Kalyani Government Engineering College

Mini Project

Topic: Representation of Brain Stroke Using Medical Image Processing System

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Abstract

Medical image processing is a field of study that focuses on the application of image processing techniques to medical images. Medical images can include medical images such as X-rays, CT scans, and MRI scans, as well as microscopic images of cells and tissues. The goal of medical image processing is to improve the accuracy and efficiency of medical diagnosis and treatment. This can be achieved through the development of algorithms and techniques that can enhance, segment, and analyse medical images. One of the key challenges in medical image processing is the need to extract meaningful information from images that are often noisy and contain complex structures. Image processing techniques such as filtering, segmentation, and feature extraction can be used to isolate regions of interest and extract relevant information.

Some commonly used techniques in medical image processing include:

Image Acquisition: The first step in medical image processing is acquiring an image data. This is usually done through various imaging technique such as X-Ray, CT scan, MRI, Ultrasound and microscopy

Image enhancement: This involves applying filters or algorithms to improve the quality or clarity of the image, such as removing noise, enhancing contrast, or sharpening edges.

Image segmentation: This involves partitioning an image into different regions or segments based on certain criteria, such as brightness, texture, or color, in order to identify and separate different structures or tissues.

Image registration: This involves aligning and overlaying images obtained at different times or from different modalities in order to track changes over time or to combine information from multiple sources.

Machine learning: This involves developing algorithms or models that can learn from a set of training data to automatically classify, segment, or analyse images.

Image filtering: Techniques such as smoothing and sharpening can be used to improve image quality and remove noise.

Segmentation: This technique involves dividing an image into regions or segments based on characteristics such as colour or intensity.

Feature extraction: This technique involves identifying and extracting specific features of interest from an image, such as edges or texture.

Classification: This technique involves categorizing image regions into specific classes or categories, such as healthy tissue or cancerous tissue. Overall, medical image processing is a critical tool for medical professionals and researchers alike, enabling them to extract meaningful information from complex medical images and ultimately improve patient outcomes.

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Introduction

The two modalities capable of producing multidimensional images for radiological applications are Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). Normally the first radiologic examination in suspicion of stroke is brain CT imaging. But MRI provides high resolution images with excellent soft tissue characterization capabilities. A comparative analysis for the diagnosis of stroke on CT and MRI images is presented in this paper. The algorithm proposes the use of Digital Image processing tools for the identification of infarct and Haemorrhage in human brain. Pre-processing of medical images is done by *median filtering*. Segmentation is done by *Gabor filtering* and seeded region growing algorithm. The method is demonstrated on the CT and MRI brain images having different types of infarcts

1. Stroke is a cerebrovascular accident affecting the blood supply to the brain. Without proper treatment, it leads to death or long-term disability. A medical condition called a stroke is cell death associated with weak blood flow into the brain. It is an ischemic stroke caused by insanity caused by blood flow, and it is a bleeding that in two different forms causes haemorrhagic stroke.

Haemorrhagic stroke occurs when a weakened blood vessel ruptures. There is a possibility for co-occurrence of both ischemic and haemorrhagic strokes.

Ischemic stroke is a type of stroke that occurs when blood flow to a part of the brain is blocked, usually by a blood clot. This results in the death of brain cells in the affected area due to lack of oxygen and nutrients.

Ischemic strokes are the most common type of stroke, accounting for around 87% of all strokes

Ischemic strokes can cause a variety of symptoms, depending on the location and severity of the stroke. Symptoms can include sudden weakness or numbness in the face, arm, or leg, difficulty speaking or understanding speech, sudden vision changes, and a sudden severe headache.

2. Codes to process the image in the MATLAB software.

```
% Load the image
brainImage = imread('brain_stroke_image.jpg');

% Convert to grayscale
grayImage = rgb2gray(brainImage);

% Apply median filtering to remove noise
medImage = medfilt2(grayImage);

% Threshold the image to separate the brain from the background
threshImage = imbinarize(medImage, 'adaptive');
```

```
% Fill in any holes in the brain image
fillImage = imfill(threshImage, 'holes');



% Remove any small objects from the image
cleanImage = bwareaopen(fillImage, 100);

% Apply edge detection to highlight the edges of the brain
edgeImage = edge(cleanImage, 'Sobel');

% Display the original image and processed images
subplot(2,3,1), imshow(brainImage), title('Original Image');
subplot(2,3,2), imshow(grayImage), title('Grayscale Image');
subplot(2,3,3), imshow(medImage), title('Median Filtered Image');
subplot(2,3,4), imshow(threshImage), title('Thresholded Image');
subplot(2,3,5), imshow(fillImage), title('Filled Image');
subplot(2,3,6), imshow(edgeImage), title('Edge Detected Image');
```

3 Stroke diagnosis

MRI and CT scans are used to determine the amount of brain damage caused when a stroke occurs. The imaging methods allowed the phenomenon of occultation to be located. Scanning techniques can help identify a stroke's subtype and identify where its source is. Doctors may also be able to perform other blood tests that can help diagnose a stroke as well. Blood tests can reveal what something is really like to another person.

3.1 Physical examination

A medical examination involves cross-referencing a person's past medical history to their current clinical history. If there is a normal level of stroke severity, it is recommended to assign a normal level.

3.2 Imaging

The case study: "Ischemic stroke.

• An x-ray of the chest (without contrast enhancements)

○ Recovery Time: (less than 10 percent within first 3 hours of symptom onset)

○ Specificity of positive predictive value = 96%.

• On the MRI scans.

○ Affectivity is, well, very strong.

○ Specificity of objects (98%).

• When it comes to diagnosing head injury in the hospital, it's important to use.

○ It’s a type of MRI scan for NMA (without contrast enhancements)

○ The sensitivity dropped by eleven percent.

○ Ultrasound scans are used.

○ the level of sensitivity is 83 percent.

○ Personalization is complete.

The MRI scan is sufficient to be evaluated for a chronic stroke. However, it may also be necessary for scanning with SPECT or PET. The metabolism of PET, brain blood movement isotopes, PET, and PET neurons are reported as PET and SPECT. In the blood supply, CT scans identify mild ischemic strokes with tender detection of blight. To estimate the underlying cause of a CT test, it is possible to use many other image enhancers. Determination of the quality of these medicines is very important, depending on the prescription. The selection of the stroke response will depend heavily on the cause of the stroke. The conventional way is the following:

• Doppler Ultrasound Studies (for detection or pre-brain diagnosis of carotid stenosis);

• The electrocardiogram or echocardiogram (ECG) (for identification of arrhythmias and after cardiac clots may spread to brain vessels throughout the bloodstream)

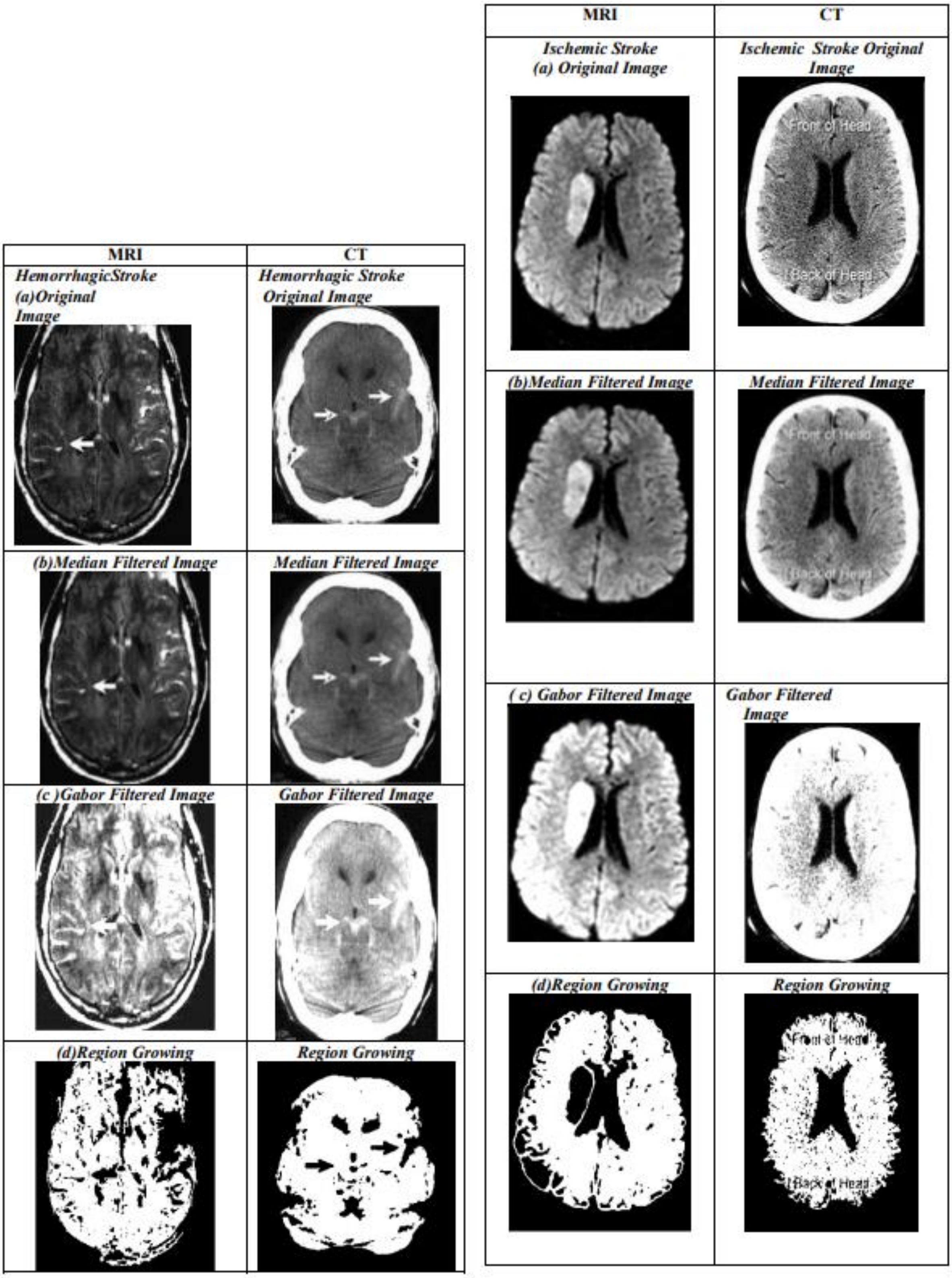
• Survey for the detection of abnormal rhythms of the heart.

• Cerebral vasculature angiography, in which bleeding is presumed to be due to aneurysm or arteriovenous malformation.

• Blood tests to evaluate the presence of high blood cholesterol or whether it could be a rare process, including, etc. There are abnormal tests for blood. If hemorrhagic stroke test deficiencies are present, the CT or MRI contrast scan can identify cerebral artery deformation or any other source of bleeding or structural MRI if this does not result (for example, aneurysms). Invasive cerebral angiography may also be performed if the underlying cause of bleeding is not identified but implies access to the blood stream with the intravascular catheter, which can cause additional strokes and complications at the place of insertion, and therefore this study is reserved for certain situations.

4. Medical imaging processing for stroke

Doctors have multiple strategies and methods for identifying medical images to diagnose diseases. Cell segmentation in diseases, with the help of MATLAB, can be the easiest way for doctors to examine illnesses of the immoral tissue. Image classification in sectors with structural units is the interpretation and analysis of an image that you plan to be mutually compatible. The MI brain imaging is one of the most competitive physiques in the organism. Medical imagery represents the body that consists of the soft tissue, organ, and bone structure. In such circumstances, they cannot tell whether or not this raw medical view of adolescent health climaxes. This means that medical image analysis through image handling is so critical that it is essential for medics to be conscious of special problems and of their development related to disease and growth problems. There are numerous types of medical visual sectors in MATLAB application like threshold and morphology.



Images represented by CT scan and MRI scan. Original Image of Hemorrhagic Stroke (b) Median Filtered Image (c) Gabor Filtered Image (d) Region Growing

Image Filtering by Histogram

This example shows how to create a histogram for an image using the `imhist` function. An image histogram is a chart that shows the distribution of intensities in an indexed or grayscale image. The `imhist` function creates a histogram plot by defining *n* equally spaced bins, each representing a range of data values, and then calculating the number of pixels within each range. You can use the information in a histogram to choose an appropriate enhancement operation. For example, if an image histogram shows that the range of intensity values is small, you can use an intensity adjustment function to spread the values across a wider range.

```
I = imread('rice.png');
imshow(I)
```

Histograms are commonly used in medical image processing for analyzing and visualizing image data. A histogram is a graphical representation of the distribution of pixel intensity values in an image. The x-axis represents the pixel intensity values, and the y-axis represents the number of pixels in the image that have that intensity value.

In medical image processing, histograms can be used for a variety of purposes, such as:

Image segmentation: Histograms can be used to segment an image into regions based on the intensity values of the pixels. For example, if the image contains objects with different brightness levels, a threshold value can be chosen from the histogram to separate the objects.

Image enhancement: Histogram equalization is a technique used to enhance the contrast of an image by redistributing the pixel intensities. This technique can be useful in medical images to enhance the visibility of certain structures or features.

Image classification: Histograms can be used to classify images based on their intensity distribution. For example, if a certain pattern or texture in an image is associated with a particular disease or condition, the histogram can be used to differentiate between healthy and diseased tissues.

Image quality assessment: Histograms can be used to assess the quality of an image by analyzing the distribution of pixel intensities. A well-exposed image should have a histogram that is evenly distributed across the intensity range, while an underexposed or overexposed image may have a histogram that is skewed towards one end of the range.

Overall, histograms are a useful tool in medical image processing for analyzing and visualizing image data. By providing a quantitative representation of the distribution of pixel intensities in an image, histograms can be used for a variety of purposes, including image segmentation, enhancement, classification, and quality assessment.

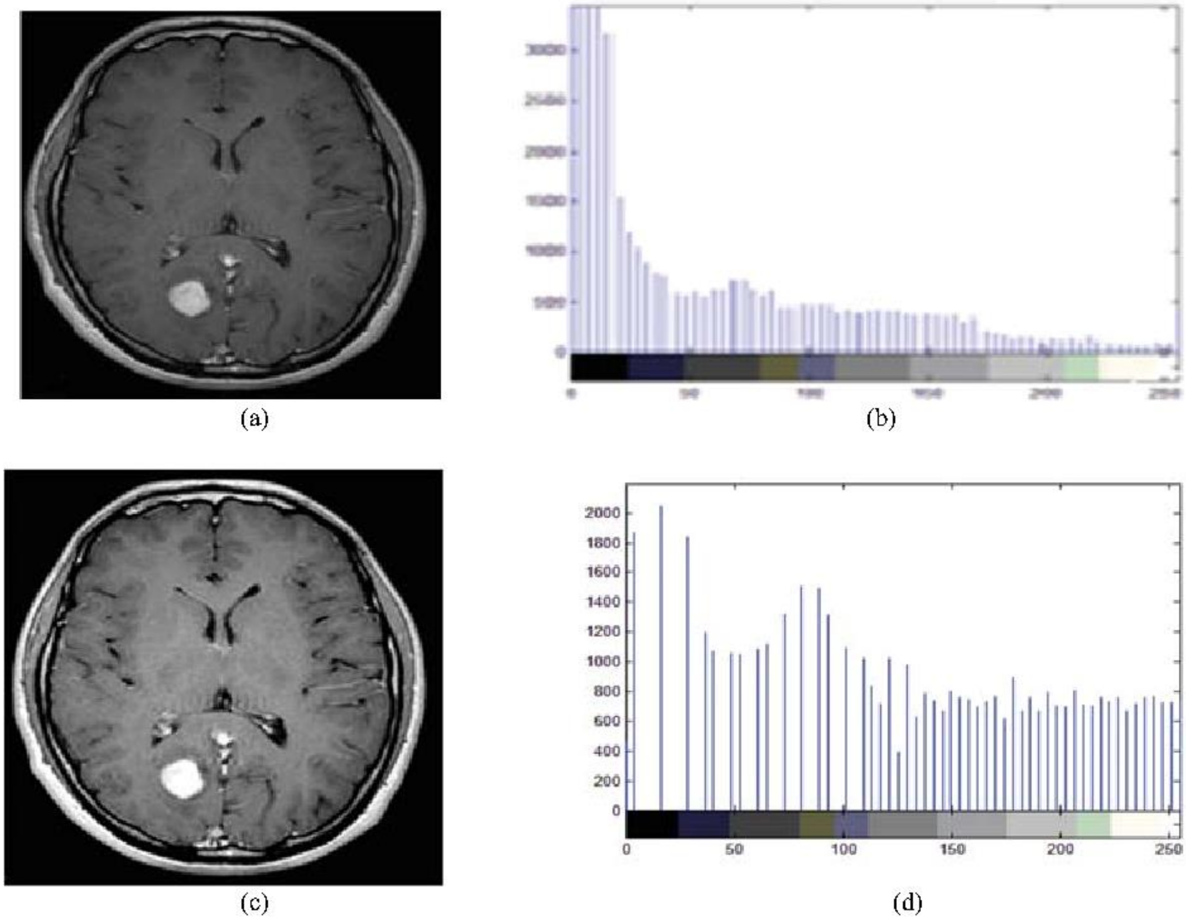


Figure- Shows a deliberate histogram image for each brain scans.

Edge detection

Edge detection is a commonly used technique in medical image processing for identifying the boundaries of objects or structures in an image. Here's an example of how to perform edge detection on a brainstroke image using the Canny edge detection algorithm in MATLAB:

```
% Load the brainstroke image
img = imread('brainstroke.jpg');

% Convert the image to grayscale
gray_img = rgb2gray(img);

% Apply Gaussian blur to the image to reduce noise
blur_img = imgaussfilt(gray_img, 2);

% Apply Canny edge detection algorithm to detect edges
edges = edge(blur_img, 'canny', [0.1 0.3]);

% Display the original image and the detected edges
figure;
subplot(1,2,1);
imshow(img);
```

```
title('Original Image');
subplot(1,2,2);
imshow(edges);
title('Edges');
```

In the code above, we first load the brainstroke image and convert it to grayscale. We then apply a Gaussian blur to the image to reduce noise using the imgaussfilt function. Finally, we apply the Canny edge detection algorithm using the edge function with a lower threshold of 0.1 and an upper threshold of 0.3 to detect the edges in the image. The resulting image with the detected edges is displayed in a separate window.

This is just one example of how to perform edge detection on a brainstroke image using MATLAB. There are many other edge detection algorithms and parameters that can be used depending on the specific application and image characteristics.

Conclusion

- So, here we have concluded that we have used MATLAB filters for medical image processing, and In conclusion, medical image processing plays a crucial role in modern healthcare by providing valuable insights and aiding in accurate diagnosis. One of the key benefits of medical image processing is its ability to enhance and improve the quality of medical images, making it easier to identify and analyze abnormalities or subtle features that may be indicative of a disease or condition. Moreover, medical image processing enables the integration of different imaging modalities, such as computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound, facilitating a comprehensive and multi-dimensional understanding of the human body.

Reference

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Characterization of Brain Stroke Using Image and Signal Processing Techniques
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