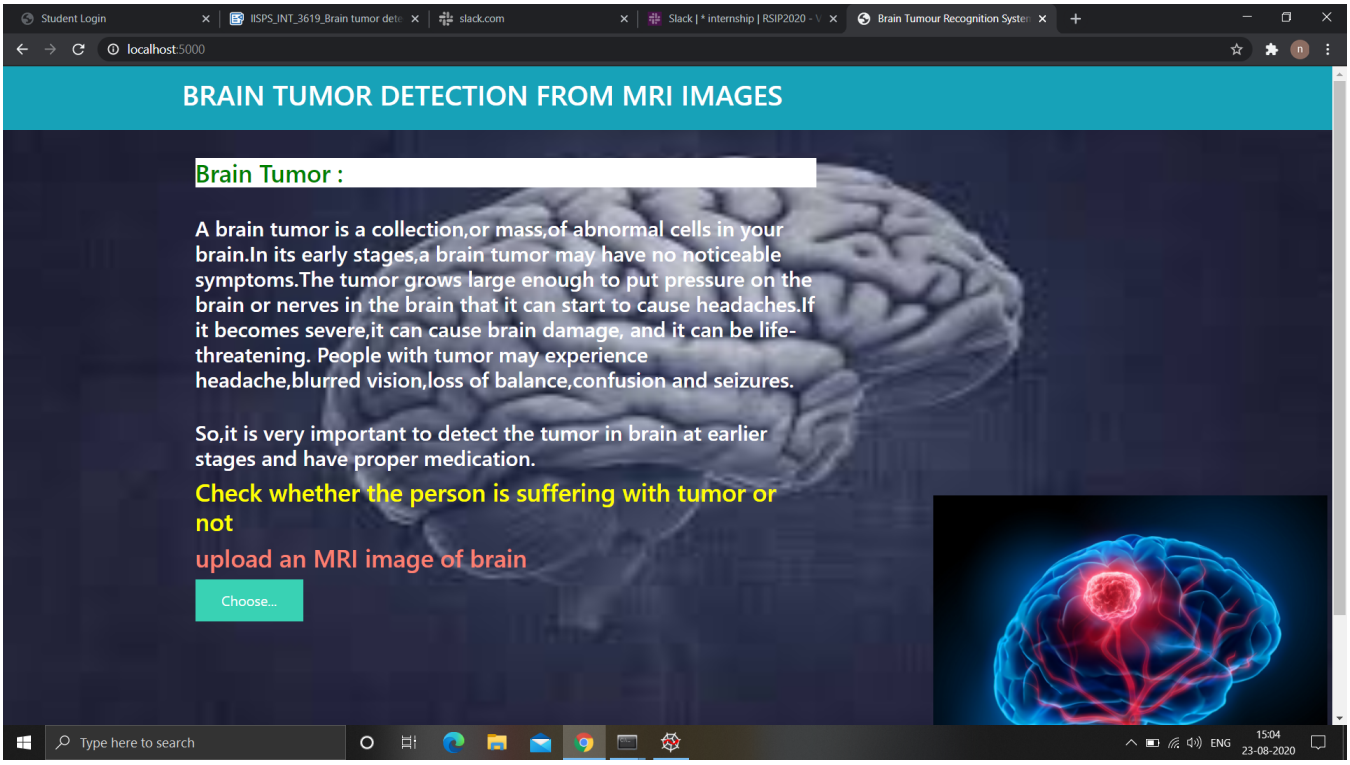

Manage
testset
File Home Share View Picture Tools
This PC > New Volume (D:) > vec-rsip > tumor images > testset
Search testset
Quick access
Desktop
Downloads
Documents
Pictures
no tumor
Screenshots
templates
tumor flask app
OneDrive
This PC
3D Objects
Desktop
Documents
Downloads
Music
Pictures
Videos
OS (C:)
New Volume (D:)
New Volume (E:)
Network
no tumor
tumour
2 items
Type here to search
ENG
13:14
23-08-2020

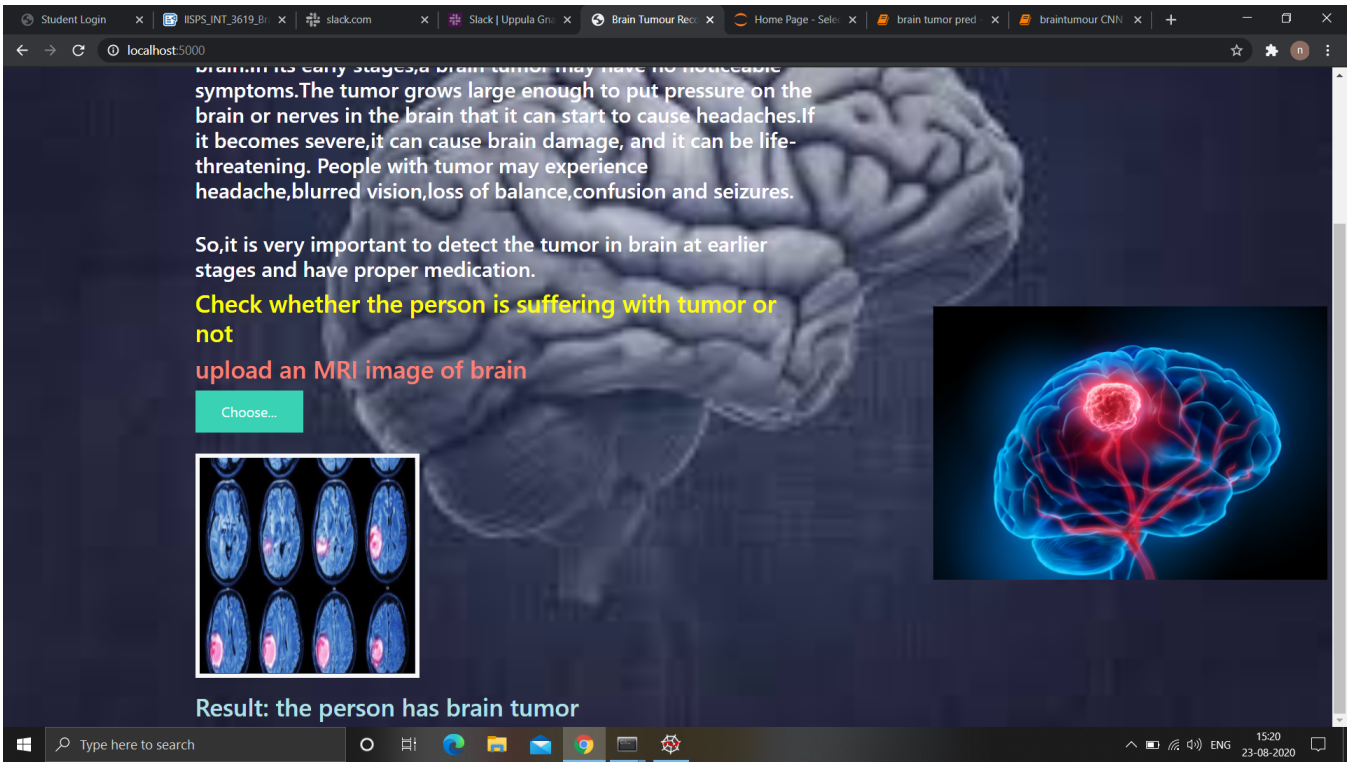
5.FLOWCHART


Start
choose an image and upload
algorithm
prediction
has tumor
yes
no
person has tumor
person has no tumor

6.RESULT

In this paper,CNN algorithm is used to recognize the image uploaded and predict the result.The result will display whether the person has tumor or not.After uploading the image, clicking on the check result button,the predicted result is displayed.The result shows that the person is suffering with brain tumor or not.





7.ADVANTAGES AND DISADVANTAGES

Advantages:

● Easy and simple User Interface for the people who are testing their brain to check whether they are effected by tumor or not.

● Convolution Neural networks give the accurate result of the prediction upto 73% which is the algorithm we used for prediction.

● By this model,diagnosing a brain tumor usually begins with magnetic resonance imaging (MRI). Once MRI shows that there is a tumor in the brain, the most common way to determine the type of brain tumor is to look at the results from a sample of tissue after biopsy or surgery.

● It is commonly applied for analysing visual imagery.They are also known as shift invariant or space invariant artificial neural networks,based on their shared-weights architecture and translation invariance characteristics.It is composed using the HTML and Python for the web

usage in real time.

● It can work in real time and predict as soon as the necessary details for prediction are given to the model,further treament can be processed based on the results.

● Needs only single mri images for the prediction.

● Gives 94% accuracy for the prediction.

Disavantages:

● It only predicts the presence of tumor ,but it will not predict the stage and size of the tumor.

● It asks for the MRI image of brain which cannot be affordable by everyone.

8. APPLICATIONS

● Convolution Neural networks is a class of deep neural networks, most commonly applied to analyzing visual imagery, which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other.are dealing with in real time.

● It is one of the most widely used in Analysing the visual imagery in the Hospitals.

● By this model,we can directly analysis and predict the possibility of tumor cells without going to Hospitals etc. It saves time and money of people by directly providing an User interface using machine learning algorithms.

● So we use Machine Learning Algorithms to analyze the data and predict the tumor and propose the stage for treatment by mri images,we can detect the tumor by using Mri images by sitting in our home.

9.CONCLUSION

In this paper,the CNN algorithm is adopted to build a UI model for predicting the image uploaded by the user.Its prediction depends on the accuracy of the training of the image.The

experiment says that CNN is easy to predict the result effectively than other NN algorithms.

10.FUTURE SCOPE

In future the CNN algorithm can be applied on other datasets of different images.A rigorous anlaysis of other deep learning algorithms are used for image predictions.In further study,we will try to predict the stage as well as the size of the tumor if it is predicted as "has brain tumor" and a great UI support system making it complete web application model.

11.BIBLIOGRAPHY

● Giuseppe Bonaccorso,Mastering Machine Learning Algorithms,Expert techniques for implementing popular machine learning algorithms, fine-tuning your models, and understanding how they work, 2nd Edition.

● Rahul Raj,Java Deep Learning Cookbook,Train neural networks for classification, NLP, and reinforcement learning using Deeplearning .

● AurélienGéron,Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow,Concepts, Tools, and Techniques to Build Intelligent Systems.

● Mark Graph,Deep Learning with Python,The Ultimate Guide to Understand Deep Neural Networks with Python through PyTorch, TensorFlow and Keras. Discover the Ethical Implications of Deep Learning in the New World .

● Le Lu,Xiaosong Wang,Gustavo Carneiro,lin yangDeep Learning and Convolutional Neural Networks for Medical Imaging and Clinical Informatics.

●Umberto Michelucci,Advanced Applied Deep LearningConvolutional Neural Networks Detection.

APPENDIX

HTML:

```
<html lang="en">

<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <meta http-equiv="X-UA-Compatible" content="ie=edge">
  <title>Brain Tumour Recognition System</title>
  <link href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.css"
```

```
rel="stylesheet">
   <script src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.js"></script>
   <script src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script>
   <script src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js"></script>
   <link href="{{ url_for('static', filename='css/main.css') }}" rel="stylesheet">
         <style>
         .bg-dark {
                  background-color: #42660c!important;
         }
         #result {
                  color: #b0e0e6;
         }
         #pic
         {
         top:65%;
         left:70%;
         height:400;
   width:400;
   position:absolute;

         }
         </style>
</head>
<body style = "background-image:
url('https://encrypted-tbn0.gstatic.com/images?q=tbn%3AANd9GcS483AS5srT4ErbavU98z9ri
2ckxH927CAIfw&usqp=CAU'); background-size: 100%
100%;background-position:center;background-repeat:no-repeat;">
      <nav class="navbar navbar-dark bg-info">
      <div class="container">
         <a class="navbar-brand" href="#"><h2 style="text-align:center;">BRAIN TUMOR
DETECTION FROM MRI IMAGES</h2></a>
      </div>
   </nav>
   <div class="container">
      <div id="content" style="margin-top:2em">
                  <div class="container">
                   <div class="row">
```

```
                    <div class="col-sm-8 bd" >
                     <h3 style="background-color:white;"><font color="green">Brain Tumor :
</font></h3>
                     <br>
                     <h4><font color="white">A brain tumor is a collection,or mass,of
abnormal cells in your brain.In its early stages,a brain tumor may have no noticeable
symptoms.The tumor grows large enough to put pressure on the brain or nerves in the brain
that it can start to cause headaches.If it becomes severe,it can cause brain damage, and it can
be life-threatening.
                          People with tumor may experience headache,blurred vision,loss of
balance,confusion and seizures.
                     </font></h4>
                    <br>
                     <h4><font color="white">So,it is very important to detect the tumor
in brain at earlier stages and have proper medication.</font></h4>

                    </div>
                    <div class="col-sm-8">
                         <div>
                         <h3><font color="yellow"> Check whether the person is suffering
with tumor or not</font></h3>
                              <h3><font color="salmon">upload an MRI image of
brain</font></h3>
                    <form action = "http://localhost:5000/" id="upload-file" method="post"
enctype="multipart/form-data">
                         <label for="imageUpload" class="upload-label">
                              Choose...
                         </label>
                         <input type="file" name="image" id="imageUpload" accept=".png,
.jpg, .jpeg">
                    </form>


                    <div class="image-section" style="display:none;">
                         <div class="img-preview">
                              <div id="imagePreview">
                              </div>
```

```
                                    </div>
                                    <div>
                                            <button type="button" class="btn btn-info btn-lg "
id="btn-predict">Click here to know the result</button>
                                    </div>
                            </div>

                            <div class="loader" style="display:none;"></div>

                            <h3><font color="salmon"><span id="result"> </span></font></h3>

                    </div>
                            </div>

                      </div>
                    </div>
                    </div>
       </div>
     <div id="pic">
              <img
src="https://q6j7k6h3.rocketcdn.me/wp-content/uploads/2018/12/Brain-Tumor-Large-Research-Grant.png" width="450",height="450">
              </div>
</body>

<footer>
   <script src="{{ url_for('static', filename='js/main.js') }}" type="text/javascript"></script>
</footer>

</html>
```

APP.PY:

```
from flask import Flask, render_template,request
import os
from keras.preprocessing import image
from werkzeug.utils import secure_filename
```

```
from keras.models import load_model
import tensorflow as tf
global graph
graph = tf.get_default_graph()
import numpy as np
model = load_model("tumor.h5")
app = Flask(__name__)
@app.route('/')
def index():
    return render_template("base.html", methods = ['GET'])
@app.route('/predict',methods = ['GET','POST'])
def pred():
    if request.method == "POST":
        f = request.files["image"]
        print("hie")
        """take the path of  the current
        running prog,and concatenate to the
        folder where you wouldlike to save the file"""
        basepath = os.path.dirname(__file__)
        print(basepath)
        file_path = os.path.join(basepath,"uploads",secure_filename(f.filename))
        print(file_path)
        f.save(file_path)
        img = image.load_img(file_path,target_size = (64,64))
        x = image.img_to_array(img)
        x = np.expand_dims(x,axis = 0)
        with graph.as_default():
            p = model.predict_classes(x)
            print(p)
        index = ["no brain tumour"," brain tumor"]
        text = "the person has " +index[p[0]]
        return text
if __name__ == "__main__":
    app.run(debug = True)
```