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BRAIN TUMOR DETECTION USING DEEP LEARNING APPROACH

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ABSTRACT:
Cancer poses significant challenges in medicine, particularly in postoperative recovery. MRI is widely used for brain tumor assessment, but manual segmentation of the vast data it produces is time-consuming and prone to variability among observers. Automatic segmentation methods are thus essential. The proposed system leverages Hyper Spectral Imaging (HSI) to detect cancer cells and address ambiguities in Magnetic Resonance Imaging (MRI) samples. This system aims to accurately identify cancer cell locations in MRI images, recommending effective treatments to physicians and improving diagnostic accuracy and treatment efficacy.

Keywords:
Magnetic Resonance Imaging**,** Automatic Segmentation, Hyper Spectral Imaging.

1. INTRODUCTION

Cancer identification is a very challenging one, particularly in postoperative recovery for brain tumor patients. MRI is a critical tool for brain tumor diagnosis, but manual segmentation of the extensive data it generates is labor-intensive and subject to observer variability, limiting precise analysis. The proposed research suggests using Hyper Spectral Imaging (HSI) to detect cancer cells and reduce ambiguities in MRI samples. The goal is to develop an automatic, reliable segmentation system that accurately identifies cancer cell locations in MRI images. This system will also provide treatment recommendations, enhancing diagnostic accuracy and improving treatment efficacy, ultimately benefiting clinical practice.

1.1 EXISTING TECHNOLOGY AND DRAWBACK

Brain tumor is an abnormal growth of cells within the brain or the central spinal cord. These tumors can be benign (non-cancerous) or malignant (cancerous) and may originate from brain tissue or spread to the brain from other parts of the body (metastatic tumors). Magnetic Resonance Imaging (MRI) is a technique that uses radio frequency signals to get an image of the brain.

The study addresses the challenges of brain tumor diagnosis and treatment, highlighting the labor-intensive and error-prone nature of manual segmentation in MRI images. These factors not only disrupt clinical workflows but also introduce potential errors affecting patient care. Ambiguities in MRI samples further complicate accurate cancer cell localization and characterization. An urgent need exists for an automated solution to improve the precision, speed, and consistency of brain tumor detection and segmentation while reducing errors. Integrating Hyper Spectral Imaging (HSI) technology promises to overcome MRI-related challenges, potentially elevating the quality of cancer care provided.

1.2 SCOPE AND OBJECTIVES

The objectives of this research are to develop an automatic segmentation method for brain tumors in MRI images, reducing reliance on manual intervention and enhancing accuracy. It aims to leverage Hyper Spectral Imaging (HSI) technology to improve cancer cell detection and mitigate ambiguities in MRI scans. The study seeks to enhance the localization and characterization of cancer cells, providing a comprehensive understanding of tumor extent. Additionally, it aims to recommend effective treatment strategies, such as medications, vaccines, and chemotherapy, to assist physicians. Ultimately, this research intends to reduce diagnostic errors and increase the reliability of brain tumor detection and segmentation.

2. PROPOSED WORK

The proposed system leverages Hyper Spectral Imaging (HSI) to detect cancer cells and address ambiguities in Magnetic Resonance Imaging (MRI) samples. This system aims to accurately identify cancer cell locations in MRI images, recommending effective treatments to physicians and improving diagnostic accuracy and treatment efficacy. The proposed method uses Convolution Neural Network (CNN) Algorithm and the working architecture details are given below.

2.1 CONVOLUTION NEURAL NETWORK (CNN) – ALGORITHM

The algorithm used is CNN (Convolution Neural Network). The purpose of using CNN is the best for image recognition. CNN works by extracting features from the image any consists of the following:

- The input layer which is a gray scale image.
- The output layer may be binary or multi-class labels.
- Hidden layers consisting of convolution layers, RELU (rectified linear unit) layers, the pooling layers, and a fully connected Neural Network.

2.2 WORKING ARCHITECTURE

MRI Brain Image is the input image which is taken from the dataset (database) for image processing. The image processing has three major steps are:

- Data pre-processing
- Segmentation
- Classification

Data pre-processing: The first step of image processing is Data pre-processing. Data pre-processing is the process of taking only the necessary data from the input MRI by removing unwanted data present in the MRI image data pre-processing involves functions like converting into a grayscale image, applying different filtering methods to remove noise and image enhancement to improve the image quality. This will be converted into a suitable form on which further work can be performed.

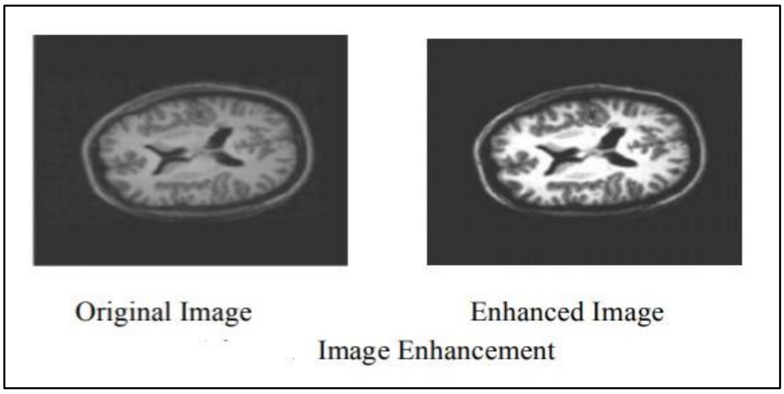


Fig.1: Data Preprocessing

Segmentation: The segmentation process will separate the tumor region from the MRI image and segmentation involves the function of threshold-based segmentation. The threshold-based segmentation is the technique used by in segmentation process. This technique will detect and highlight the tumor region based on pixel intensity (high impressions).

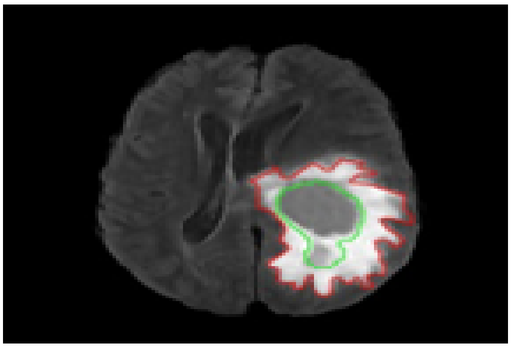


Fig.2: Segmented Image

Classification: Image classification is a process of classifying the items according to its type and pattern from image and the dataset performs on image using CNN algorithm. This CNN algorithm used to classify into normal brain or tumor brain.

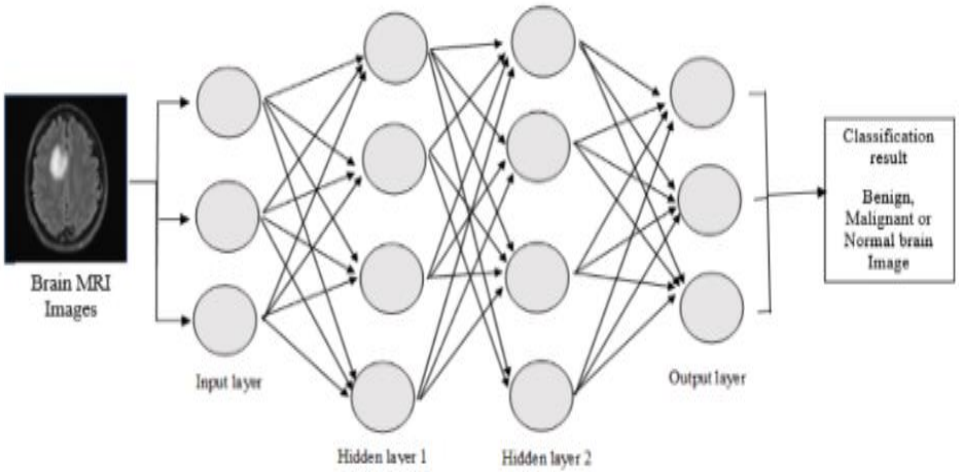
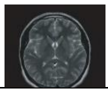
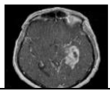
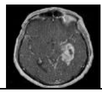
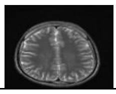
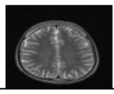
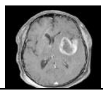
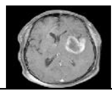


Fig. 3: Classification

3. RESULTS AND DISCUSSION

Automating the segmentation of brain tumors in MRI scans has the potential to significantly improve clinical practice. The integration of Hyper Spectral Imaging augments the precision of cancer cell detection. By capturing spectral information, HSI can distinguish cancerous tissues from healthy ones more effectively, contributing to earlier and more accurate diagnoses.

INPUT IMAGE	DETECTION OF TUMOR	RESULT/OUTPUT
		No Tumor Detected
		Tumor Detected
		No Tumor Detected
		Tumor Detected

The above table gives a detailed explanation about the images given as input and the detection of tumor in the given images. Thus the result shows whether the tumor has been detected or no tumor and the treatement suggestions has been given as below.

TREATMENT SUGGESTIONS

- Treatment for a brain tumor depends on size, type and location of the tumor cells.
- Treatment includes surgery, radiation and chemotherapy.
- Surgery - If the tumor is located in a place that makes it accessible for an operation, the surgeon will work to remove the tumor cells as much as possible.

4. CONCLUSION

Hyper Spectral Imaging (HSI) technology with CNN helps physicians detect the location of tumors. Initially, image processing techniques are done by taking MRI images as input, to detect and classify MRI images from benign or malignant using a proposed CNN algorithm. HSI is designed only to detect a tumor in the brain and give treatment suggestions after the detection of a tumor in the brain. For physicians, it works like an add-on, which reduces their work and time.

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