IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 2, December 2022
Impact Factor: 6.252

Brain Tumor Detection using Machine Learning

Mr. Satish Nadig[1], Jithesh K[2], Likhith Kumar U M[3], Suraj Rao[4], Sushanth D U[5]
Professor, Department of Information Science & Engineering[1]
Students, Department of Information Science & Engineering[2,3,4,5]
Canara Engineering College, Mangalore, Karnataka, India

Abstract: *This research seeks to develop a brain tumor detection system using magnetic resonance imaging (MRI), biomedical image processing, and machine learning pre-processing approaches to distinguish aberrant brain tissues from normal brain tissues. Augmentation techniques and convolution neural networks are used to extend the training set and extract the best details from the image. Early detection and diagnosis is crucial in preventing more serious consequences.*

Keywords: Brain Tumor, MRI, Convolutional Neural Network (CNN), Machine Learning, Image Processing.

I. INTRODUCTION

One of the challenging disorders in the field of medical science is the brain tumour. The term "tumour" refers to a group of aberrant cells that develop from unregulated cell division and spread to the spinal cord and various brain cells. The effective and efficient examination of the early stages of tumour progression is a radiologist's top priority. The two types of tumours are benign and malignant, respectively. There is a danger of death if a tumour is not correctly identified and treated. The tumour is a development of cells and tissues that is unusual and, on the rise. Histological classification, which is based on the image - guided histology test, is the gold standard and generally accepted method for determining the grade of a tumour. Brain tumours, whether primary or metastatic (secondary), affect more than 190,000 people worldwide each year. Brain tumour development exhibits a variety of patterns, despite the fact that the cause's exact nature is unknown. Anyone can be impacted by it, whether they are a child or an adult. The risk of mortality has initially been found to be lower in the tumour region. As a result, the radiology division has become well-known for its imaging-based research on brain tumours. This study uses MRI to obtain brain images, and it uses those MRIs to identify noise and other alterations that may have occurred during acquisition.

MRI, is a technology for images that are frequently used in clinical settings to diagnose patients and treat cancers. The image includes non-invasive soft tissue that is utilised to diagnose brain tumours. Sagittal, axial, and coronal are the three directions in which MR images are captured. MRIs contain noise brought on by operator error, which can result in substantial classification errors. Because manual segmentation takes time and is prone to human error, users can learn the pattern of brain tumours using deep learning techniques. Because tumours can vary in their shapes, sizes, and locations, computer detection systems are hard elements in every sector.

II. LITERATURE SURVEY

In this system [1], the authors proposed a system to detect tumors using MRI images. Magnetic Resonance Imaging (MRI) is used to acquire brain images, which are then pre-processed and divided into pieces. Conditional Random Field approach is used to segment the brain tissues, and Convolutional Neural Networks (CNN) algorithm is used for the processing and detection of tumors. The accuracy of the system was evaluated and found to be 87.30%, which is higher than existing systems.

This system [2] is an interface with a Client-Server technology which takes MRI brain scans and produces a thorough report. It requires basic information such as name, email, MRI, gender and age. It uses CNN-based segmentation algorithms and two different segmentation techniques (region and edge) to detect brain tumors. Additionally, using the k-means algorithm, preprocess the dataset to ensure the data points of the same category are close together while keeping data points of different categories as far apart as possible.

Method proposed in [3] encompasses the SVM method by the following steps: 1. Image Pre-processing: The MRI images are pre-processed by applying median filtering and contrast enhancement to reduce the noise from the images.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 2, December 2022
Impact Factor: 6.252

2. Feature Extraction: Features such as texture and shape of the tumor are extracted using GLCM and Gabor filter. 3. Segmentation: Segmentation is performed using the FCM algorithm. 4. SVM Classification: The SVM classifier is used to classify the segmented tumor into different stages. 5. ANN: The ANN is used to further improve the accuracy of the classification.

The authors in paper [4] proposed the performance of popular edge detection methods for image segmentation, comparing their performance in an experiment. Edge detection is a key tool for segmenting images to separate the object from the background and classify the image's content.

In this work [5] proposed two methods for dividing the tumors on an MRI picture and identifying its type. The system implemented a segmentation technique and a clustering algorithm to pre-process, segment, and extract features from the image. These features were then used to categorize the image and detect tumors in the brain.

This paper [6] discusses a user-friendly computer-assisted system in order to detect tumors through brain MRI image segmentation. The system uses a threshold segmentation algorithm in the OpenCV library to calculate the tumor's area. An MRI scan image is first converted to grayscale, which is then improved with noise removal, threshold segmentation, and feature extraction using morphological operations. The results are said to be more precise and quicker than existing systems, and the system can recognise and determine the size of the tumor accurately.

Paper [7] proposed a system combining a CNN and the multi-layered ML-SVM algorithm to detect tumors at the brain's glioma regions from MRI scans. The system consists of five elements: Image Acquisition, Pre-processing, ML-SVM Classifier, CNN Classification, Patch Extraction, and Feature Extraction. Images from the dataset are filtered and intensity levels are standardized before patch extraction and feature extraction. It achieved a 99.23% accuracy rate..0

The article [8] describes various methods for preprocessing brain MRI images for tumor detection, such as edge detection for smoothing, filtering, contrast enhancement, and edge enhancement. Post-processing procedures involve threshold, histogram, segmentation, and morphological operations to remove noise, increase contrast, and separate the foreground from the background. Image segmentation can be used to separate the picture into parts.

Referred paper [9] proposed a system using the K-Nearest Neighbour method to classify MRI brain scans as normal or abnormal. The system begins by collecting MRI data and extracting features from it. The extracted features are then used to compute distances between the test sample and all training samples, which then have the class assessed by a clear majority. The suggested method produced a classification accuracy of 100% when using the K-NN algorithm and 98.92% when using NN.

[10] The authors of this study proposed and tested the DWAE model, a deep wavelet autoencoder, for classifying images of brain tumours. The DWAE model was shown to improve the quality of the output slices through the application of a high pass filter and a high median filter. The results of the study demonstrated that the DWAE model had a low false positive rate, false negative rate, a validation loss of 0.1 and an accuracy of 99.3%, demonstrating its efficacy in aiding in the automatic brain tumor detection.

In [11] authors proposed an approach that utilizes neural networks for detecting and segmenting the brain tumors. This approach consists of five stages: skull stripping, segmentation, tumor contouring, feature extraction and application to models. A CNN model was used for classification and prediction, with layers including an Input layer, ZeroPadding layer, Convolution2D layer, Batch Normalization Layer, an "relu" Activation function, and two MaxPooling2D layers. This model achieved a f1 score of 0.846153% and accuracy of 98.067023%.

In this paper [12] proposed a system for detecting tumors in MRI scans which consists of five components: collection, pre-processing and analysis of datasets, data division, Deep Neural Network training over epochs and classification using a CNN model. Image Data Generator from the keras library is used to pre-process images and create convolution image data in batches using real-time data augmentation. Transfer learning is used to reduce the majority of the training data, the amount of time and cost of computation. Experimental results show that VGG-16 offers higher accuracy than the proposed Deep CNN model, with an accuracy rate of 92%.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 2, December 2022
Impact Factor: 6.252

Sl. No	Title	Existing System	Methodology/ Algorithm	Drawback
1	Brain Tumor Detection and Disease Prediction using CNN Algorithm	Brain Tumor Detection using FCM algorithm	Image processing using Weiner filter and segmentation approach with CNN algorithm	Existing procedures for K-implies can't be directly exchanged to CNN
2	Detection of brain tumor using CNN and ML	Integrated Framework for Analysis and Classification of Brain Tumor	Deep learning neural networks, K-Means algorithm	Systems needed a lot of hardware computation, which resulted in slower yields
3	Classification of Tumors and It Stages in Brain MRI Using Support Vector Machine and Artificial Neural Network	Classification of brain MRI image using ANN	Image segmentation and dataset clustering using FCM	This process requires a perfect pixel classifier, training data and huge time to proceed
4	Estimation of the noise in magnitude MR images	Robust Rician noise estimation	Mode of the Histogram	The results were not accurate enough
5	Brain Tumor Detection using Image Processing	Image processing on a brain CT scan	Pre-processing techniques and segmentation	Detection of the brain cancer were confined to segmentation, Did not detect which stage the cancer belongs
6	Brain Tumor Detection Using Threshold Segmentation and Morphology Operation	Brain tumor detection using different image processing techniques	Gaussian noise, Salt-and-pepper noise, median filter	The noise reduction of brain MR image is not up to mark
7	CNN-Based Brain Tumor Detection Model Using Local Binary Pattern and Multilayered SVM Classifier	Brain Tumor detection using various hybrid approach like SVM and FCM or KNN and SVM	J48 decision tree and Neural Networks	Downside of this strategy is that it is a conventional approach
8	Image Processing Techniques for Brain Tumor Detection: A Review	MRI, CT scan, Ultrasound, SPECT, PET and X-ray	Image processing and image enhancement	The processing techniques are only applicable on MR images
9	A Classifier to Detect Tumor Disease in MRI Brain Images	Hybrid techniques where the first classifier is based on ANN and the other classifier is based on SVM	Feature Extraction and classification based on K-NN	Feature Extraction can only be done on a MR image
10	Brain Tumor Detection and Classification on MR Images by a Deep Wavelet Auto-Encoder Model	Deep learning approach to detect brain tumor	Image filtering, Seed growing approach for segmentation, and DWAE model	Different layered parameters causing the system to be slow
11	Brain Tumour Detection Using CNN	Using CNN to classifying the data and predict them correctly.	Skull stripping, segmentation, tumor contouring, feature extraction Using CNN	The segmentation of brain tumor is not efficient enough
12	Brain Tumor Detection Using Deep Learning	Brain tumor detection using clustering algorithm and feature extraction	Transfer learning using DNN	The system does not recognize the type of tumor

Figure 1: Analysis Table

III. DISCUSSION

By reading through each paper, we discovered that CNN algorithm was used in many articles to identify malignancy using a dataset of many sorts of brain MRI images. Feature extraction and threshold segmentation were the methodology that proved to be more efficient in image processing techniques.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 2, December 2022
Impact Factor: 6.252

IV. FINAL ANALYSIS

This paper's goal is to develop a model with high accuracy to determine brain tumours from the MRI images. The model is based on the machine learning algorithm. It helps to predict just by reducing and resizing the image without losing any important information that will be used for predicting

REFERENCES

[1]. Mary Gladence & Valarmathi, Selvaraj, A & Maria, Shanmuga &L.,Snowlin& Prof, Asst, J & Joy. (2020). Brain Tumor Detection and Disease Prediction using CNN Algorithm. Test Engineering and Management. 82. 13376 -13381.

[2]. Suraj & Jambhulkar, Shetty, Pranav & Singh, Rasvi&Sheth, Kajal &Ujlambkar, Deepali. (2021). Detection of brain tumor using CNN and ML. 7. 308-313. 10.22271/allresearch.2021.v7.i5e.8585.

[3]. Md. Foisal, Md.Abdur Rafiqand Rasel Ahmmed Anirban Sen Swkshar, "Classification of Tumors and It Stages in Brain MRI Using Support Vector Machine and Artificial Neural Network" in International Conference on Eletrical, Computer and Communication Engineering(ECCE),Cox's Bazar, Bangladesh, February 16-18,2017.

[4]. Sijbers J et al (1998), "Estimation of the noise in magnitude MR images", MagnReson Imaging 16(1):87- 90.

[5]. Nagari Swetha, N. Sateesh, Suwarna Gothane, Siliveru Rachana, N. Sravanthi, Poreddy Rupa Devi, "Brain Tumor Detection using Image Processing", International Journal of Scientific Research in Computer Science, Engineering and Information Technology (IJSRCSEIT), ISSN: 2456-3307, Volume 7 Issue 3, pp. 348-352, May-June 2021.

[6]. Journal, IRJET. "IRJET- Brain Tumor Detection Using Threshold Segmentation And Morphology Operation." IRJET, 2020.

[7]. Rupesh Kumar Mishra, Morarjee Kolla, Y. Vijayalata, M Venu Gopalachari, S Zahoor ul Huq, KazyNoor-e-Alam Siddiquee, "CNN-Based Brain Tumor Detection Model Using Local Binary Pattern and Multilayered SVM Classifier", Computational Intelligence and Neuroscience, vol. 2022, Article ID 9015778, 9 pages, 2022.

[8]. Kawthekar, Borole, Vipin Y, Sunil S. Nimbhore and Dr. Seema S. "Image Processing Techniques for Brain Tumor Detection: A Review." (2015).

[9]. Al-Badarneh, Amer & Hassan, Najadat& Al-Raziqi, Ali. (2012). A Classifier to Detect Tumor Disease in MRI Brain Images. 784-787. 10.1109/ASONAM.2012.142.

[10]. Xu, G., Shuai, Z., Saminu, S., Javaid, I., Abd El Kader, I.,Ahmad, I. S., &Kamhi, S. (2021). Brain Tumor Detection and Classification on MR Images by a Deep Wavelet Auto-Encoder Model. Diagnostics (Basel, Switzerland), 11(9), 1589.

[11]. K. Lakshmi Nadh,Jagannadham, Sri Lekha and M. Sireesha. "Brain Tumour Detection Using CNN." 2021 Fifth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC) (2021).

[12]. Publication, IJRASET. "Brain Tumor Detection Using Deep Learning." International Journal for Research in Applied Science & Engineering Technology (IJRASET) 10.III (2022)