

Detection of Brain Tumor from MRI images by using Segmentation & SVM

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ABSTRACT

In this project we propose adaptive brain tumor detection, Image processing is used in the medical tools for detection of tumor, only MRI images are not able to identify the tumorous region in this paper we are using K-Means segmentation with preprocessing of image. Which contains denoising by Median filter and skull masking is used. Also we are using object labeling for more detailed information of tumor region. To make this system an adaptive we are using SVM (Support Vector Machine), SVM is used in unsupervised manner which will use to create and maintain the pattern for future use. Also for patterns we have to find out the feature to train SVM. For that here we have find out the texture feature and color features. It is expected that the experimental results of the proposed system will give better result in comparison to other existing systems.

Index Terms—K-Means algorithm, Object Labeling Algorithm, Image segmentation.

1. INTRODUCTION

It is an important to find out tumor from MRI images but it is somewhat time-consuming and difficult task sometime performed manually by medical experts. Large amount of time was spent by radiologist and doctors for identification of tumor and segmenting it from other brain tissues. However, exact labeling brain tumors is a time-consuming task, and considerable variation is observed between doctors [2]. Subsequently, over the last decade, from various research results it is being observed that it is very time consuming method but it will get faster if we use image processing techniques [3]. Primary brain tumors do not spread to other body parts and can be malignant or benign and secondary brain tumors are always malignant. Malignant tumor is more dangerous and life threatening than benign tumor. The benign tumor is easier to identify than the malignant tumor. Also the first stage tumor may be malignant of benign but after first stage it will change to dangerous malignant tumor which is life threatening [12]. Different brain tumor detection algorithms have been developed in the past few years. Normally, the automatic segmentation problem is very challenging and it is yet to be fully and satisfactorily solved. The main aim of this system is to make an automated system for detecting and identifying the tumor from normal MRI. It takes into account the statistical features of the brain structure to represent it by significant feature points. Most of the early methods obtainable for tumor detection and

segmentation may be largely divided into three groupings: region- based, edge-based and fusion of region and edge-based methods. Well known and broadly used segmentation techniques are K-Means clustering algorithm, unsupervised method based on neural network classifier [4]. Also, the time spent to segment the tumor is getting condensed due to the detailed demonstration of the medical image by withdrawal of feature points. Region-based techniques look for the regions satisfying a given homogeneity standards and edge based segmentation methods look for edges between regions with different characteristics [5]. Gliomas are the brain tumors with the most elevated death rate that are categorized into LG Gliomas (Low Grade) & HG Gliomas (High Grade), with the previous being lightly forceful and insinuate than the last mentioned. Considerably during therapy, people sparsely live after 14 months from detection. Present therapies incorporate medical operations, chemotherapy, radiotherapy, or a mixture of all these. X-ray is specifically helpful to figure out and break down gliomas in normal practice as it is easy to obtain MRI sequences giving integral data. The precise segmenting technique of gliomas and its intra-tumoral figures is significant to schedule treatment, yet additionally to follow-up assessments. The main objectives are:

- Primarily to explore the feasibility of utilizing deep architectures in compact convolutional bits for gliomas segmenting technique in MRI images.
- Secondly to address information heterogeneity brought about by multiple-site multiple-scanner accession of MRI images utilizing Depth Normalizing technique Strategy.

2. LITERATURE SURVEY

R.Muthukrishnan, et.al [6] Proposed brain tumor detection in which Segmentation separates an image into its component regions or objects. Image segmentation it needs to segment the object from the background to read the image properly and classify the content of the image carefully. In this framework, edge detection was an important tool for image segmentation. In this paper their effort was made to study the performance of most commonly used edge detection techniques for image segmentation and also the comparison of these techniques was carried out with an experiment.

M.Saritha et.al, [7] Proposed approach by integrating wavelet entropy based spider web plots and probabilistic neural network for the classification of Brain MRI. The proposed technique uses two steps for classification i.e. Wavelet entropy based spider web plot for feature withdrawal and probabilistic neural network for classification. The obtained brain MRI, the feature extraction was done by wavelet transform and its entropy value was calculated and spider web plot area calculation was done. With the help of entropy value classification using probabilistic neural network was calculated. Probabilistic neural network provides a general solution for pattern classification problem and its classification accuracy is about 100%.

P.NandaGopal et.al, [8] in their paper they presented a combination of wavelet statistical features (WST) and cooccurrencewavelet texture feature (WCT) obtained from two level distinct wavelet transform was used for the organization of abnormal brain matters in to benign and malignant. The planned system was consists of four stages: segmentation of region of interest, discrete wavelet disintegration, feature abstraction, feature selection, organization and evaluation. The support vector machine was employed for brain tumor segmentation. A grouping of WST and WCT was

used for feature extraction of tumor region extracted from two level discrete wavelet transform. Genetic algorithm was used to select the optimal texture features from the set of mined features. The probabilistic neural network was used to classify abnormal brain tissue in to benign and malignant and the performance evaluation was done by comparing the classification result of PNN with other neural network classifier. The classification accuracy of the proposed system is 97.5%.

3. INTRODUCTION TO IMAGE PROCESSING

An image is a two-dimensional picture, which has a similar appearance to some subject usually a physical object or a person. Image is a two-dimensional, such as a photograph, screen display, and as well as a three-dimensional, such as a statue. They may be captured by optical devices— such as cameras, mirrors, lenses, telescopes, microscopes, etc. and natural objects and phenomena, such as the human eye or water surfaces. The word image is also used in the broader sense of any two-dimensional figure such as a map, a graph, a pie chart, or an abstract painting. In this wider sense, images can also be rendered manually, such as by drawing, painting, carving, rendered automatically by printing or computer graphics technology, or developed by a combination of methods, especially in a pseudo-photograph.



Fig 3.1. General image

3.1 RASTER FORMATS:

These formats store images as bitmaps (also known as pixmaps)

JPEG/JFIF: JPEG (Joint Photographic Experts Group) is a compression method. JPEG compressed images are usually stored in the JFIF (JPEG File Interchange Format) file format. JPEG compression is lossy compression

EXIF: The EXIF (Exchangeable image file format) format is a file standard similar to the JFIF format with TIFF extensions. It is incorporated in the JPEG writing software used in most cameras.

TIFF: The TIFF (Tagged Image File Format) format is a flexible format that normally saves 8 bits or 16 bits per color (red, green, blue) for 24-bit and 48-bit totals, respectively, usually using either the TIFF or TIF filename extension.

PNG: The PNG (Portable Network Graphics) file format was created as the free, open-source successor to the GIF. The PNG file format supports true color (16 million colors) while the GIF supports only 256 colors.

GIF: GIF (Graphics Interchange Format) is limited to an 8-bit palette, or 256 colors.

BMP: The BMP file format (Windows bitmap) handles graphics files within the Microsoft Windows OS. Typically, BMP files are uncompressed, hence they are large. The advantage is their simplicity and wide acceptance in Windows programs.

3.2 VECTOR FORMATS:

As opposed to the raster image formats above (where the data describes the characteristics of each individual pixel), vector image formats contain a geometric description which can be rendered smoothly at any desired display size.

3.3 IMAGE PROCESSING:

Digital image processing, the manipulation of images by computer, is relatively recent development in terms of man's ancient fascination with visual stimuli. In its short history, it has been applied to practically every type of images with varying degree of success. The inherent subjective appeal of pictorial displays attracts perhaps a disproportionate amount of attention from the scientists and also from the layman. Digital image processing like other glamour fields, suffers from myths, mis-connections, mis-understandings and mis-information. It is vast umbrella under which fall diverse aspect of optics, electronics, mathematics, photography graphics and computer technology. It is truly multidisciplinary endeavor ploughed with imprecise jargon.

FUNDAMENTAL STEPS IN DIGITAL IMAGE PROCESSING:

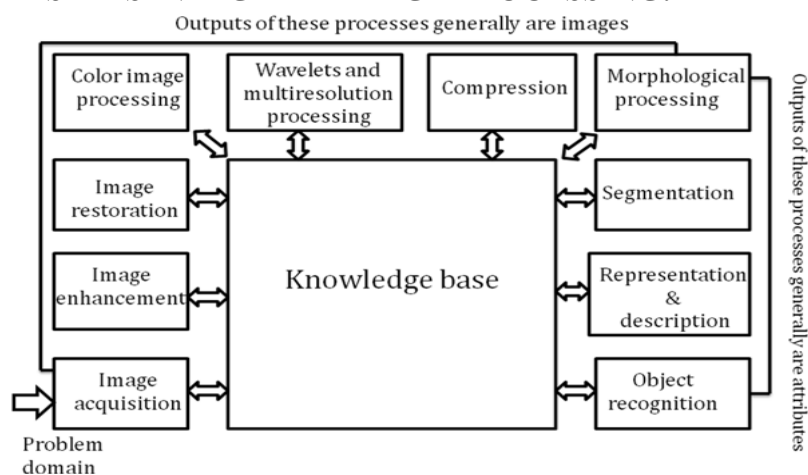


Fig 3.2 Image fundamental

4. DIGITAL IMAGE PROCESSING

Digital image processing is an area characterized by the need for extensive experimental work to establish the viability of proposed solutions to a given problem. An important characteristic underlying the design of image processing systems is the significant level of testing & experimentation that normally is required before arriving at an acceptable solution. This characteristic implies that the ability to formulate approaches & quickly prototype candidate solutions generally plays a major role in reducing the cost & time required to arrive at a viable system implementation.

4.1 Color image:

It can be represented by three functions, R (xylem) for red, G (xylem) for green and B (xylem) for blue. An image may be continuous with respect to the x and y coordinates and also in amplitude. Converting such an image to digital form requires that the coordinates as well as the amplitude to be digitized. Digitizing the coordinate's values is called sampling. Digitizing the amplitude values

is called quantization.

4.2 Reading Images:

Images are read into the MATLAB environment using function `imread` whose syntax is `Imread ('filename')`

Format name	Description	Recognized extension
TIFF	Tagged Image File Format	.tif, .tiff
JPEG	Joint Photograph Experts Group	.jpg, .jpeg
GIF	Graphics Interchange Format	.gif
BMP	Windows Bitmap	.bmp
PNG	Portable Network Graphics	.png
XWD	X Window Dump	.xwd

Here filename is a string containing the complete of the image file(including any applicable extension).For example the command line

```
>> f = imread ('8. jpg');
```

Reads the JPEG (above table) image chestxray into image array f. Note the use of single quotes (') to delimit the string filename. The semicolon at the end of a command line is used by MATLAB for suppressing output If a semicolon is not included. MATLAB displays the results of the operation(s) specified in that line. The prompt symbol (>>) designates the beginning of a command line, as it appears in the MATLAB command window.

4.3 RGB Image

An RGB color image is an $M*N*3$ array of color pixels where each color pixel is triplet corresponding to the red, green and blue components of an RGB image, at a specific spatial location. An RGB image may be viewed as “stack” of three gray scale images that when fed in to the red, green and blue inputs of a color monitor produce a color image on the screen. Convention the three images forming an RGB color image are referred to as the red, green and blue components images. The data class of the components images determines their range of values. If an RGB image is of class double the range of values is [0, 1].

5. Software Introduction:

5.1 Introduction to MATLAB

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include

- Math and computation
- Algorithm development
- Data acquisition
- Modeling, simulation, and prototyping

- Data analysis, exploration, and visualization
- Scientific and engineering graphics
- Application development, including graphical user interface building

5.2 GUI

A graphical user interface (GUI) is a user interface built with graphical objects, such as buttons, text fields, sliders, and menus. In general, these objects already have meanings to most computer users. For example, when you move a slider, a value changes; when you press an OK button, your settings are applied and the dialog box is dismissed. Of course, to leverage this built-in familiarity, you must be consistent in how you use the various GUI-building components.

5.2.1 Creating GUIs with GUIDE

MATLAB implements GUIs as figure windows containing various styles of uicontrol objects. You must program each object to perform the intended action when activated by the user of the GUI. In addition, you must be able to save and launch your GUI. All of these tasks are simplified by GUIDE, MATLAB's graphical user interface development environment.

5.2.2 GUI Development Environment

The process of implementing a GUI involves two basic tasks.

- Laying out the GUI components
- Programming the GUI components

GUIDE primarily is a set of layout tools. However, GUIDE also generates an M- file that contains code to handle the initialization and launching of the GUI. This M- file provides a framework for the implementation of the callbacks - the functions that execute when users activate components in the GUI.

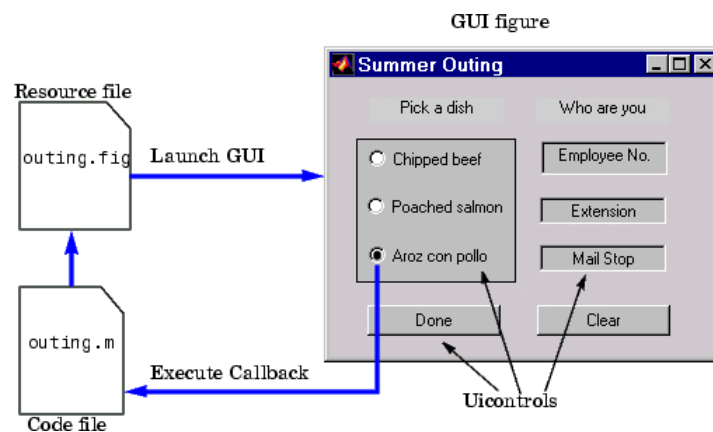


FIG 5.1 graphical user blocks

5.2.3 Features of the GUIDE-Generated Application M-Fil

GUIDE simplifies the creation of GUI applications by automatically generating an M-file framework directly from your layout. You can then use this framework to code your application M-file. This approach provides a number of advantages:

The M-file contains code to implement a number of useful features (see Configuring Application Options for information on these features). The M-file adopts an effective approach to managing object handles and executing callback routines (see Creating and Storing the Object Handle Structure for more information). The M-files provides a way to manage global data (see Managing GUI Data for more information).

6. EXISTING SYSTEM

Brain tumor is a life-threatening disease. Brain tumors can be malignant or benign. When tumor cells grow it causes pressure inside the skull, this leads to brain damage. Two types of Brain tumor namely Primary and secondary. Primary brain tumors are benign and that originates in brain. Secondary brain tumors occur when cancer cells spread over the brain from other organs such as lung or breast. It is also called metastatic brain tumor. Brain tumors can occur in any ages. If a brain tumor is detected in an early stage it is treatable. Brain tumors cause more death in children and adults under the age of 40 than any other cancer. In India the tumors range from 5 to 10 per 100,000 populations with an increasing trend. Diagnosing brain tumors is a tedious process. Computer Tomography scan (CT scan), Magnetic Resonance Imaging (MRI), tests like an Angiogram, Spinal tap and Biopsy are used to diagnosis brain tumors. CT scan uses x-ray to produce images. CT scan expose patients to ionizing radiation. High radiation are involved in CT scan. A new study in the Journal of the National Cancer Institute suggests that CT scans, commonly used in medical imaging, may increase the risk of brain tumors.

Magnetic Resonance Imaging (MRI) plays an important role in the medical era. It is noninvasive method to detect Brain tumor. MRI uses Magnetic field and Radio waves to produce Brain images. MRIs create more detailed pictures than CT scans. MRI is the preferred screening examination for brain tumor. The goal is to detect brain tumor before clinical signs are noticeable. The size of the tumor can be measured by MRI. A special dye called contrast medium is injected into the patient's vein or given as a pill or fluid to swallow before an MRI scan.

Thus, motivated by these factors, our main contributions in this work are:

- Create a new BRAMSIT database which involves 319 MRI scan images along with its ground truth images.
- Present the annotation of all the 319 subject's biological data along with their axial position.

In proposed method, motivated by the innovating work on deep CNNs, the ability of using deep figures with light convolutional parts for segmenting gliomas from other anatomical structures in MRI images has been researched. Making use of little 3x 3 portions to get further CNNs, with lighter parts stacking of numerous convolutional bands is possible, while having the equivalent responsive field of greater bits. Programmed division of cerebrum tumors by utilizing profound CNNs is suggested. Additional exploration of the utilization of the force standardization technique as a pre-handling procedure. It intends to notice information heterogeneity brought about by multiple-site multiple-scanner MRI images acquisitions. Advantages of suggested system

7. PROPOSED SYSTEM

The main purpose of this paper is to identify the region of tumor and to do the detailed diagnosis of that tumor which will be used in treating the cancer patient. The detailed about the proposed system is given below. Threshold is a specific intensity value which contains a predefined intensity value; it is used to separate object or Region of Interest (ROI) from the image background, chosen in the range of 0 to 255. But it is detected that clustering methods followed by threshold cannot notice tumor correctly from MRI image, because the image consists of several nonbrain tumor tissue. For this reason, we express the proposed method using K-Means algorithm followed by Object Labeling algorithm also, some preprocessing steps (median filtering and morphological operation) is used for tumor detection purpose [14].

7.1 Skull Masking

Detection of skull is used to control the boundaries of the object. The edge information helps to find out the region of interest (ROI) i.e., the portion of the image covering the tumor. This work is done with the help of calculating the centroid in the image. Extraction of brain tissue from non-brain tissues in MR images which is referred to as skull stripping is an important step in many neuron imaging studies. In this, we used automatic threshold value selector to automatically choose threshold value. Then, mathematical morphology operations on a binaries image are applied stage by stage to achieve acceptable skull stripped brain images. The proposed skull stripping method comprises four steps. Initially image binarization is completed using threshold value and narrow connections are removed from binarized image using morphological opening. Then, the largest connected component from binarized image is selected since brain is the largest connected structure inside the head.

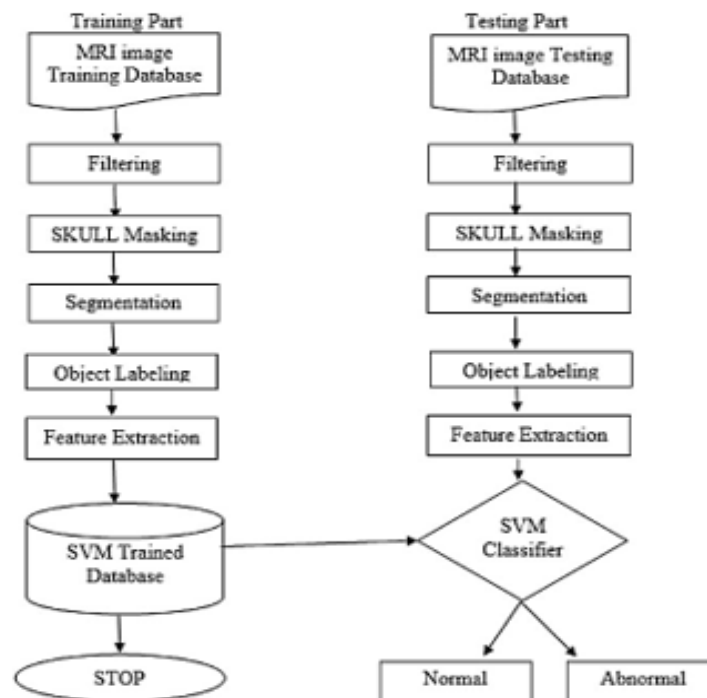
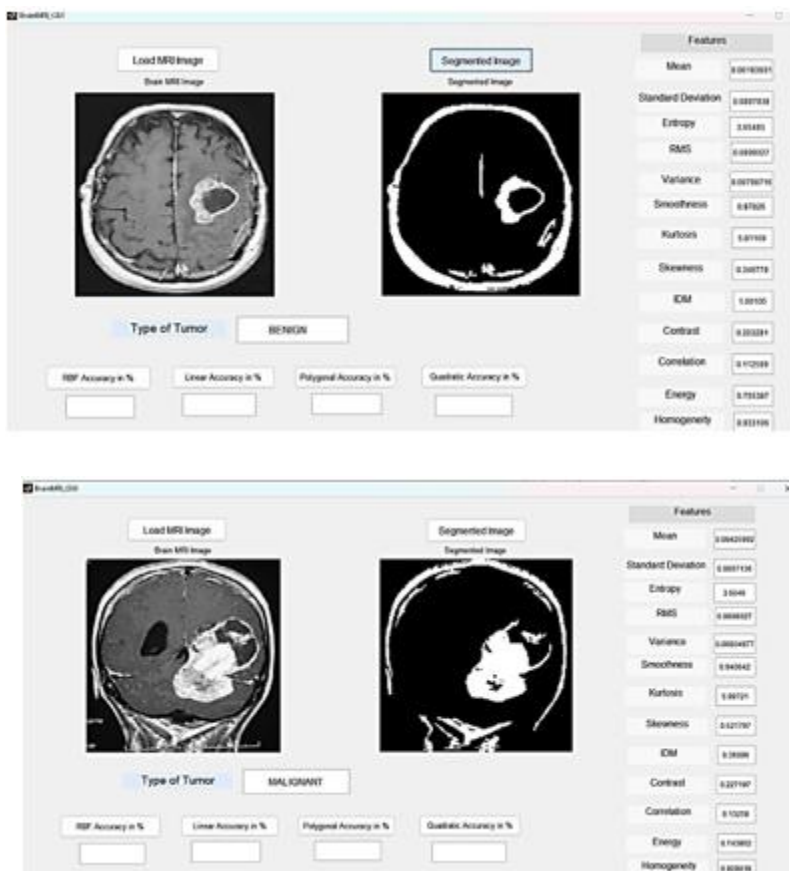


Figure 6.1: Flow diagram of Proposed System

8. SIMULATION RESULT



The above figures are the output of this project where we can find whether the given image of tumor is benign or malignant tumor

ADVANTAGES

- Elapsed time is less compared to existing system
- SVM makes easy to classify the tumor
- Less chances for wrong predictions

DISADVANTAGE

- Computational Complexity is more

9. CONCLUSION

Brain tumor detection is done by preprocessing, which is first step in that median filter and by using diagonal, antidiagonal masks segmented images get preprocessed and skull masking is done here. After skull masking fatty tissues and other unwanted details get smoothen. Preprocessed image is segmented with the K-Mean segmentation and Object Labeling with HOG, HOG is friendly with feature extraction. So the texture feature and color feature are extracted here in the system which is use to find out the region of interest and SVM is use for pattern mapping and pattern matching process. Also use to learn Neural Network. Image processing has become a very important task in today's world. Today applications of image processing can be originated in

number of areas like medical, remote sensing, electronics and so on. If we focus on medical applications, image segmentation is widely used for diagnosis purposes. In this paper, we have proposed a system that can be used for segmentation of brain MR Images for Detection and identification of brain tumor. We find the area of tumor and its type of tumor. Future scope for detection and segmentation of brain tumor is that if we obtained the three-dimensional image of brain with tumor then we can also find out its tumor size and also can evaluate its tumor type and also its stage of tumor.

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