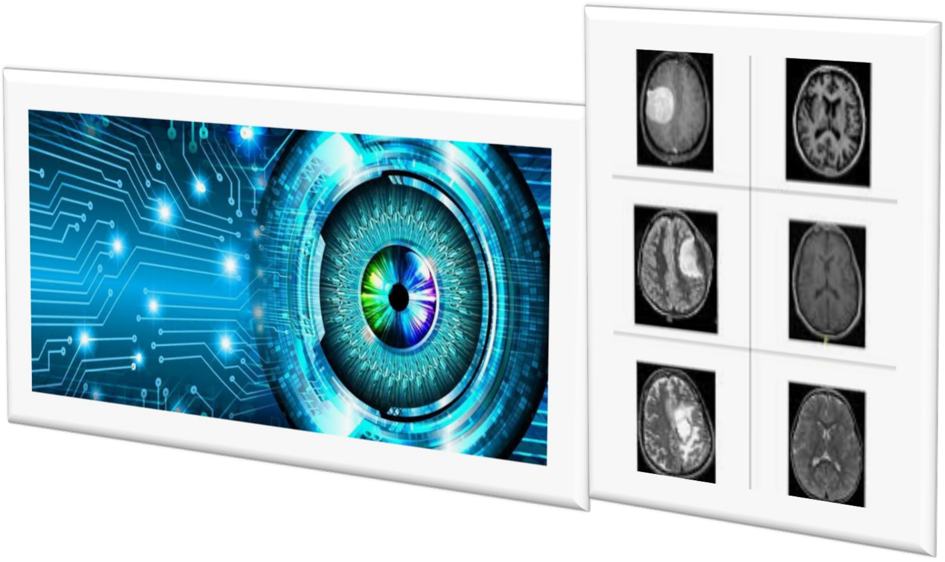
JSS SCIENCE & TECHNOLOGY UNIVERSITY

MYSURU 570006

TOPIC:"BRAIN TUMOR DETECTION USING IMAGE PROCESSING"



SUBMITED TO

SHRUTHI NM

Assistant Professor,

DEPARTMENT OF COMPUTER SCINENCE

JSSSTU, MYSURU

SUBMITTED BY

Rahul Singh(29)	**Sanjay CB (35)**	**Shreyas SR(39)**	**Prajwalan(66)**
01JST18CS098	**01JST18CS119**	**01JST18CS131**	**01JST19CS413**

SIGNATURE:

ABSTRACT

Processing magnetic resonance images are very complex and constantly studied by the researchers to give doctors better ability to diagnose the patients. In order to detect automatically suspicious regions or tumors, we present a new approach inspired by threshold segmentation and based on morphological operations in this paper. The advantages of our approach come from the complementarities between these two approaches. The morphological operations extract roughly the tumor region and eventually can affect healthy while the threshold segmentation method gives a clear picture of the structure of the different brain and therefore these two approaches improve significantly the threshold segmentation and detection and extraction of the tumor zone based on morphological operations.

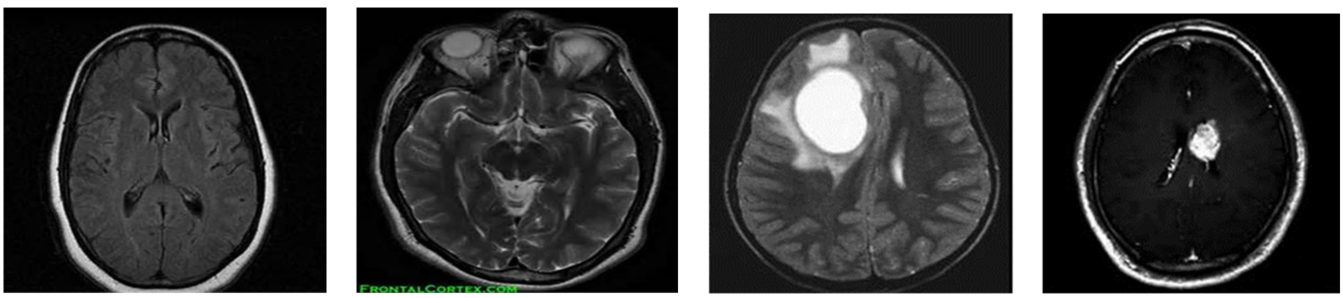
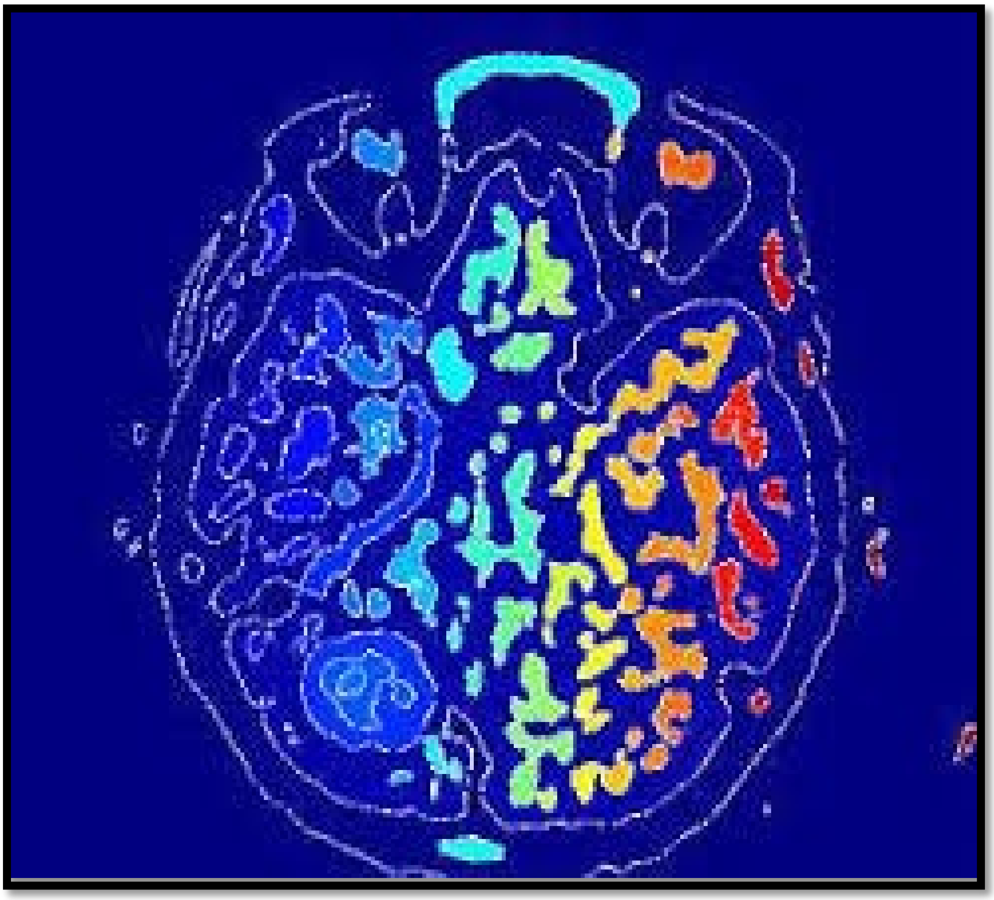


Fig: Images database with and without tumor

INDEX

INTRODUCTION



Nowadays, brain tumor is one the main reason for increasing mortality among adults and kids. It's been concluded in the research of the majority of the western world that number of individuals who suffering and dying from brain tumors continues to be increased to 300 a year during past few decades. As this number is candidate to increase, tools and methods to detect, extract the tumors and also to analyze their behavior are increasingly widespread and must consider the type of tumor, the kind of images to be utilized and depending there from the several approaches to use or develop.

Brain Tumor

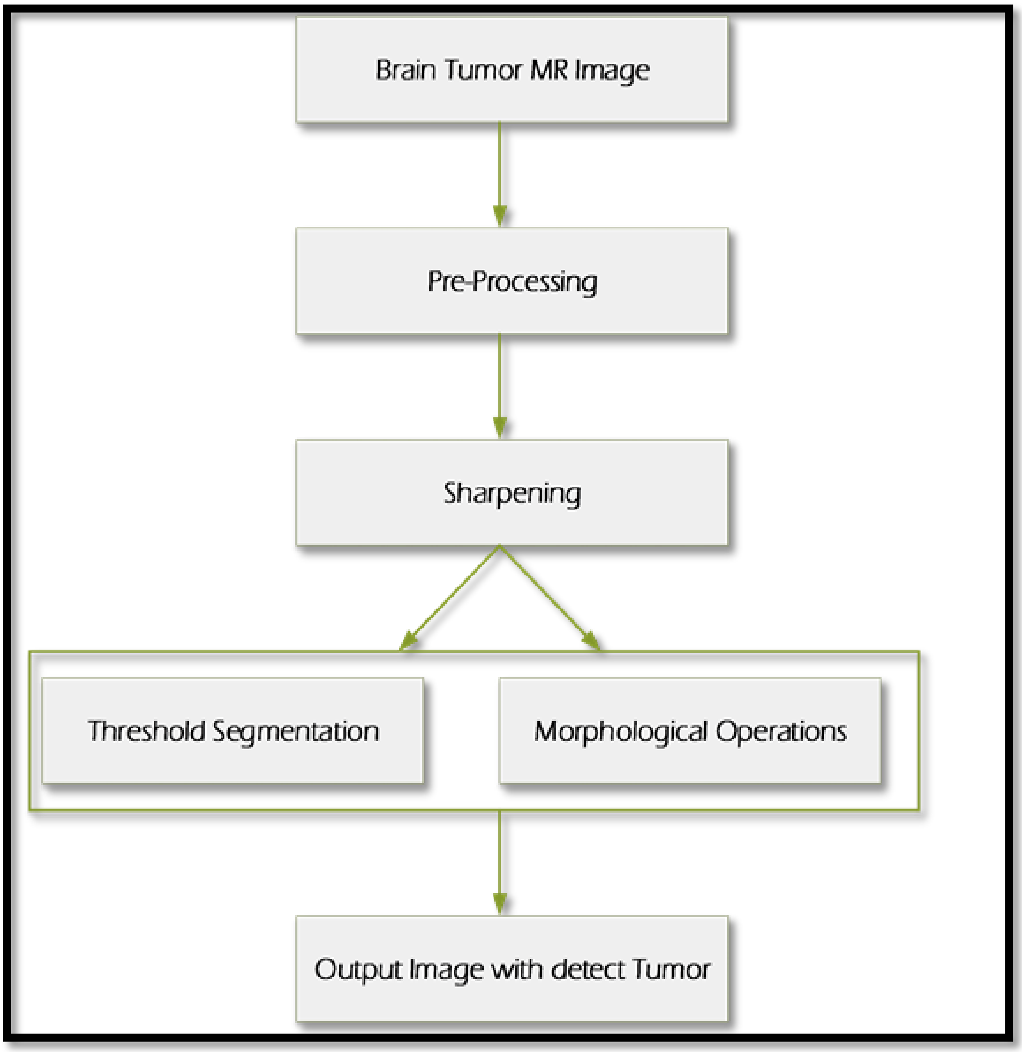
The word tumor, also referred to as neoplasm, means the abnormal expansion of the tissues that results when cells divide more than they need to or do not die after they should. Brain tumor can be an abnormal mass of tissue through which cells grow and multiply uncontrollably, seemingly unchecked by the mechanisms that control normal cells. Two large individuals are recognized and which rely on the origin with the tumors (primary, metastatic) in addition to their styles of growth of malignity (benign, malignant).

MRI Brain Tumors' Images

Magnetic Resonance Imaging (MRI) is the most sophisticated and waves used magnetic resonance imaging to obtain high-quality images from all over the body and tissues and to ability of MRI to detect the smallest details within the body. MRI is usually used when treating brain tumors or any other cancers. Through high-resolution imaging magnetic resonance images we can infer anatomical information and find out where abnormalities. This technique has a great ability to detect differences in tissue and structures and is better than computed tomography for the detection of the size of the tumor in the brain.A more classy and versatile approach will depend on thresholding which divides the image into two regions this forming a binarized image a depending on a typical threshold method for segmentation. Its gives the better segmented results over other traditional algorithms because threshold value is dependent on the inner cluster variance.

A morphological filtering based approach of brain tumor segmentation on MRI images provides significant outputs through operations like erosion and dilation. It work over the binarized image for automatic region splitting dependant on region growing approach like automated seeded selection also for detection and extraction of tumor. Before processing the image must be pre-processed by removing noise using fourth order derivative. Also a mixture of flood-fill algorithm with morphological operations also detects and extracts tumor brain MRI image.

STEPS FOR DETECTION



The flow chart illustrates the procedure of tumor detection and segmentation. The images are acquired from radiologist and some images are downloaded from the brain tumor MRI database. Each image is pre-processing and applied various thresholding and morphological operations to segment and detects the tumor that is explained in more detail in the following sub sections.

➢ Image Pre-Processing and Enhancement

Pre-processing stage removes the noise and also high frequency artifact seen in the image. It removes the patient name, age and other marks within in the image. You'll find so many methods available for pre-processing technique. After these stages the medical image is converted into standard image without noise, film artifacts and labels. This process is done by using median filter, high pass filter, label filter etc. In our experimentation we've used median filter for pre-processing and histogram equalization for image enhancement.

➢ Threshold Segmentation

Segmentation is a division of the digital image into multiple parts and objective process is to simplify the representation of the image to what is more pronounced for the analysis of the image. The threshold of an image is calculated using the Equation (2). The output of the threshold image is a binary image. Thresholding creates binary images from grey-level ones by turning all pixels below some threshold to zero and all pixels above that threshold to 1. If g(x, y) is a threshold version of f(x, y) at some global threshold T, then

$$g(x, y) = 1 \text{ if } f(x, y) > T \quad ; \qquad 0 \text{ if } f(x, y) < T \quad (2)$$

➢ Morphological Operations

In medical image processing, we use mathematical morphological by means of identity and detect and extract significant image descriptors by using properties of the shape in an image. Morphological operations are the logical transformation established on comparison of pixel neighborhood with a specified pattern that is known as a structural element. Here the morphological operations such as binary dilation, binary erosion are applied to the image. Binary closing and binary opening operations are applied to images

➢ Tumor Detection

Finally, this approach based on morphological operations detected the tumor area in MRI brain image

Implementation

We have performed addition of images using OpenCV and Python

PROGRAM:

```
import numpy as np

import cv2

from matplotlib import pyplot as plt

from skimage.morphology import extrema

from skimage.morphology import watershed as skwater


def ShowImage(title,img,ctype):

  plt.figure(figsize=(10, 10))

  if ctype=='bgr':

    b,g,r = cv2.split(img)       # get b,g,r

    rgb_img = cv2.merge([r,g,b])     # switch it to rgb

    plt.imshow(rgb_img)

  elif ctype=='hsv':

    rgb = cv2.cvtColor(img,cv2.COLOR_HSV2RGB)

    plt.imshow(rgb)

  elif ctype=='gray':

    plt.imshow(img,cmap='gray')

  elif ctype=='rgb':

    plt.imshow(img)

  else:

    raise Exception("Unknown colour type")

  plt.axis('off')
```

```
  plt.title(title)
  plt.show()
img = cv2.imread('brains1.png')
gray = cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
ShowImage('Brain MRI',gray,'gray')
cv2.imwrite('Brain MRI.png', gray)
ret, thresh = cv2.threshold(gray,0,255,cv2.THRESH_OTSU)
ShowImage('Thresholding image',thresh,'gray')
cv2.imwrite('Thresholding.png', thresh)
ret, markers = cv2.connectedComponents(thresh)
#Get the area taken by each component. Ignore label 0 since this is the background.
marker_area = [np.sum(markers==m) for m in range(np.max(markers)) if m!=0]
#Get label of largest component by area
largest_component = np.argmax(marker_area)+1 #Add 1 since we dropped zero above

#Get pixels which correspond to the brain
brain_mask = markers==largest_component
brain_out = img.copy()
#In a copy of the original image, clear those pixels that don't correspond to the brain
brain_out[brain_mask==False] = (0,0,0)
img = cv2.imread('brains1.png')
gray = cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
ret, thresh = cv2.threshold(gray,0,255,cv2.THRESH_BINARY_INV+cv2.THRESH_OTSU)
# noise removal
kernel = np.ones((3,3),np.uint8)
opening = cv2.morphologyEx(thresh,cv2.MORPH_OPEN,kernel, iterations = 2)
```

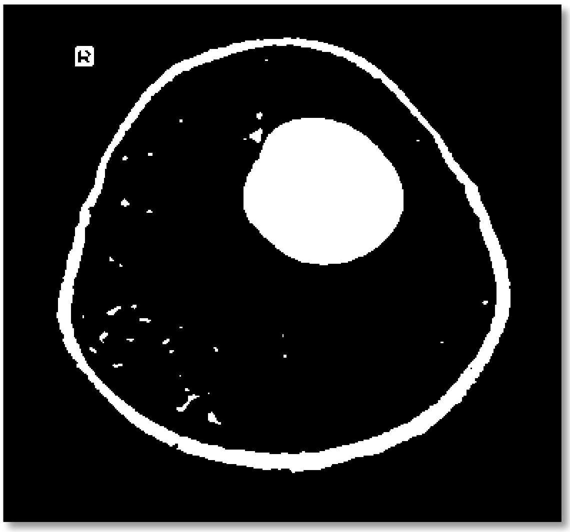
```
# sure background area
sure_bg = cv2.dilate(opening,kernel,iterations=3)

# Finding sure foreground area
dist_transform = cv2.distanceTransform(opening,cv2.DIST_L2,5)
ret, sure_fg = cv2.threshold(dist_transform,0.7*dist_transform.max(),255,0)

# Finding unknown region
sure_fg = np.uint8(sure_fg)
unknown = cv2.subtract(sure_bg,sure_fg)

# Marker labelling
ret, markers = cv2.connectedComponents(sure_fg)
# Add one to all labels so that sure background is not 0, but 1
markers = markers+1

# Now, mark the region of unknown with zero
markers[unknown==255] = 0
markers = cv2.watershed(img,markers)
img[markers == -1] = [255,0,0]

im1 = cv2.cvtColor(img,cv2.COLOR_HSV2RGB)
ShowImage('Watershed segmented image',im1,'gray')
cv2.imwrite('watershed_segemnted.png', im1)
brain_mask = np.uint8(brain_mask)
kernel = np.ones((8,8),np.uint8)
```

```
closing = cv2.morphologyEx(brain_mask, cv2.MORPH_CLOSE, kernel)

ShowImage('closing', closing, 'gray')

cv2.imwrite('closing.png', closing)

brain_out = img.copy()

#In a copy of the original image, clear those pixels that don't correspond to the brain

brain_out[closing==False] = (0,0,0)
```

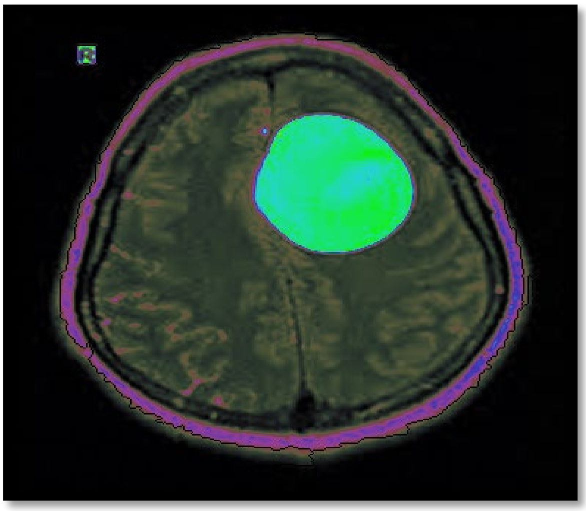
RESULTS & ANALYSIS

Images we worked on :-)

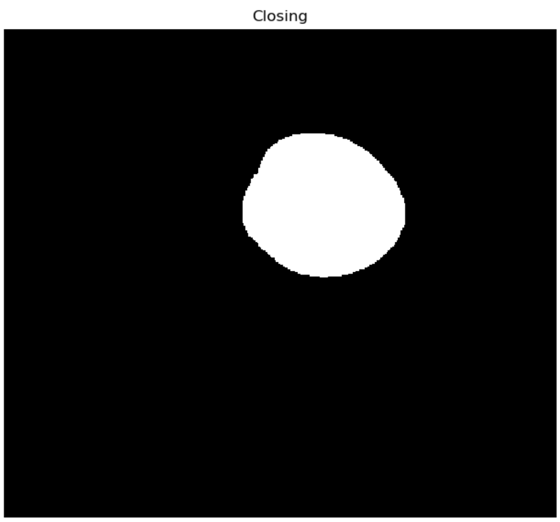
BRAIN MRI IMAGE



THRESHOLDING



WATERSHED SEGMENTED IMAGE



CLOSING

CONCLUSION

In this project, we presented a method for image acquisition, image pre-processing using median and high pass and label filtering, image enhancement using histogram equalization, segmentation using threshold and morphological operations therefore the detection of the tumor. Some of the features of the tumor are detected which will be helpful in medical applications. The future works involve the segmentation and detection of more images with more features which help in classifying several types of the tumors.

REFRENCES

[1] Logeswari, T. and Karman, M. (2010) An Improved Implementation of Brain Tumor Detection Using Segmentation Based on Soft Computing. Journal of Cancer Research and Experimental Oncology, 2, 6-14.

[2] American Brain Tumor Association (2012) Facts and Statistics, 2012. http://www.abta.org/secure/about-brain-tumors-a-primer.pdf

[3] National Cancer Institute Dictionary of Cancer Terms. http://www.cancer.gov/publications/dictionaries/cancer-terms

[4] Devos, A. and Lukas, L. (2014) Does the Combination of Magnetic Re-sonance Imaging and Spectroscopic Imaging Improve the Classification of Brain Tumors? IEMBS' 26th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, 1-5 September 2004, 407 410.

[5] Natarajan, P., Krishnan, N., Kenkre, N.S., Nancy, S. and Singh, B.P. (2012) Tumor Detection Using Threshold Operation in MRI Images. IEEE 2012.

[6] Gajanayak, G.M.N.R., Yapal, R.D. and Hewawithana, B. (2009) Comparison of Standard Image Segmentation Methods of Brain Tumors from 2D MR Images. ICIIS 2009, 28-31 December 2009. http://dx.doi.org/10.1109/iciinfs.2009.5429848

[7] Resmi, A.S. and Thomas, T. (2012) Automatic Segmentation Framework for Primary Tumors from Brain MRIs Using Morphological Filtering Techniques. 5th BMEI, 2012.

[8] Thapaliya, K. and Kwon, G.R. (2012) Extraction of Brain Tumor Based on Morphological Operations. 8th (ICCM) 2012.

[9] Ahmed, F., Sharmin, P., Shahriar, B. and Sarwar, S. (2012) An Improved Image Denoising and Segmentation Approach for Detecting Tumor from 2-D MR Brain Images. IEEE 2012.