



Automatic brain tumor detection MR images

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Abstract

Brain tumors are the most common malignancies disease; Among these, it is the most common cancer in the 0-19 age group. It is also the leading cause of cancer in men and women under 20, so its detection must be rapid and accurate. Physical examination of brain tumors with MRI scans is not only time-consuming but also effective, and brain diagnosis must be rapid and accurate. MRI images prepared for the diagnosis of pathological changes in the brain require high performance. MRI scans improve the early detection of diseases due to the inability of human process perception to reveal many regions and patterns, differentiation of tumors, and segmentation techniques such as Biomedical processing for images are also used and research aims to improve Segmentation. It is now planned to adopt a four-stage process consisting of segmentation, morphological processing, feature extraction and classification process. There is training and testing. Removing the brain uses the first step to remove the skull, and a median filter removes the noise present in the MRI. SVM for cancer removal is a tool for the use of detailed radiological information designed for anatomical classification.

Keywords: Brain tumor detection, classification, segmentation, magnetic resonance imaging

Introduction

The brain is a part of the human body and the basis of the human nervous system. There are different types of brain tumors; One is benign, the other is malignant. Benign, noncancerous tumors are generally more serious, often life-threatening, and more destructive than benign tumors. Cancer cells are further divided into different types; Cancers grow on their own inside the brain and spread quickly to tissues outside the brain, making them a type of brain cancer. Secondary tumors are cancer cells that develop in new parts of the body, similar to lung cancer (cancer) and breast cancer. This is a type of brain cancer also known as a metastatic brain tumor. Brain scans are used to detect brain tumors through surgical procedures such as computed tomography, medical resonance imaging, positron tomography, and similar medical procedures. The most common test (MRI) is used for diagnosis and uses radio wave energy to obtain deep information from MRI images of the brain. Doctors then diagnose and complete the abnormality in the body. Image segmentation analyzes the image process and divides the image into different regions based on homogeneity. Image segmentation is a rather difficult task, thanks to computer support, there is no universal method to date. Diagnosing brain tumors in the early stages is a very difficult task for specialists because tumors vary in shape, appearance and metabolism or size, as well as overlapping due to non-invasive imaging similarities of tentacles and similar structures.

T1-weighted MRI is a good way to see tumors. The morphological function is related to the kmeans clustering algorithm. A preliminary step was used to remove the skull and brain, and the MRI sequences used were T1-weighted and T2-weighted scans. T1 weighting results from short TE (intermittent interval) and RT (repetition interval) time [2]. The contrast and depth of the image are determined by the T1 properties of the tissue. Similarly, T2-weighted MR images are produced using long-term TE and RT. Flair is the third most commonly used MRI sequence. Automatic detection requires brain image segmentation, which is the

process of segmenting images from a lot of noise, and reducing this noise is a difficult task. From a clinical perspective, micro anatomical information should not be destroyed by de noising. However, accurate image classification is essential for accurate detection with computerized medical tools. Various algorithms have been developed for MRI image segmentation.

Literature Survey

Saha B.N *et al.* The MR slice area used in the fast-bounding box algorithms is the only longterm patient study. The output is the separation of slices bounding the tumor or edema and the bounding box parallel to the axis to record the tumor and swelling area. Leftright brain coordination was consistently observed in each MR image. Tumors or swellings (such as irregularities in the brain) often affect symmetry [12]. proposed a negative work formation theory. Computeraided analysis technology for the detection of brain tumors is used in clinical care and includes the study of many techniques. In this proposal, our aim is to propose a technology that helps improve the brain's tumor detection by completing the final and preliminary steps of digital image processing. The signs of cancer are mainly based on the size or clusterlike arrangement, and the type of cancer is determined by the method based on the detection of cancer. Manoj Diwakar and Pawan Kumar Patel proposed the basis of the study based on cellular automata [5] and the collaborative research between scientists. The basis of cellular automaton is the unit and all calculations or operations are performed based on the state of the unit. Cells can store one state at a time. Cellular automata constantly update their state based on the rules used. These rules depend on the cell's neighbors. These rules determine the future state of a cell based on its previous state relative to its neighbors. First step Convert to binary image and work on binary image. Use the im2bw toolbox function to convert a grayscale image to a binary image. Therefore, it was decided to convert the actual pixel intensity range to [0, 1]. Next Spatial Cellular Automata Graphs There are important

rules here. MRI images were further segmented and clustered using Kmeans clustering, and tumors were then prepared using morphological filtering for false clustering. The planned study for brain tumor MRI image segmentation uses Kmeans and fuzzy C-means as well as SVM model to classify patients' level. Preprocessing and segmentation or feature extraction and classification are the most important steps in CAD systems. Histogram equalization is used in the preprocessing stage, so the process is called morphological brain tumor detection and classification by histogram equalization [4]. price is in. Histogram equalization makes the image clearer by determining the unevenness of pixels in the image. By using histogram equalization, MRI images become clearer and more accurate results are obtained. In segmentation, the region of interest is divided into segments during the operation. After the segmentation ROI, feature extraction is performed by removing the segmented tumor. Grayscale, color and texture features are removed from the ROI. In classification, ROIs are saved to an Excel file during the extraction process and features are extracted. The Excel file is used as a log file in the Rapid Miner program. This is how the Rapid Miner program is used for distribution. Six different classification algorithms are used to classify ROIs in the Rapid Miner program. K-nearest neighbor and bitwise support vector machines provide the best performance in tumor classification.

Proposed System

Introduced capable method to identify & classify brain tumor MRI images.

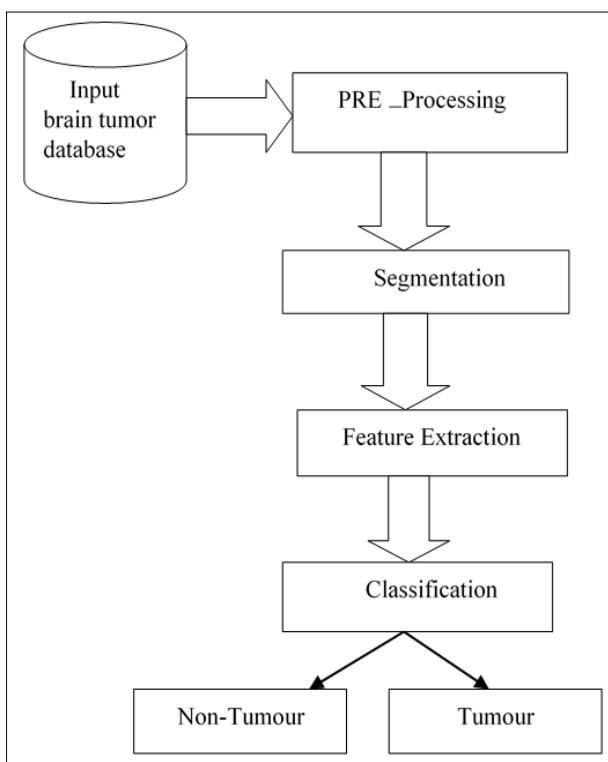


Fig 1: Proposed Methodology Overview

Preprocessing: Main aim of preprocessing, image of improve the data to suppress unnecessary data or enhances several images feature important for further image

preprocessing method make use of the significant redundancy in images and correct some degradation in the image.

Feature extraction: Extract features of the object of interest through feature extraction and extract necessary information from the image. The classifier uses the input from the extracted features. MRI database was studied in the training program. Continue taking MRI images for testing. Features such as surface, density, contrast, uniformity, color, contour, and entropy resolution are extracted from each brain MRI image. tumor. SVM (Super Vector Machine) classifier is used for detection. The classifier will determine whether the brain MRI contains tumors based on training. If there is cancer on the MRI, then it will become more widespread. If there is no room on the tumor, the process will stop. It can be used for object recognition, occlusion boundary extraction in motion or stereoscopic systems, image compression, image editing, or image database searching. We think of this as bottom-up image segmentation. This ignores the given object (top to bottom) because the object is detected during segmentation. Designed for ideas, we typically think of glossy images, but related techniques can be used with color, motion, and/or non-uniform stereoscopic information.

SVM classification: SVM distinguishing confirmed tumor. The SVM method, which determines the extracted features or after training and testing, is sometimes called the nearest neighbor [12]. SVM is a fast regression algorithm that analyzes SVM for a set of points. These algorithms work by manipulating the applicant's support vectors for the space and using the rage method to select additional points in the applicant's space. It prevents new elements from being added to the candidate set because other elements are already in the set, so it uses the return method to remove those elements SVM classifiers: 1. Linear SVM classifier 2. Non-linear SVM classifier.

SVM Linear Classifier

Here is the linear classifier model and three preset training examples to be prepared in Space The contents of this file can be divided into approximations using spaces. It approaches a flat hy perplane dividing the 2 classes. The main purpose of drawing a hyperplane is to maximize the distance from the hyperplane to the nearest data point on the route. The target hyperplane is called from the maximum edge hyperplane. To solve this problem, splitting the data into several groups of straight lines is not a good choice. To do this, Vapnik proposes to create a nonlinear distribution on using the most important deception point, the maximum marginal hyperplane.

SVM Non-Linear Classifier: In the real world our dataset is usually metadata to some extent. To solve this problem, splitting the data into several groups of straight lines is no t a good choice. To do this, Vapnik proposes to create a nonlinear distribution using the most important deception point, the maximum marginal hyperplane. Inside. NonLinearSVM categorization, information point plotted in an advanced dimensional space.

Table 1: Comparison Table

Name	Methodology	Dataset	Performance Metrics	Key Findings
Hsieh <i>et al.</i> (2020) ^[11]	Deep Learning (CNN)	BRATS 2018	Accuracy: 92.5%, Dice: 0.88	High accuracy with deep learning models, demonstrated robustness against variations in MRI images.
Kumar <i>et al.</i> (2019) ^[12]	Machine Learning (SVM)	Custom dataset of 500 MRI scans	Accuracy: 89.7%, Sensitivity:87.6%	SVMs perform well but require Significant feature engineering.
Chandra <i>et al.</i> (2021) ^[13]	Hybrid Model (CNN + SVM)	BRATS 2019	Accuracy: 94.1%, Specificity: 90.2%	Combining CNN and SVM enhances performance, leveraging CNN for feature extraction and SVM for classification.
Ali <i>et al.</i> (2018) ^[14]	Deep Learning (3D CNN)	MICCAI 2017	Dice: 0.85, Precision: 0.82	3D CNNs capture spatial features more effectively than 2D approaches.
Patel & Sharma (2020) ^[15]	Transfer Learning (VGG16)	BRATS 2015	Accuracy: 91.3%, F1 Score: 0.89	Transfer learning improves performance, particularly when training data is limited.
Liu <i>et al.</i> (2021) ^[17]	U-Net Architecture	BRATS 2020	Dice: 0.90, Jaccard Index: 0.84	U-Net architecture excels in segmentation tasks, providing high accuracy in delineating tumor boundaries.

Conclusion

Automated techniques for MRI images already exist that facilitate brain diagnosis. The technology is validated in three steps: The first step is the removal of unnecessary and duplicate skulls, and the validation of image detection and image enhancement, which involves a filtering process to remove image noise from the MRI. Then, in the second stage, the GLCM method is used to localize the tumor and determine the location of the tumor. The SVM classifier was also used to extract tumors from MRI images. When the results of this method are compared with existing methods, better and more accurate results are clearly seen. SVM techniques can also be replaced by advanced segmentation.

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