BRAIN TUMOR DETECTION BY IMAGE SEGMENTATION USING MACHINE LEARNING

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Abstract:

The detection, segmentation, and extraction from Magnetic Resonance Imaging (MRI) images of contaminated tumor areas are significant concerns; however, a repetitive and extensive task executed by radiologists or clinical experts relies on their expertise. Image processing concepts can imagine the various anatomical structures of the human organ. Detection of human brain abnormal structures by basic imaging techniques is challenging. The Image Segmentation has been proposed for brain tumor segmentation based on Machine learning techniques. The present work proposes the separation of the whole cerebral venous system into MRI imaging with the addition of a new, fully automatic algorithm based on structural, morphological, and relaxometry details. The segmenting function is distinguished by a high level of uniformity between anatomy and the neighboring brain tissue. ELM is a type of learning algorithm consisting of one or more layers of hidden nodes. Such networks are used in various areas, including regression and classification. In brain MRI images, the probabilistic neural network classification system has been utilized for training and checking the accuracy of tumor detection in images. The numerical results show almost 98.51% accuracy in detecting abnormal and normal tissue from brain Magnetic Resonance images that demonstrate the efficiency of the system suggested.

Keywords – segmentation,googletrans, textblob, gTTS, image processing,mri, pytesseract, elm,brain tumor,relaxometry, magnetic resonance

I. Introduction

The ability to think, move voluntarily, speak, judge, and perceive is all controlled by the brain, which is one of the body's most vital organs. Movement, balance, and posture functions are under its control. This behaves like" walking puppets" without it. The Latin term for" small brain" is where the word cerebellum originates. A brain tumor is defined as the development of a tumor in the brain that can either be benign (non-cancerous) or malignant (cancerous). As opposed to primary brain tumors, metastases from brain tumors can also occur. About 250,000 people per year, or fewer than 2percent of all cancer cases, are affected by about half of lung or breast cancer metastases worldwide

Machine learning

The way we engage with technology and the outside world is changing as a result of machine learning, a field that is quickly expanding. Machine learning, an area of artificial intelligence (AI) that focuses on creating algorithms that can learn from experience and get better over time without being explicitly programmed, is at its core. Machine learning aims to make it possible for computers to automatically identify data patterns and base predictions or choices on those patterns. This has several uses, including speech and picture recognition, fraud detection, and customized suggestions. Machine learning algorithms come in a variety of forms, such as supervised learning, unsupervised learning, and reinforcement learning. A machine learning model is trained under supervision on a labeled dataset where the desired result is predetermined. Contrarily, in unsupervised learning, a model is trained on an unlabeled dataset and is left to discover patterns and structure on its own.

Image classification

A level-based approach to the classification of normal and pathological MRI brain pictures is suggested, and the outcome is contrasted with current techniques. The classification of MRI brain pictures in the previous studies does not take the anatomical structure of the brain slices into account. The anatomical similarity of the brain slices can be addressed in the context of image processing as the similarity of the brain slices in the viewing aspect as well as the actual anatomical structure. The purpose of this work is to demonstrate how the classification of anything as normal or abnormal will be improved by taking into account its anatomical structure.

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II. PROPOSED SYSTEM

The proposed real time speech-to-speech language translator consists of 4 modules i.e. Login, Input, Translation, Output

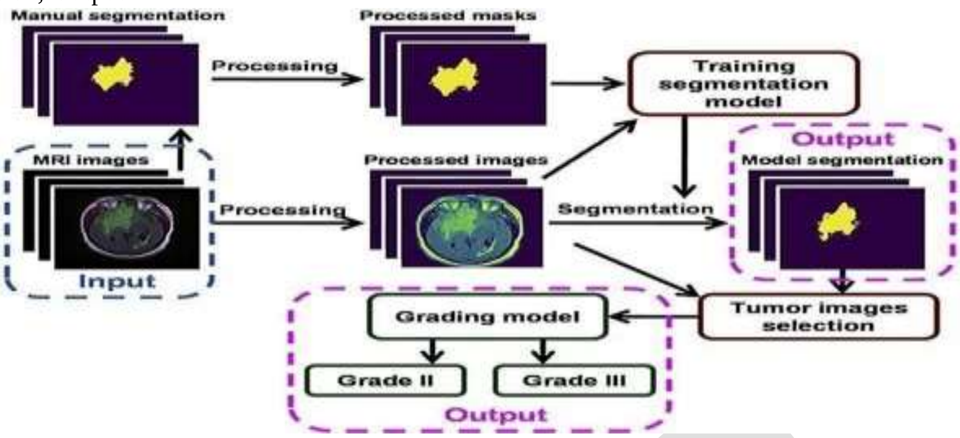

Figure 1 Proposed System

Data Collection: Gather a data set of brain MRI or CT scans that includes both normal brain images and images with tumors. A good data set is essential for training and testing your segmentation model.

Preprocessing: Clean and preprocess the images to enhance their quality and remove noise. Common preprocessing steps include resizing, normalization, and skull stripping.

Selecting a Segmentation Method: Choose an appropriate image segmentation technique. Common approaches include thresholding, region-growing, and more advanced methods like U-Net, Mask R-CNN, or deep learning-based architectures**.**

Model Development: If using deep learning, design and train your model on the labeled dataset. Ensure you have enough training data to achieve good performance. Fine-tuning pre-trained models like U-Net on medical data is often beneficial.

Validation and Evaluation: Split your dataset into training, validation, and testing sets to assess the model's performance. Use metrics like Dice coefficient, sensitivity, specificity, and F1-score to evaluate the segmentation accuracy.

Post-processing: Apply post-processing techniques like morphological operations to refine the segmented regions and reduce false positives or false negatives. Visualization: Visualize the segmented regions overlaid on the original images to verify the accuracy of your model's predictions**.**

Clinical Validation: Collaborate with medical professionals to validate the accuracy of your model's tumor segmentation results against ground truth data. Ethical and Regulatory

III. EXPERIMENT AND RESULT

The detection of brain tumors using image segmentation and machine learning is a crucial application in the field of medical image analysis. This process involves the use of advanced algorithms to analyze medical images, identify regions of interest, and distinguish between normal and abnormal tissues. The primary goal is to assist healthcare professionals in early and accurate diagnosis, leading to more effective treatment strategies.

1. Clone the Project:Begin by cloning or downloading the project's source code from our repository on GitHub.

2. Open the Project in matlab:Launch Visual Studio Code and use the "Open Folder" option to open the project directory in the matlab workspace.

3. Create a Virtual Environment (Optional but recommended):Open a terminal within matlab.Navigate to the project directory.Create a virtual environment for the project to isolate its dependencies.

On Windows:python -m venv venv

Activate the virtual environment:

On Windows:venv\Scripts\activate

4. Install Dependencies:Install the required Python packages by running the following command within the activated virtual environment:

pip install tensorflow

pip install torch torchvision

pip install pillow

pip install scikit-learn

5. Install Tesseract (OCR Engine):If we haven't already, we need to install the Tesseract OCR engine. Download and install Tesseract from the official repository:https://github.com/tesseract-ocr/tesseract/releases.Ensure that to add Tesseract to your system's PATH during the installation

6. Run the Application:In matlab, open the main.py file.

Ensure that the system is correctly set up for any external tools or libraries mentioned in the code (e.g., Tesseract).

Start the application by running the main.py script within matlab.

7. Interact with the Application:The application's GUI should appear, allowing us to interact with its features.

Use the provided functionalities like image processing.

Figure 3.1, we see a image translation system that takes image input and outputs translated image by detecting the tumor.

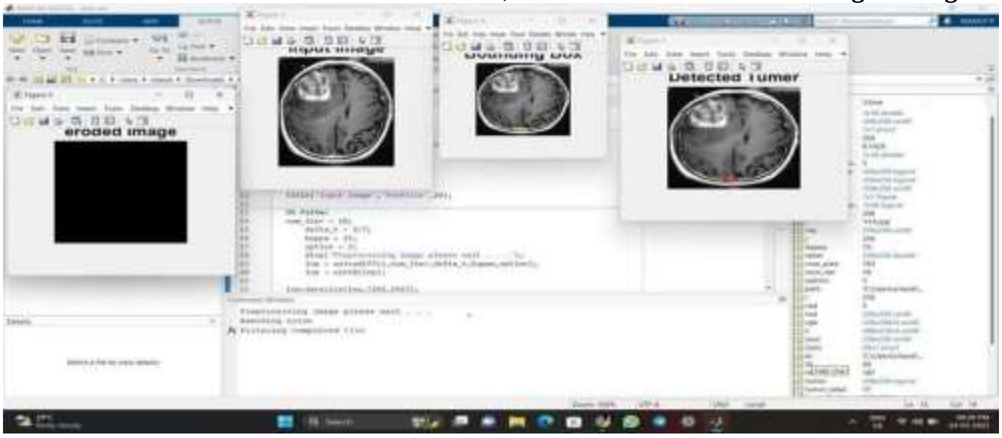

Figure 3.2, we see a image translation system that takes image input and outputs translated image by detecting the tumor.

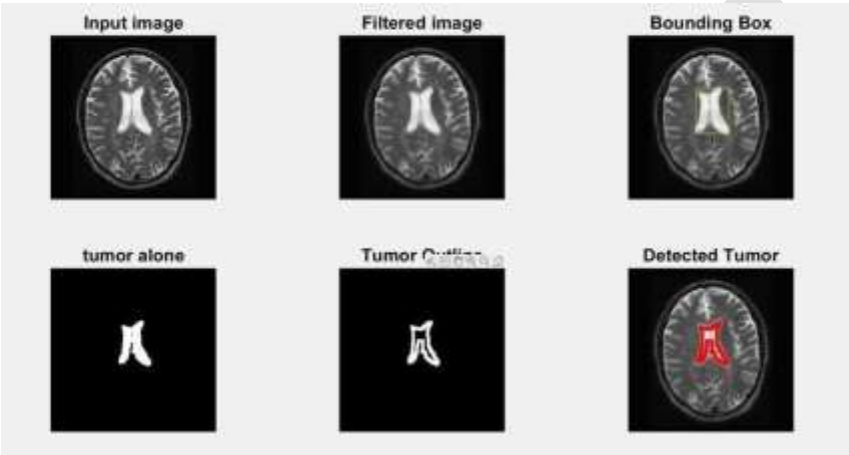

Figure 3.3. Test cases

IV. CONCLUSION

Image segmentation is an essential method, particularly for the identification and diagnosis of brain tumours. In medical pictures like MRI or CT scans, it entails isolating the tumour location from the surrounding healthy tissues. Brain tumour segmentation is a challenging task that calls for sophisticated algorithms and deep learning models. Planning the treatment and assessing its efficacy depend heavily on the precision of the segmentation. The effectiveness of various segmentation approaches in the detection of brain tumours has been assessed in a number of studies. Brain tumour segmentation using deep learning models, such as convolutional neural networks (CNNs), has demonstrated encouraging results

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