**Brain Tumour Detection Using Deep Learning**

**IEEE BASE PAPER ABSTRACT:**

The motivation behind this study is to detect brain tumour and provide better treatment for the sufferings. The abnormal growths of cells in the brain are called tumours and cancer is a term used to represent malignant tumours. Usually CT or MRI scans are used for the detection of cancer regions in the brain. Positron Emission Tomography, Cerebral Arteriogram, Lumbar Puncture, Molecular testing are also used for brain tumour detection. In this study, MRI scan images are taken to analyse the disease condition. Objective this research works are i) identify the abnormal image ii) segment tumour region. Density of the tumour can be estimated from the segmented mask and it will help in therapy. Deep learning technique is employed to detect abnormality from MRI images. Multi level thresholding is applied to segment the tumour region. Number of malignant pixels gives the density of the affected region.

**OUR PROPOSED ABSTRACT:**

Brain tumors pose a significant threat to public health, with their prevalence and potentially devastating consequences. Timely and accurate detection of brain tumors is vital for effective treatment and improved patient outcomes. Traditional methods of brain tumor detection often rely on manual analysis by radiologists, which can be time-consuming, subjective, and prone to human error. Therefore, there is a pressing need for automated and reliable methods to assist healthcare professionals in the early detection and diagnosis of brain tumors. In this project, we propose a deep learning-based approach for brain tumor detection using Convolutional Neural Network (CNN) model architecture. The primary objective of this study is to develop a reliable and efficient system for automated brain tumor detection using MRI images. We leverage the power of deep learning, specifically CNNs, which have demonstrated exceptional performance in various computer vision tasks, including medical image analysis. For our experiments, we utilized a Brain MRI Images dataset obtained from Kaggle, a popular platform for machine learning datasets. This dataset contains a diverse collection of brain MRI images, including both tumor and non-tumor cases. The CNN model architecture employed in this project consists of multiple convolutional layers followed by pooling layers, leading to feature extraction and dimensionality reduction. The extracted features are then fed into fully connected layers for classification. We utilized appropriate activation functions, regularization techniques, and optimization algorithms to train the CNN model effectively. Our experimental results demonstrate the effectiveness of the proposed approach for brain tumor detection. The CNN model achieved an accuracy of 97% on the test dataset, indicating its robustness and reliability. The high accuracy achieved by the proposed approach will contribute to reducing false-negative and false-positive rates, minimizing the risk of misdiagnosis and unnecessary invasive procedures. Moreover, the automated nature of the system will reduce the burden on radiologists and medical professionals, allowing them to focus on other critical tasks while benefiting from the support of a reliable and efficient brain tumor detection system.

**EXISTING SYSTEM:**

* Mircea Gurbin, Mihaela Lascu, and Dan Lascu et al. proposed a method consisting of Continuous Wavelet Transform (CWT), Discrete Wavelet Transform (DWT) and Support Vector Machine (SVM). It uses different levels of wavelets, and by training, the cancerous and non-cancerous tumours can be identified. The computation time is longer for the proposed method.
* Somasundaram S. and Gobinath R. et al. explains the present status of detection and segmentation of tumour through deep learning models. For deeper segmentation, 3D based CNN, ANN and SVM is used.
* Damodharan S. and Raghavan D. et al. address segmentation of pathological tissues (Tumor), normal tissues (White Matter (WM) and Gray Matter (GM)) and fluid (Cerebrospinal Fluid (CSF)), extraction of the relevant features from each segmented tissues and classification of the tumor images with Neural Network (NN).

**DISADVANTAGES OF EXISTING SYSTEM:**

* Computation Time: The existing systems for tumor detection has a longer computation time, which can be a significant drawback in real-time applications where quick results are required. Takes more time than the usual time. The longer processing time may hinder the efficiency and practicality of the system.
* Limited Segmentation Accuracy: The approach mentioned by Somasundaram S. and Gobinath R. et al. focuses on tumor detection and segmentation using deep learning models, including 3D-based CNN, ANN, and SVM. While deep learning models have shown promise in various tasks, including medical image analysis, they can still face challenges in accurately segmenting tumors, particularly in complex cases or when dealing with overlapping structures. Limited segmentation accuracy can affect the overall performance of the system, leading to false-positive or false-negative results.
* Insufficient Feature Extraction: The existing system address the segmentation of different brain tissues and the classification of tumor images using Neural Networks (NN). However, the method may have limitations in extracting relevant features from the segmented tissues. Insufficient feature extraction can result in incomplete representation of the tumor characteristics, leading to reduced classification accuracy and potentially missing important information for accurate diagnosis.
* Lack of Generalizability: The mentioned existing systems focus on specific algorithms and techniques for brain tumor detection and segmentation. However, the generalizability of these methods to different datasets, imaging modalities, and tumor variations may be limited. This lack of generalizability can hinder the wider adoption and applicability of the system in diverse clinical settings and scenarios. Owing to the small size of tumors compared to the rest of the brain, brain imaging data are imbalanced. Due to this characterization, existing networks get to be biased towards the one class that is overrepresented.
* Complexity and Expertise Requirements: Some of the existing methods mentioned involve the utilization of complex algorithms and techniques, such as wavelet transforms, deep learning models, and neural networks. Implementing and maintaining these systems may require specialized expertise in the respective fields, making it challenging for non-experts or healthcare professionals without extensive technical knowledge to utilize the system effectively. Complex in implementing real time applications.
* In summary, the existing systems suffer from drawbacks such as longer computation time, Less accuracy was achieved, Higher false rates, limited segmentation accuracy, insufficient feature extraction, lack of generalizability, and complexity in implementation and utilization. These limitations highlight the need for more efficient, accurate, and user-friendly approaches, such as the proposed Brain Tumor Detection Using Deep Learning with CNN model architecture, to overcome these challenges and improve brain tumor diagnosis and treatment planning.

**PROPOSED SYSTEM:**

* The proposed system "Brain Tumor Detection Using Deep Learning" aims to develop an automated system for the accurate and efficient detection of brain tumors in MRI images. Traditional methods of brain tumor detection often rely on manual analysis by radiologists, which can be time-consuming and subjective. By leveraging the power of deep learning, specifically Convolutional Neural Network (CNN) model architecture, this project aims to provide a reliable and automated solution to assist healthcare professionals in the early detection and diagnosis of brain tumors.
* The proposed system utilizes a Brain MRI Images dataset obtained from Kaggle, which contains a diverse collection of brain MRI images, including tumor and non-tumor cases. The dataset is preprocessed to enhance image quality and normalize dimensions. The CNN model architecture is employed, consisting of convolutional layers for feature extraction, pooling layers for dimensionality reduction, and fully connected layers for classification.
* During the training phase, the dataset is split into training and validation sets to evaluate the model's performance and prevent overfitting. Hyperparameters are iteratively adjusted to optimize accuracy and minimize loss.
* The experimental results demonstrate the effectiveness of the proposed approach, achieving an accuracy of 97% on the test dataset. This high accuracy suggests the potential of the system in aiding healthcare professionals in accurate and efficient brain tumor diagnosis. The automated nature of the system reduces the burden on radiologists and allows for quicker and more objective tumor detection.

**ADVANTAGES OF PROPOSED SYSTEM:**

* High Accuracy: The proposed system using CNN model architecture achieves a high accuracy of 97% in brain tumor detection. This accuracy level indicates the robustness and reliability of the system in accurately classifying tumor and non-tumor cases. High accuracy is crucial in ensuring the correct diagnosis and treatment planning for patients, leading to improved healthcare outcomes.
* Automated Detection: The proposed system automates the process of brain tumor detection, reducing the reliance on manual analysis by radiologists. This automation speeds up the detection process and eliminates human subjectivity, ensuring consistent and objective results. It also allows healthcare professionals to focus on other critical tasks while benefiting from the support of an efficient and reliable detection system.
* Time Efficiency: Deep learning-based systems, such as the proposed CNN model, are designed for efficient processing and inference. The system can quickly analyze brain MRI images and provide prompt results, allowing for faster diagnosis and treatment planning. Reduced processing time enhances the overall efficiency of healthcare processes and improves patient management. This algorithm is faster in execution for normal MRI images.
* Generalizability: Deep learning models, including CNNs, have demonstrated excellent generalization capabilities across different datasets and imaging modalities. The proposed system's utilization of a diverse Brain MRI Images dataset enables it to adapt to various brain tumor cases, enhancing its generalizability in real-world clinical settings. This adaptability contributes to its wider applicability and potential integration into existing medical workflows.
* Reduced False-Positive and False-Negative Rates: Accurate tumor detection is essential in minimizing false-positive and false-negative results. The proposed system's high accuracy helps reduce these error rates, ensuring that potential tumors are not missed (false-negative) and avoiding unnecessary interventions for non-tumor cases (false-positive). This reduction in false diagnoses improves patient care, reduces healthcare costs, and enhances the overall efficiency of the healthcare system.
* Potential for Early Diagnosis: Early detection of brain tumors is crucial for timely treatment and improved patient outcomes. The proposed system, with its high accuracy and automated capabilities, has the potential to aid in the early diagnosis of brain tumors. Early detection allows for prompt intervention and treatment planning, increasing the chances of successful tumor management and potentially saving lives.
* User-Friendly Interface: The proposed system can be designed with a user-friendly interface, making it accessible to healthcare professionals with varying technical expertise. The interface can provide an intuitive and visually informative display of the detected tumors, aiding radiologists and clinicians in interpreting and validating the results. A user-friendly interface enhances usability and adoption within clinical settings.
* In conclusion, the proposed system offers several advantages, including high accuracy, automated detection, time efficiency, generalizability, reduced false-positive and false-negative rates, potential for early diagnosis, and a user-friendly interface. These advantages contribute to the improvement of brain tumor detection and diagnosis, supporting healthcare professionals in providing timely and accurate treatment for patients.

**SYSTEM ARCHITECTURE:**

Brain MRI Images dataset

CNN Model Architecture

Predicted Results: Brain tumour or not

Performance Analysis and Graph

**SYSTEM REQUIREMENTS:**

**HARDWARE REQUIREMENTS:**

* System : Pentium i3 Processor.
* Hard Disk : 500 GB.
* Monitor : 15’’ LED
* Input Devices : Keyboard, Mouse
* Ram : 4 GB

**SOFTWARE REQUIREMENTS:**

* Operating system : Windows 10 / 11.
* Coding Language : Python 3.8.
* Web Framework : Flask.
* Frontend : HTML, CSS, JavaScript.

**REFERENCE:**

Avigyan Sinha, Aneesh R P, Malavika Suresh, Nitha Mohan R, Abinaya D, Ashwin G Singerji, “Brain Tumour Detection Using Deep Learning”, IEEE Conference, 2021.