Tumor Detection and Classification of MRI Brain Image Using Region Based Detection and Support Vector Machines

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Abstract- *In the recent times computer science applications in resonance Imaging (MRI) is applied in numerous clinical researches. However, for analyzing tumor without human intervention is taken into account as a major space of analysis as a result of the extracted brain images need to be optimized mistreatment segmentation rule that should have high resilient towards noise and cluster size sensitivity problem with automatic region of Interest (ROI) detection. During this analysis, an improved Region Based machine-learning approach is employed to analyses the under segment and over segments of the tumor regions to find the abnormality with automatic ROI detection. After the successful detection of tumor parts, we are going to classify the two different classes of brain tumors such as benign and malignant. For that we are using different feature extraction methods and support vector machine classification method for identifying the above. This analysis pays its proficiency within the field of brain abnormality detection and analysis in health care sector without human intercession.*

Keywords- Brain tumour, classification, denoising, detection, support vector machine

I. INTRODUCTION

MRI is an extensively used technique which facilitates the diagnosis and prognosis of brain tumors in many neurological diseases and conditions. Standard MRI sequences are generally used to differentiate between different types of brain tumors based on visual qualities and contrast texture analysis of the soft tissue. More than 120 classes of brain tumors are known to be classified in four levels according to the level malignancy by the World Health Organization (WHO). The grading from low to high (1-4) are malignant levels from the least aggressive biological tumor to the most aggressive tumors, as shown by histological criteria, for example, vascularity, invasiveness, and tumor growth rate. Gliomas are the most primary cerebral tumor and a pretreatment evaluation grade is necessary; however, the exclusive use of standard MRI sequences may be insufficient for a precise diagnosis. As the K-nearest neighbor (KNN) architectures are becoming more mature, they gradually outperform previous state-of-the-art classical machine learning algorithms the literature survey has revealed that some of the techniques are invented to obtain segmentation only; some of the techniques are invented to obtain feature extraction and some of the techniques are invented to obtain classification only.

II. RELATED WORKS.

1. Brain Tumor Detection using Image Segmentation Techniques Digvijay Reddy, Dheeraj, Kiran, Bhavana.V and Krishnappa H.K.-2018.

The methodology presented in this work uses a two-step procedure for brain tumor detection that combines k-means clustering algorithm followed by level set segmentation and morphological operations. Experimental results have shown that, this methodology is robust in detecting and bounding the abnormal cells in MRI images despite the complicate shape of the tumor. This paper proposed a k-means clustering image processing algorithm for brain tumor detection only.

2. Detection of human brain tumour using MRI image segmentation and morphological operators Anupurba Nandi.-2015

The output image clearly shows the tumour cells which have been separated from the healthy cells. The threshold and watershed segmentation is very simple and popular but using morphological operators is the new introduction to this problem which on applying to the output image of other two provided a better detection of tumour. The factor used in thresh holding is very difficult to determine because the factor used for one image may not work for other image. This factor may be different for different images. The watershed method has the disadvantage that it is highly sensitive to local minima, since at each minima, a watershed is created. This work proposes a morphology based image processing algorithm for brain tumor detection only.

3. Brain tumor classification from multi-modality MRI using wavelets and machine learning Khalid Usman1 Kashif Rajpoot.-2017

An algorithm used to hierarchically classify the tumor into three regions: whole tumour, core tumour and enhancing tumour- is proposed in this work. Intensity, intensity difference, neighborhood information and wavelet features are extracted and utilized on multi-modality MRI scans with various classifiers. The use of wavelet-based texture features with RF classifier has increased the classification accuracy as evident by quantitative results of our proposed method which are comparable or higher than the state of the art. This paper proposed a wavelet transformed image processing algorithm for tumor detection and classification by means of their area values.

III. PROPOSED SYSTEM

Figure 1 depicts the stages involved in brain tumour detection.

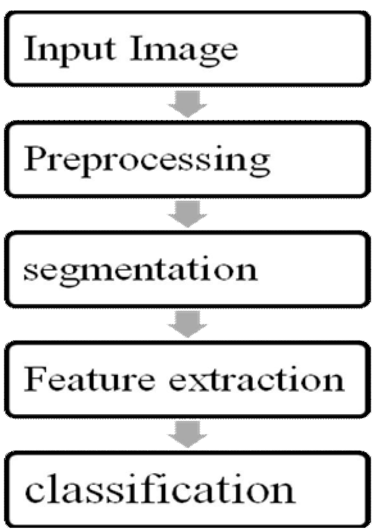

Figure 1 steps involved

A) MODULE DESCRIPTION:

1) INPUT:

Read and Display an input Image. Read an image into the workspace, using the imread function. In image processing, it is defined as the action of retrieving an image from some source. It is the first step in the workflow sequence because, without an image, no processing is possible. The image that is acquired is completely unprocessed

a) PROCESSING THE INPUT IMAGE:

Pre-processing is a common name for operations with images at the lowest level of abstraction both input and output are intensity images. The aim of pre-processing is an improvement of the image data that suppresses unwanted distortions or enhances some image features important for further processing. Image pre-processing methods use the considerable redundancy in images. Neighboring pixels corresponding to one object in real images have essentially the same or similar brightness value. Thus distorted pixel can often be restored as an average value of neighboring pixels.

All the input images are resized into same dimensions. If the specified size does not produce the same aspect ratio as the input image, the output image will be distorted.

Image enhancement is the process of adjusting digital images so that the results are more suitable for display or further image analysis. For example, we can remove noise, sharpen, or brighten an image, making it easier to identify key features.

2) SEGMENTATION OF THE AFFECTED PART:

Image segmentation is a commonly used technique in digital image processing and analysis to partition an image into multiple parts or regions, often based on the characteristics of the pixels in the image. In computer vision, Image Segmentation is the process of subdividing a digital image into multiple segments (sets of pixels, also known as super pixels. Segmentation is a process of grouping together pixels that have similar attributes. Image Segmentation is the process of partitioning an image into non-intersecting regions such that each region is homogeneous and the union of no two adjacent regions is homogeneous pixels in a region are similar according to some homogeneity criteria such as color, intensity or texture so as to locate and identify objects and boundaries (lines, curves, etc) in an image. Segmentation accuracy determines the eventual success or failure of computerized analysis procedure.

This similar property is cluster together our propounded approach implements the RGB TO HSV color space. This technique aids in the extraction of important image characteristics, based on which information can be easily perceived. Then we use different color space conversions like then the labels are adjusted with a shape detection method based on large regional context information to produce meaningful results.

3) FEATURE EXTRACTION:

In machine learning, pattern recognition and in image processing, feature extraction starts from an initial set of measured data and builds derived values (features) intended to be informative and non-redundant, facilitating the subsequent learning and generalization steps, and in some cases leading to better human interpretations. Feature extraction is related to dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be redundant (e.g. the same measurement in both feet and meters, or the repetitiveness of images presented as pixels), then it can be transformed into a reduced set of features (also named a feature vector). Determining a subset of the initial features is called feature selection. The selected features are expected to contain the relevant information from the input data, so that the desired task can be performed by using this reduced representation instead of the complete initial data.

- Shape features
- Color features
- Geometrical features
- Texture features

a) *SHAPE FEATURES:*

Visual features of objects are called the shape characteristics or visual features. For example, circular object or triangular objects or other shapes, perimeter boundary of the object, the diameter of the border and so on. The visual features showed intuitively are all belongs to shape features.

b) COLOR FEATURES:

Global features include color and texture histograms and color layout of the whole image. Local features include color, texture, and shape features for sub images, segmented regions, and interest points. These features extracted from images are then used for image matching and retrieving

c) GEOMETRICAL FEATURES:

Geometric features are features of objects constructed by a set of geometric elements like points, lines, curves or surfaces. These features can be corner features, edge features, Blobs, Ridges, salient point's image texture and so on, which can be detected by feature detection methods. Here we use region based geometrical features for geometrical feature analysis.

d) TEXTURE FEATURES:

An image texture is a set of metrics calculated in image processing designed to quantify the perceived texture of an image .Image Texture gives us information about the spatial arrangement of color or intensities in an image or selected region of an image. Here we use GLCM (Grey level co-occurrence matrix) and LBP (Local Binary Pattern) for texture feature analysis.

4) CLASSIFICATION:

Image classification refers to the task of extracting information classes from a multiband raster image. The resulting raster from image classification can be used to create thematic maps. The recommended way to perform classification and multivariate analysis is through the Image Classification toolbar. Here we use SVM (Support Vector Machine) for classification.

IV. ALGORITHM

- *ROI SEGMENTATION*

ROI based machine-learning approach is used to analyses the under segment and over segments of the brain tumour regions to detect the abnormality with automatic ROI detection. For ROI With the use of some mathematical calculations we segment the affected part accurately.

- *PRINCIPAL COMPONENT ANALYSIS*

PCA is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components.

- *GREY LEVEL CO-OCCURRENCE MATRIX*

GLCM is a feature extraction method That functions characterize the texture of an image by calculating how often pairs of pixel with specific values and in a specified spatial relationship occur in an image, creating a GLCM, and then extracting statistical measures from this matrix.

- *LOCAL BINARY PATTERN*

LBP is a simple yet very efficient shape operator which labels the pixels of an image by threshes holding the neighbourhood of each pixel and considers the result as a binary number.

- *SUPPORT VECTOR MACHINE*

SVM is a supervised machine learning algorithm which can be used for either classification or regression challenges. Support Vectors are simply the co-ordinates of individual observation. Support Vector Machine is a frontier which best segregates the two classes (hyper-plane/ line).

V. RESULTS OBTAINED

- *Input images*

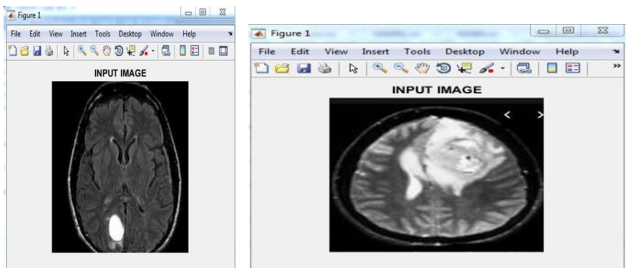

Figure 2 Input images

- *Benign tumor detected*

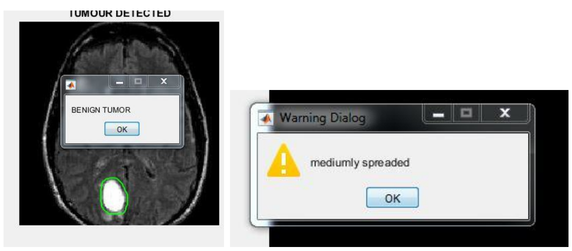

Figure 3 Benign tumour is detected

- *Malignant tumor detected*

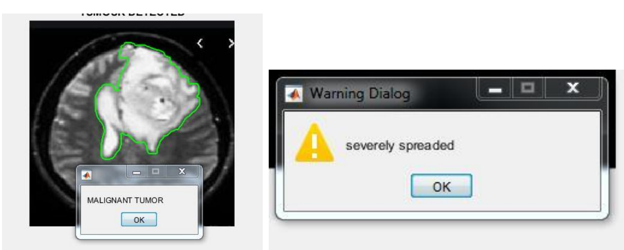

Figure 4 Malignant tumour is detected

VI. CONCLUSIONS

The brain tumor detection and classification system is implemented using ROI and SVMs. The proposed method uses different levels of operations. The high accuracy part is obtained using Region Based Detection. The result shows that SVM having the proper sets of training data are able to distinguish between benign and malignant tumor regions and classify them correctly as a benign tumor, malign tumor. In practice, SVM have significant computational advantages. This classification is very important for the physician in establishing a precise diagnostic and recommending a correct further treatment. The obtained results show that the Region based segmentation provides higher computation comparing with DWT.A hybrid approach is recommended in solving properly the detection and classification problems in brain tumors.

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