Brain MRI Tumor Detection Using SVM

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Abstract— If not caught and diagnosed early, brain tumors can turn into cancer. Today, the detection and classification of brain tumors is done by doing the biopsy, which can be a timeconsuming process. With less time and effort radiologists can now construct tumors thanks to advancement in technology and machine learning algorithms . First, are going to propose a model that will determine whether there are tumors in the brain by segmenting MRI images and, if they are detected, we use an architecture based on SVM to classify tumors in MRI images as tumors and no tumors function well. The foundation allows staff to decide on the repair process. The development of the model will be divided into a training and testing phases and will be tested using more data and more methods. The proposed SVM/KMEANS architecture achieves high accuracy, reliability and execution speed and will become a powerful diagnostic decision for radiologists.

***Keywords*—** Magnetic Resonance Imaging(MRI), Support Vector Machine (SVM), K- Nearest Neighbor(KNN).

I. INTRODUCTION

When it comes to identifying brain cancers, brain MRI is crucial. The location and kind of the tumor are difficult even for expert doctors to determine because the tumor's anatomy is almost identical. This also relies on radiologist availability. An effective way to address this issue would be to find and isolate tumors before they have a significant impact on a large number of individuals. development of a dependable model, particularly with regard to learning algorithms. SVM is capable of analyzing pictures, extracting models that may be applied to classification, and identifying significant data. With less ionizing radiation, MRI pictures are highly accurate and exact in providing information about the location, size, and shape of tissue. Consequently, while training the model, MRI pictures are utilized rather than CT scans.

Since MRI pictures are filled with a lot of unnecessary information, we just need to remove the parts of the image that are valuable before feeding it into the SVM model. We employ the skull, tumor, and FCM for segmentation and clustering in our study. The SVM module will receive the output picture directly as input. Reliability and authenticity are crucial traits, particularly in the medical industry. In order to increase the model's accuracy and dependability, we train and test it using the multilayer SVM model using huge data from websites such as BraTS-2020, Kaggle, and other sources. Survival prognoses and improving treatment decision- making for lung cancer patients.

II. LITERATURE SURVEY

In their publication in the Hindawi International Journal of Biomedical Imaging, Nilesh Bhaskarrao Bahadure, Arun Kumar Ray, and Har Pal Thethi introduce a novel method for detecting brain tumors and extracting features from MRI scans. Their study focuses on accurately classifying various brain tissues, including white matter, gray matter, cerebrospinal fluid (background), and cancerous regions. To enhance the signal-to-noise ratio and minimize interference from unnecessary noise, the authors employ preprocessing techniques. Particularly noteworthy is their proposal to utilize a technology-based skull-stripping algorithm, which significantly improves performance in this regard. [15]

Luxit Kapoor and Sanjeev Thakur delve into the realm of brain tumor detection using image processing techniques in their article published in the IEEE 7th International Conference on Cloud Computing, Data Science & Engineering. The survey comprehensively covers the landscape of medical imaging techniques commonly employed in diagnosing brain diseases, particularly through MRI images. The authors meticulously outline the array of technologies utilized in this domain, providing concise descriptions of each process. Emphasizing the significance of segmentation in the tumor diagnosis process, the article underscores its pivotal role among the various steps involved.[16]

Praveen Gamage's research, featured on ResearchGate, focuses on the identification of brain tumors using image processing techniques, delineated into four distinct phases. The initial stage involves preprocessing the MRI images to refine quality and reduce noise interference. Subsequently, image segmentation techniques are employed to delineate regions of interest within the brain scans. Following segmentation, feature extraction methods are applied to distill pertinent characteristics from the identified regions. Finally, image classification algorithms are utilized to categorize the extracted features, facilitating accurate identification and diagnosis of brain tumors. [17]

Devendra Somwanshi, Ashutosh Kumar, Pratima Sharma,and Deepika Joshi present a study on efficient brain tumor detection from MRI images using entropy measures in their publication in the IEEE International Conference on Recent Advances and Innovations in Engineering. The research scrutinizes diverse entropy functions for tumor segmentation and detectyion across a spectrum of MRI images. Variations in approaches stem from the nuanced definitions of entropy employed. Notably, the segmentation outcomes are role in refining the accuracy of tumor detection within MRI scans. [19]

III. COMPARISION TABLE

Aspect	Support Vector Machine(SVM)	K-Nearest Neighbour(KNN
Basis	Based on the ideal hyperplane that maximise the margin between classes.	Classify a data poi s according to the majority class of it nearest neighbors
Algorithm Type	The discriminative algorithm learns by examining the distinctions between classes	Lazy Learning save all training data an classifies new point based on their similarity to previously store data points at prediction time.
Training Type	Steady	Quick as there is no explicit learning
Memory Usage	Less	Versatile, accommodating distribution of data
Prediction Time	Quick	Lenient with large dataset
Scalability	Greater scalability	Less scalablity
Example	Image Classification, Text classification, Bioinformatics, etc	Anomaly Detection, Recommendation Systems, Predictive maintenance, etc

IV. . PROPOSED

METHODOLOGY Data Preparation:

We will use the BraTS 2020 dataset image data , which contains 369 multi-contrast MRI scans from glioma patients, including low glioma grade(lgg) patients and some are advanced patients (lgg) glioma. The images in the dataset were created from the following MRI techniques : T1, T2, FLAIR . The data we will be using is from BraTS 2020, Kaggle.

1) **Data Argumentation:** It can be used to modify already-existing s training data so it is available for model training. It also fixes the problems with data incompatibility.
File preparation: For each image in the file, we will first perform the following steps: We will be converting the images from the 3D s form of MRI images in .nii file format. Then by using the d Med2Image python library we will be converting it to the .jpg s format. Then we will transform the image because we need the same image size to create and make SVM and we will also be cropping the image so that only the brain is placed in the image to better create SVM

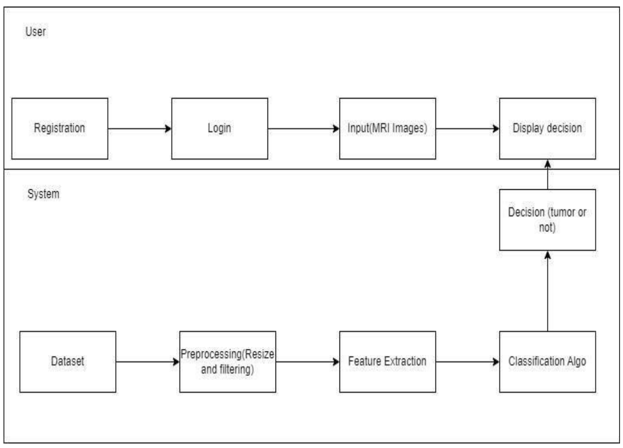
2) **Data Split:** Data will be split as follows: for training: 80%, for testing: 20%. For verification (development) we will use a separate file of 125 images.

Operation:
Front view: First of all, the patient's age, gender, etc. We will collect detailed information such as. and brain MRI scan. We then pre- process the MRI images to remove noise and useless MRI images such as skulls.
Brain
diagnosis and classification to be done using SVM.
The first steps are:
Skull stripping: Skull stripping is the process of removing the skull from the brain MRI. We will use OTSU thresholding and connectivity analysis to complete the skull.
III Gauss filter: We will use the Gauss filter to remove noise from the image.
☆ Image enhancement: We will be using image enhancement to raise the quality of image. We will also use the weighting method to improve the image.

3) **Tumor Segmentation**: The location of tumor will be detected by performing following operation on MRI image:
III Segmentation: The process of segmentation will be used to t distinguish the tumor from the brain MR imaging. Fuzzy C-means algorithm will be used to segment tumors.

4) **™ Tumor Outline**: A diagram of the same color or density that can easily be described as a curve. We will use edge detection and the findContours() algorithm to draw the shape of the brain tumor

V. FLOW DIAGRAM



VI. FUTURE SCOPE

In the future, this machine could be utilized to detect tumors not only in the brain but also in other organs such as the lungs, breasts, skin, and more. The software can be adapted to enable early-stage tumor detection, thereby aiding in patients' recovery. Future studies will encompass automatic axis of symmetry detection and advanced tumor removal techniques based on the current findings. Additionally, research will delve into the detection of images containing brain tumors and explore the relationships between neighboring cells. Automated tumor detection has the potential to streamline computerized surgeries. Further advancements in this field are poised to significantly impact the healthcare sector..

VII . CONCLUSION

We present the model, which is the first model that examines brain MRI images and predicts brain tumors when talking about tumors, by providing the necessary information so that everyone can easily understand it. The proposed model will pre- processes the dataset and extracts important information to identify the tumor present in the brain.

If there is a tumor, the SVM architecture will work to identify the tumor. Our proposed system will serve as a powerful decision support tool for diagnostic radiologists. By achieving accuracy and reliability, we hope to replace the current system in the future.

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