National University
Of Computer and Emerging Sciences

Project Title

Brain Tumor Detection

Prepared By

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Submitted to:

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Course: Digital Image Processing

Abstract:

With the advancement in the field of technology, the need for rapid progression in the field of medical research has also been opened. These advancements not only help in enhance diagnostic of disease but also play a very crucial role in accuracy and treatment precision. Without technology, it is very difficult to diagnose brain tumors at early stages. MRI Images are usually exposed to noise and other environmental disturbances. For this reason, it becomes very difficult for doctors to detect the cause and the tumor. So, this makes us think of automated detection of the tumor in brain. We applied many image processing techniques to detect the possibility of having tumor or not in MRI Image. We have proposed an image segmentation process and a variety of image filtering techniques to obtain image characteristics. Through this entire process, accuracy can be improved.

1.Introduction:

Brain-tumor is one of the life-threatening and leading causes of death. About 11,000 people are diagnosed with a brain tumor every year. Annually, about 1 lakh of 50 thousand cancer patients are affected by a brain tumor. MRI shows the abnormal or diseased tissues forming a mass like structure to be finally called as tumor. So, there is need of detecting the tumor in brain as earliest as possible to decrease the people affected from it and try to cure it from the very beginning.

With the advantage of being a painless diagnostic procedure, MRI allows medical personnel to illustrate clear pictures of the anatomy and the physiological processes occurring in the body, thus allowing early

detection and treatment of diseases. These images, combined with image processing techniques may be used in the detection of tumors, difficult to identify with the naked eye. A malignant neoplasm or malignant tumor is also known as cancer. These cells divide and grow excessively to form lumps that are cancerous [9]. Hence, spreading to other parts of the body and invading healthy tissues. Treatments include chemotherapy and radiation therapy that are used to kill cancer cells throughout and specific parts of the body, respectively.

2.Related Work:

There has been a lot of work done in this field to identify the diseased tumor and still a lot of work needs to be done to fully address this. There have been many attempts to classify the possibility of tumor in brain and then segment the tumor for further information. Rasel Ahmmed Anirban Sen Swkshar, Md. Foisal Hossain, Md. Abdur Rafiq [4] proposed method which include stages like image pre-processing, segmentation, feature extraction, SVM classification and tumor stage

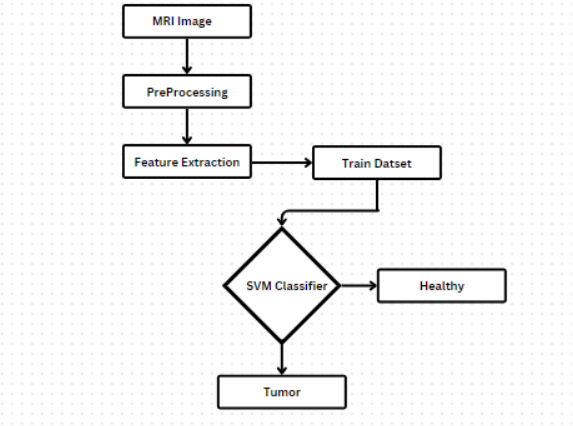
classification using Artificial Neural Network (ANN). Key image processing techniques for brain MRI image segmentation is classified as SVM, FCM. Swapnil R. Telrandhe Proposed tumor detection inside which Segmentation separates an image into parts of regions or objects. In this it has to segment the item from the background to browse the image properly and classify the content of the image strictly.

3.Proposed System:

In the proposed system, we have augmented the Digital Image Processing techniques with Support Vector Machine to detect the tumor in MRI Images. This diagnostic includes three steps:

- Pre-Processing
- Feature Extraction
- Classification

The first step involves taking input an MRI Image that will go various image processing techniques for going into further processing. Then there will be an SVM that will finally classify the image as healthy or cancerous. In feature extraction, all the features from the input images will be extracted and then the acquired features will be compared with the trained data set.

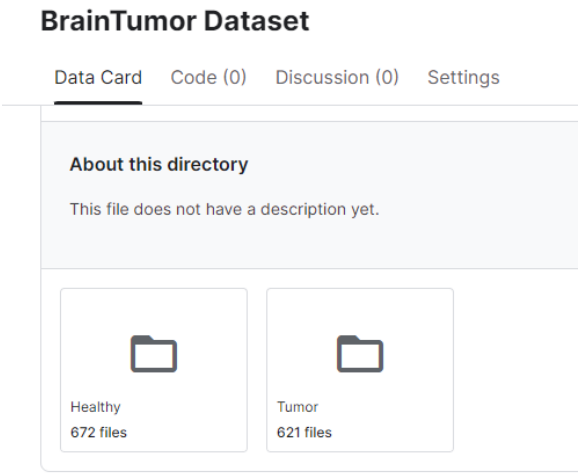


In the end, after comparing with the trained data set the output will tell whether the tumor is present or not. If there exists, the tumor the output will be abnormal or else the output will be as normal.

4.Implementation

4.1-Dataset:

The dataset contains both healthy as well as tumor images. The dataset has **621 tumors and 672 Healthy Images** imported from Kaggle brain tumor detection dataset. No Augmentation technique is applied to this dataset. The images in the dataset are off good quality but there is need of applying pre-processing techniques for detection of tumor.



4.2-Pre-Processing:

This phase marks the initial manipulation of data to ready it for primary processing or subsequent analysis. Within the preprocessing stage of our project, we primarily engage in operations essential before the targeted analysis and extraction of required data, often involving geometric corrections to the original image. These enhancements encompass rectifying information for irregularities and undesirable noise within a specified area, eliminating non-brain elements from the image, and adjusting the data to accurately align with the original image. The initial preprocessing step involves converting the input MRI image into a format conducive to subsequent tasks. Following Image Preprocessing techniques have been applied for this project

- Grayscale.
- Gaussian Blur
- Resizing

4.3-Feature Extraction:

One of the key features in detection of brain tumor in MRI Images is Feature Extraction. This important feature makes the computer vision and imaging solution valuable. When extracting, certain parameters are considered: size, shape, composition, image location. This step extracts the features of the given input image. Based on these characteristics, the image is analyzed, and the area of the tumor is determined For this reason, we have used the Histogram of Oriented Gradient (HOG) for feature Extraction.

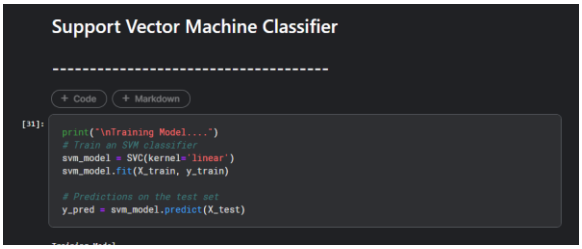
```
def extract_hog_features(image):
    features, _ = hog(image, orientations=8, pixels_per_cell=(8, 8), cells_per_block=(2, 2),
    hog_features_list.append(features)
```

It is particularly effective for detecting and describing the shape and appearance of objects in images.

The method is known for its ability to capture the local intensity gradients and, therefore, the shape information within an image.

4.4-Classification:

For Classification Purpose, we have used the Support Vector Machine for Detection of Brain Tumor in MRI Images.



The support vector machine (SVM) approach is considered a good candidate because of its high generalization performance, especially when the size of the function space is very large. SVM uses the following idea. The SVM takes operational images as input and gives the accuracy of a neural network with manual options in a purely handwriting recognition task. Those training points for which the equality of the dividing plane is satisfied, those that lie on one of the hyperplanes (H1, H2) and the removal of which will change the found solution, are called support vectors (SV).

5.Results

Metrics

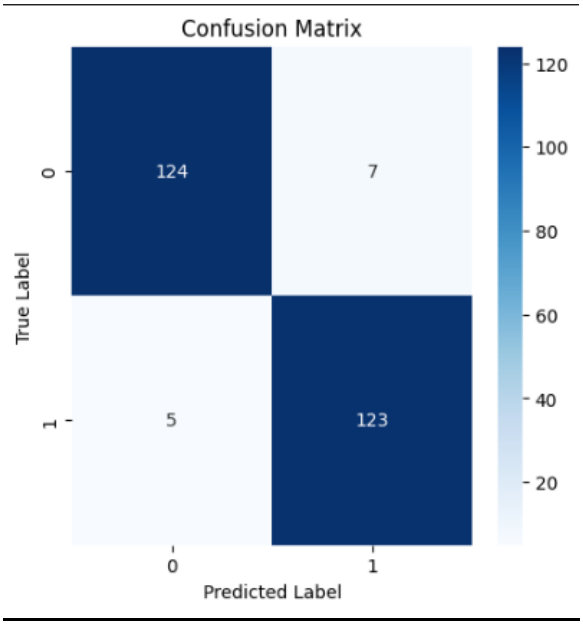
Following Metrics have been used as evaluation metrics for this project.

- Accuracy
- Precision
- F1 Score
- Recall

After training our Support Vector Machine through the training data, Following Results are obtained. Our Proposed System has able to surpass the accuracy of 95% making it more reliable and best use for brain tumor detection.

```
Evaluating....
Accuracy: 0.95
Precision: 0.95
Recall: 0.95
F1 Score: 0.95
```

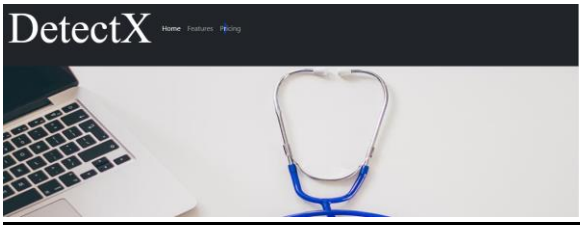
The below fig has shown the Confusion Matrix for our Model.

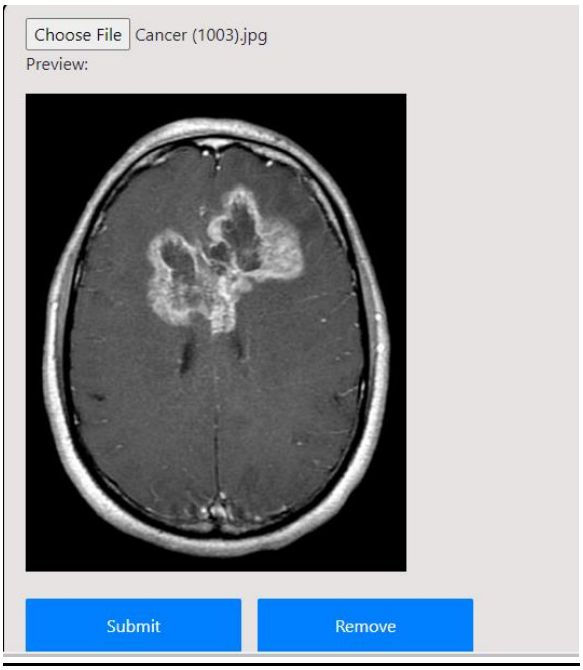


System Requirements:

- **Windows**
- **Python**
- **React**
- **Flask**

Web Application :





6.Conclusion

In conclusion, the application of image processing techniques in brain tumor detection represents a significant stride in the field of medical diagnostics. The integration of advanced algorithms and technology has paved the way for more accurate and timely identification of brain tumors, enabling healthcare professionals to initiate prompt and targeted treatment plans. Through the analysis of medical imaging data, such as MRI and CT scans, these techniques provide a non-invasive and efficient means of early detection, contributing to improved patient outcomes and quality of life. The continuous refinement and innovation in image processing methods promise to further enhance the sensitivity and specificity of brain tumor detection, ultimately advancing the capabilities of medical practitioners in diagnosing and managing this critical health condition. As we delve deeper into the realm of medical technology, the ongoing collaboration between researchers, engineers, and healthcare professionals holds great promise for the continued evolution of brain tumor detection methods, bringing us closer to a future where early intervention becomes the norm rather than the exception.

References:

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