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Brain Tumor Detection Using Machine Learning

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ABSTRACT:A brain tumour results from the brain's cells growing abnormally. This paper deals with detecting brain tumours from MRI images, by using CNN algorithm which experimentally resulted to be the most efficient methods among all the other algorithms providing better accuracy with lower quality and also provide the accuracy while predicting the tumour by deploying the system as a web application.

A Machine Learning model based on CNN is used for classification of the brain tumour using the two publicly accessible dataset .User friendly web application is created to easily upload the MRI images and detect the abnormalities if any and the system deals with building Mask R-CNN model to display a confusion matrix that can specify the accuracy of the model to detect the tumour from brain MRI scans ,thereby assisting the physicians in early tumour identification and to provide appropriate treatment by reducing computation time.

I.INTRODUCTION

Among human body there are many significant organs , in that brain is the one which has numerous number of cells. Neoplasm is the term for an aberrant cell cluster that develops as a result of unchecked cell division.The Brain neoplasms or the brain tumours are the two categories into which they are divided. The low grade of brain tumours that's classified as benign are known as benign. Same goes with, malignant is another term for high grade neoplasm. neoplasm, benign tumour, noncancerous tumour, noncancerous neoplasm, tumour, tumour, or noncancerous neoplasm is not a cancerous tumour. Therefore, it doesn't reveal the various parts of the brain. Malignant Neoplasms quickly starts to spread to several body parts with no clear boundaries therefore they are cancerous. It results in instant death. Images from brain MRI are primarily used to identify tumours and track their development. The main applications of this data are the detection and treatment of neoplasms. This project uses CNN to categorise healthy and malignant brains. "Convolutional" this word is taken from the mathematical linear process used in CNNs (convolutional neural networks). Every CNN layer reduces the image's size, yet knowledge is not lost in the process.

II.LITERATURE REVIEW

[1]In the paper, a machine learning method is presented for determining whether a brain tumour is present in an MRI image. The outcomes demonstrate how effective this strategy is. There is no human involvement in the process. We need to do pre-processing many characteristics of the photos, including the colour, area of interest, image extension etc.

[2]The paper deals with the use of Neyral Network Technique.The experiments described in the paper show that, after pre-processing of the MRI images, the classification by using Neural Network technique was the most effective among the all. At also the Lazy-IBk technique did a great job and came next followed by the Naive Bayes technique and then the J48 decision tree that came in the last.

[3]The project's objective is to develop an accurate, efficient, and high-performance auto brain tumour classification system. The FCM or Fuzzy C means technique, which uses segmentation, feature extraction for textures as well as the forms, and SVM (support vector) classifications, is employed in the traditional categorization of brain tumours. The classification results are shown as images of a brain tumour or a brain in healthy state. The CNN is one deep learning

method that employs a number of (levels) of feed forwarded layers (FFL). For implementation, you can also use the Python IDE.

[4]These research discusses an image pre-processing strategy that increases the neural network algorithm's robustness and strengthens the model's accuracy. The method shortens the CNN model's training time while also improving prediction accuracy. Pre-processing enables the application of a considerably wider variety of algorithms for the incoming data. In order to improve the picture data and enable our AI-based models to use it to perform segmentation, digital image processors try to improve some essential imaging qualities or suppress undesirable distortions. The main goal of the research is to create an auto brain tumour detection with decent performance and low complexity.

[5]For the objective of eliminating noisy data and image enhancement, pre-processing techniques were used. The MRI brain image is additionally taken into account for pre-processing segmentation techniques to locate tumour part. Later, an appropriate morphological operation was used to further improve the tumour part. The next step is to determine the tumour area using an improved tumor-based picture that has undergone various kernel-based SVM (Support Vector Machine) classifications. The experimental results demonstrated that when pre-processing, segmentation, and morphological procedures were used in conjunction with proper Multi hybridised techniques, accuracy had enhanced.

[6]The K-Nearest Neighbor approach can be used to analyse MRI pictures. a classification method and use of image processing in basic research. A system for classifying tumours is created to both identify and detect tumours of various types. Only the Axial section of the MRI results, which are divided into the three groups of Astrocytoma, For the data interpretation of this method, glioblastoma and oligodendroglioma are used. The objective of the tumour classification system is to recognise and classify various tumour forms. Tumour categorization is used after the shape feature extraction and segmentation process. These systems use the Grey Level Co occurrence Matrix (GLCM) feature extraction approaches, Principle Component Analysis (PCA), and Linear Discriminant Analysis (LDA) to reduce the amount of information that is acquired from brain MR images.They then used two classifiers after that.

[7]The system in this study evaluates the performance of the four primary classifier types: polynomial, radial basis function, random forest, and least squares support vector machines. The software categorises the input MR imaging images.

[8]Numerous procedures have been modified for the identification of brain tumours, and as technology advances, numerous new procedures and tests are being created that are some of the approaches that have been utilised, although each had drawbacks of its own. The intensity levels of the pixels were used to first separate and then group them during thresholding.

[9] Using artificial neural networks (ANN) and convolutional neural networks (CNN), normal and malignant brains are discriminated in the study. An artificial neural network acts as the nervous system of the human brain and is based on the premise that a digital computer is connected to a substantial degree of interconnection and networking, allowing neural networks to train utilising simple processing. Neural networks can learn new things by applying datasets to the learning process.

[10]The convolution networks are mostly based on the classification mechanisms are introduced to improve accuracy and computation speed, with results presented as images of tumours or conventional brain structures. The deep-learning techniques that employs on-series of feed forwarded layers is the CNN. A file path is used to scan MRI images in the native computer and then converted back to grayscale images.

SUMMARY ON LITERATURE SURVEY

No.	Author	Paper	Technique	Description
1	ML is an Approach for brain tumour detectiontechniques.	Ghaith Husari etc	Artificial Neural Network and Naïve bayes algorithms	Algorithm(techniques) used to analyze and to classifying the Medical images. A much higher accuracy can be achieved with higher resolution images.
2	Seetha ,etc	CNN Braintumor	Fuzzy CMeans (FCM) based	Matching of pattern,clustering

		classification.	segmentation and K Nearest Neighbor (KNN)	the data even for the classification methods and so on,involve neural networks. The types of neural networks are further divided based on how they link to one another.
3	Juan Rosai M.D., LaurenV.Ackerman M.D.	The pathology of tumors, Grading, staging and classification	SVM, algorithm	The two methods used for evaluating malignant tumors are grading and staging.
4	Ronan sicre,etc	Machine Learning which has integral type of pooling of CNN network activation.	CNN algorithm	Image representations are built using the CNN algorithm
5	S. Selvakumar Raj,etc	tumor classification using machine learning	CNN algorithm	Automatic way of the brain tumour detection by usie of Convolutional Neural Networks
6	Fazli- Shah etc	Techniques of brain MR imaging classification using the k-nearest neighbour algorithm techniques.	KNN algorithm	These gives better accuracy and performance speed.
7	L Massoptier,etc	Algorithms for Segmentation (techniques) of brain structure Images.	ML, support vector machines techniques.	The kind of segmentation techniques which involves with lesions of brain ,even after that can provide the good performance and then segmenting subcortical structures of the brain is highly required.
8	Eibe Frank, Geoff Holmes, etc	Machine learning objects	ML techniques	Aim is to identify patterns that understand the domain from which data has been collected and in this way the predictions can be made.
9	Dr. Pushparani, M,etc.	Brain tumor detection and classification ways	SVM, CNN algorithm	These suggested techniques are utilised to locate a brain cancer utilising an MR scan image. the single that will be detected in the magnetic resonance image.

10	Dr.M.Karnan,etc	Survey for detecting of brain tumors by help of MR Images.	SVM,KNN algorithms.	SVM is regarded as the best classification technique because it has an quite good accuracy rate .

III.METHODOLOGY OF PROPOSED SURVEY

Our project deals with implementing CNN for better accuracy and performance. The overview of the process is as follows: The victimisation method and use of neural networks sculpt the human brain. The connections between the neurons are made up of whole separate layers. There will only be one input layer, one output layer, and maybe many hidden levels in between. The projected topic is given a CNN based on categorization to improve accuracy and accelerate calculation.
First step in this is collection of required data followed by essential procedures of image processing. These input MR pictures are then scanned from the native device by the file path and reborn into grayscale pictures.In the pre-processing, image resize is done to vary the size of images also with images enhancement and image smoothing processing. These MRI pictures taken as input are scanned from the native device by the file path of file and reborn into grayscale pictures. In the pre-processing, image resize is done to vary the size of images also with images enhancement and image smoothing.
The next step is to apply the proper algorithm to the model's construction. The CNN is driven to classify brain tumours automatically. The pre-processing of the dataset will be assigned to our suggested convolutional neural network (CNN) technique. This CNN performs evaluations repeatedly to improve model performance.
Finally, by using the dataset as input, these models can be used to provide the predicted (analysed) results.

Image preprocessing:
Image scaling and the elimination of impulsive noise are essential pre-processing steps. In the first segment, we convert the brain magnetic resonance imaging image into the corresponding gray-scale images. This procedure of reducing undesired noise is finished by using the bilateral filtering method to remove the noises if they are present in the brain MRI images. As a result, identification is improved, increasing the classification accuracy rate.

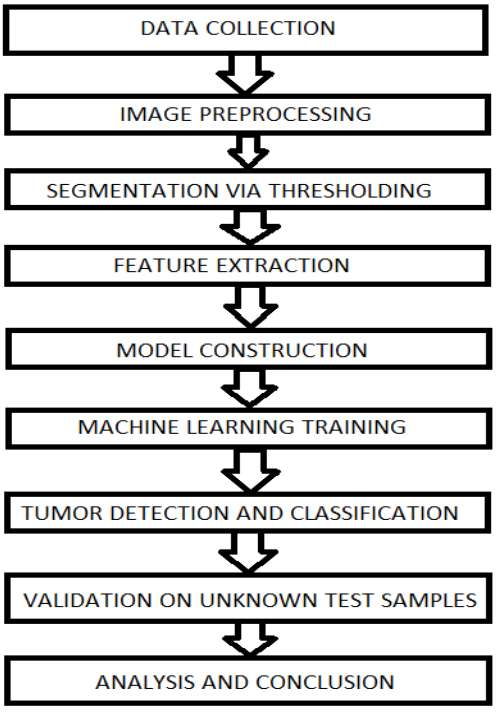

Figure 1 Block diagram of CNN based brain tumor classification

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Image segmentation:

A technique for segmenting a particular image into several portions. The objective behind the division is to offer images that are simple to explore and analyse while upholding safety standards. Additionally, this system tends to follow the edges of objects as they move between images. This approach assigns labels to the pixels depending on their characteristics and brightness. These elements take on its characteristics like intensity and similarity and serve as a stand-in for the complete original image. Segmentation algorithms can find or detect the anomalous component of the extracted image by various features.

Thresholding:

The simplest method of segmenting images is thresholding, a non-linear operation transforms a greyscale image into a binary image ,here the levels will be assigned by pixels which is above/below required threshold.

Training and testing phases:

As with training and testing phases, the CNN-based neoplasm categorization further divided into two stages. By victimisation label, that is the tumour or the non tumourous MRI's, etc, total images are divided into entirely separate classes.

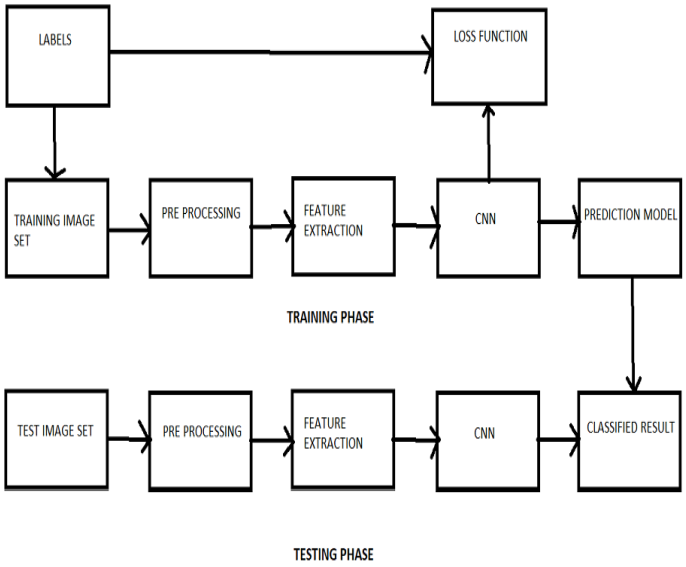

Figure 2 Training and Testing

Classification:

Classification is the best method for separating similar images in medical imaging. In scenarios where there are one or more possibilities and each of those possibilities falls under a different category, all classification algorithms provide picture prediction. automated associate degree classification scheme Because of their sturdy structure and capacity to distinguish even the tiniest details, convolutional neural networks (CNN) are utilised. A Convolutional Neural Network system that can take in a piece of input image, prioritise certain traits and objects within the image, and differentiate between them. Compared to other classification techniques, a CNN requires a lot less pre-processing.

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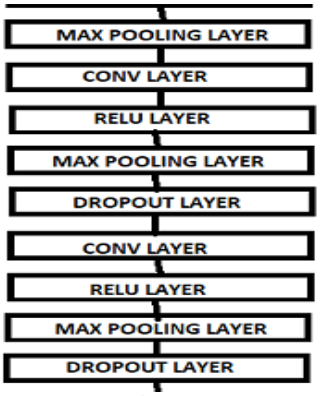

Figure 3 Architecture of CNN brain tumor classification

There are various methods or algorithms to detect Brain tumour. Few among them are as follows:

Support vector Machine:

SVM technique for regression-classification. In order to categorise the input, this method generates a line or hyperplane. Based on the courses, it will forecast the results. The SVM algorithm's disadvantage is that it struggles to train big data sets and cannot be trained correctly in case dataset consists of noise.

Artificial neural Networks:

This branch in AI called ANN is based on brain models. Typically, this is an computational type of network built on this organic neural networks that give human brain its structuring.Neural network in ANN is constructed by neurons/nodes in a layer wise structure, just like a human brain. The ANN algorithm's flaw is that its operation is unclear, and it is unclear how long the network will last.

K-Nearest Neighbors:

The most straightforward supervised machine learning algorithm is KNN. Based on commonalities, it categorises the data into separate groups. Another name for it is a Lazy Learning algorithm. This KNN algorithm's disadvantage is that it lacks a training phase and performs a poor job of detecting out-of-place layers in images.

Convolutional Neural networks or CNN:

CNN model for neural networks helps us obtain accurate representations of the images. While traditionally recognising the image in which it requires you to define features of the images yourself, CNN begins with raw pixel of data from image, trains the model, then extracts required features needed for good classification.

IV.RESULTS AND DISCUSSION

The front end of the project was built utilising Flask, a Python web framework, and HTML. By embedding Python code in HTML templates, Flask allows you to create dynamic web pages. You defined the structure of your web pages with HTML, styled them with CSS, and added interaction and functionality with JavaScript.

We use Python Programming language and Flask web framework for the backend.Flask is a micro web framework that allows you to quickly and easily construct online apps. In the backend, we collect data from various sources and preprocess it to remove any unnecessary or irrelevant information. On the preprocessed data, we then trained a machine learning model to make predictions and recommendations based on user input. For this, we used the scikit-learn library. Finally, we developed an API or web service that the application's front-end can use to fetch or transmit data as needed. These APIs were built with Flask and were in charge of interfacing with machine learning models and databases.

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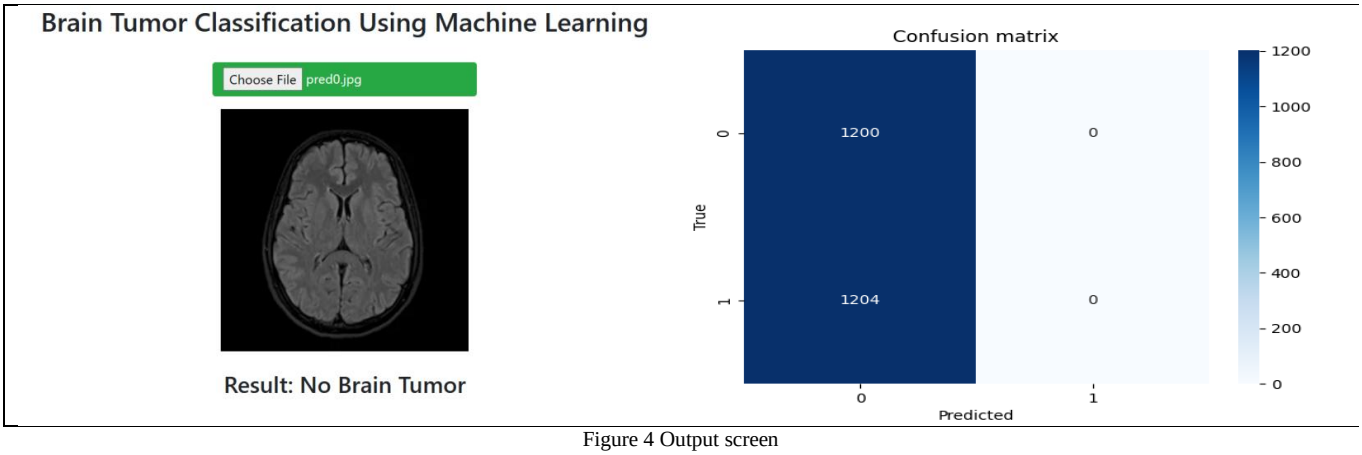

Figure 4 Output screen

V.CONCLUSION AND FUTURE WORK

An automatic brain tumors classification application along with confusion matrix that would have an high accuracy and performance is the one main objective of the model. In order to improve accuracy and reduce computing time, a computational network is deployed. Convolutional neural networks, a type of deep learning approach composed of feed forward layers, are used to identify tumours in order to improve treatment and comprehension.The proposed network has 16 layers, including an input layer that holds the previously processed images, three convolution layers, three ReLU levels, three layers for normalisation, and three layers for maxpooling. Two dropout layers, a fully connected layer, a softmax layer, and a classification layer that determines the predicted class are also used to prevent overfitting. Due to the range of imaging viewpoints, the dataset is very tiny, yet data augmentation is greatly assisted in displaying better results and thereby resolving this issue.

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