A Review on Brain Tumor Detection with the Analysis of Various Image Segmentation

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ABSTRACT : One of the basic methods of digital image processing is image segmentation. Over the last few years, magnetic resonance imaging (MRI) brain tumor segmentation has gained popularity as a field of study for medical imaging systems. In radiology, MRI is used to analyze internal structures and facilitates the extraction of necessary area. Region growing is another technique that provides seed point approach to the segmenter ROI region so the tumor is easily detected and further used for the classification purpose. Thresholding is a simple approach to introduce to the morphological operations which are useful for the detection of the tumor but not all tumors can be specifically detected by this technique. Among the most promising methods is Nonnegative Matrix Factorization to lower the data's dimensionality. Previously, NMF was utilized in image processing techniques like text mining and pattern analysis. In this work, it is primarily employed as an uninterruptible decomposition method for tumor detection, further classification into distinct types, and feature extraction. The goal of NMF is to identify two non-negative matrices whose product is quite similar to the original matrix. All matrices are found to have only non-negative elements by NMF, and the results indicate significant sparsity, linear superposition alone, and the absence of cancellations.

KEY WORDS: magnetic resonance imaging, NMF, ROI

1. INTRODUCTION :

One method that shows the most promise for reducing the dimensionality of data is non-negative matrix factorization. Regarding the processing of images, It is the best matrix decomposition method for tasks involving pattern analysis and is also frequently used for latent feature extraction and clustering. To clarify this idea, a number of objective function types have been presented; however, when discussing NMF in relation to brain tumor classification, it is readily applicable when the tumor is identified through NMF. Since NMF is a collection of non-negative terms, it searches for non-negative terms for non-negative data matrices with a lower rank of approximation. Additionally, it helps in determining the sparsesity and other matrix evaluation parameters.

The data is treated as a m*n matrix by the matrix factorization method, where each column denot es a sample of the data.The product of two k matrices approximates this matrix.

BRAIN TUMOR:

The field with the highest demand and level of challenge is medical image processing. Magnetic resonance imaging (MRI) brain tumor detection has emerged as a new area of processing of

medical images. One of the most challenging tasks in image processing is image segmentation, which is crucial in determining the final product's quality. The process of splitting an image into distinct regions is called image segmentation. In this paper, an automated tool for brain tumor segmentation using MRI scanned image datasets is reviewed. A tumor can be found and extracted from brain MRI scan images using MATLAB software.A tumor is a mass of tissues that grows uncontrollably to restore normal growth.Because brain tumors are persistent, they are inherently dangerous and serious.grave and pernicious in character.Depending on the tumor's initial phase, brain tumors are classified as either benign (non-cancerous) or malignant (cancerous).Benign brain tumors are usually resectable and rarely grow back because they do not contain malignant cells.It is simple to determine the periphery margin of a benign brain tumor. These cells can compress on sensitive areas of the brain and result in serious health problems, even though they do not spread to other parts of the body or infect the tissues around them. Cancerous cells are present in malignant brain tumors, and they are most likely to proliferate quickly.

Encircling wholesome brain tissue, very infrequently, malignant brain tumors can rupture and spread cancerous cells to other areas of the body. We will be studying metastatis, a kind of secondary brain tumor that is the spread of cancer. Brain tumor diagnosis is largely dependent on imaging, and identifying a brain tumor typically requires a neurological examination. Physicians classify patients based on their diagnosis, ranging from the least to the most persistent. This allows them to confirm which treatment plan is best for each patient.The most popular kind of diagnostic technique is magnetic resonance imaging, or MRI.The best medical imaging method, magnetic resonance imaging (MRI).

2. ERROR PROBABILITY :

It is the best indicator of how well the collection of features chosen for pattern recognition worked. Due to the challenges associated with The measure of overlap between two probability distributions was the original definition of probability error computation, which has since gained popularity as a feature evaluation criterion for tumor classification and pattern recognition the two primary causes of the exponential family of distribution's popularity, which is also the case for the Gaussian distribution, or normal distribution. Currently, radiologists manually segment patients' tumors on magnetic resonance imaging (MR) scans before administering a therapy like radiation therapy. This manual segmentation procedure is costly and time-consuming. An automated brain tumor segmentation system could be seeded or constrained by the location of the tumor.

The algorithm can be used to index tumor images for archival purposes and operates in real-time. The usual query in database applications will be dependent on the tumor's location as

as well as the approximate size of the tumor, which the suggested algorithm's bounding box can represent. To assess the suggested approach, we calculate three performance metrics: (a) detection score, (b) segmentation score, and (c) location score.

3. METHODOLOGY:

The technique used in this research can be performed using

1. Grayscale Imaging
2. Histogram Equalization
3. Threshold Segmentation
4. Morphological Operation

a.Grayscale Imaging:
Sometimes grayscale imaging is referred to as "black and white," but in actual black and white—also referred to as halftone—this is a misnomer because the only shades that can exist are a halftone image's pure black and pure white-gray shading obtained by viewing the image as a grid of black dots on a white background (or vice versa), with the apparent lightness of the gray in each dot's vicinity determined by its size. The number denoting the hues' brightness levels is exactly proportional to the gray's lightness. The ranges of grayscale shades is a collective term for grayscale imaging. The ranges of grayscale are collectively referred to as shades of gray. Grayscale images preprocessed from MRI scans are used.

b.Histogram Equalization:
A grayscale transformation called histogram equalization produces an image with a roughly flat histogram.The imhist command in MATLAB software can be used to create an image histogra m.

c.Threshold Segmentation
The process of dividing an image into several segments is called segmentation.(Pixel Set). Usually, image segmentation is utilized to find the objects and boundaries (lines, curves) in the pictures as well as assigning a label to every pixel so that all of the pixels in the picture have the same label in order to view the visual attributes. The threshold value is the foundation of the threshold method, which converts a grayscale picture into a binary image.

d.Morphological Operation
The description of an object's shape and structure is referred to as its morphology. Binary images in this case have a variety of problems. thresholds are warped by the texture and noise features. Morphological operations involve logical transformations that are based on comparing the neighborhood of a pixel with a pattern. Typically, these operations are carried out on binary images.

4. CONCLUSION:

We can draw the conclusion that morphological operations have shown to be very beneficial in a variety of image extraction and filtering methods the anatomical Operators can alter the image's structuring components based on their intended use. It has been found that certain operators, such as open, erode, dilate, close, bounding box, and region crop, are useful in removing brain tumors

from brain MRI images. To focus on the required area of the picture, threshold segmentation was applied. Thus, we can obtain the final image of the brain tumor by applying image subtraction. Additionally, after reading the paper, we can draw the conclusion that region growing technique has shown to be very promising, particularly in the detection part. In the future, we can use this technique to classify brain tumor images and determine the type of tumor they represent. The NMF technique has additionally shown benefits in the

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