CS563 - Image Analysis

Assignment-2

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Objective:

PART – 1

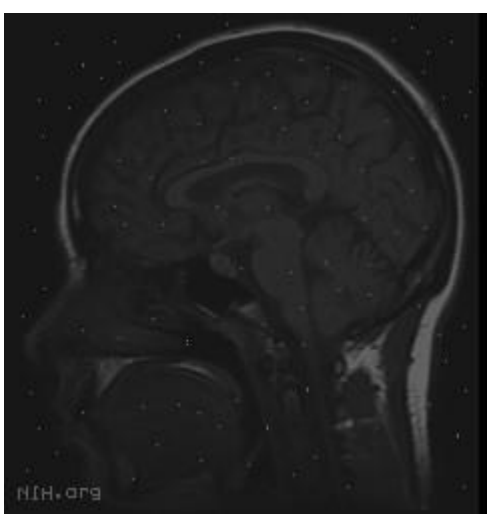
- Perform Image Enhancement techniques on image to improve the quality of the image.

PART – 2

- Perform edge detection on the enhanced image.

Approaches to Enhance and Detect Edges for MRI Image:

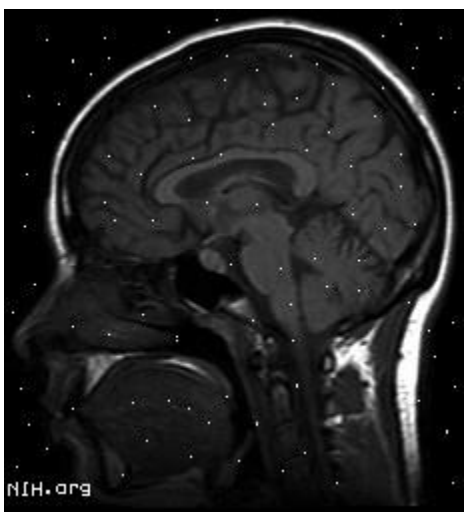
Given input image:



- The input image given has low contrast which makes the image dull.
- The range of the grayscale value is very small.
- Hence, we performed histogram stretching by finding the minimum and maximum value of the pixels in the image.
- The minimum and maximum values are necessary to increase the range of the image from 0 to 255.
- The formula used for histogram stretching was,

  new value = (old value – min. value / (max. Value - min. Value)) x 255

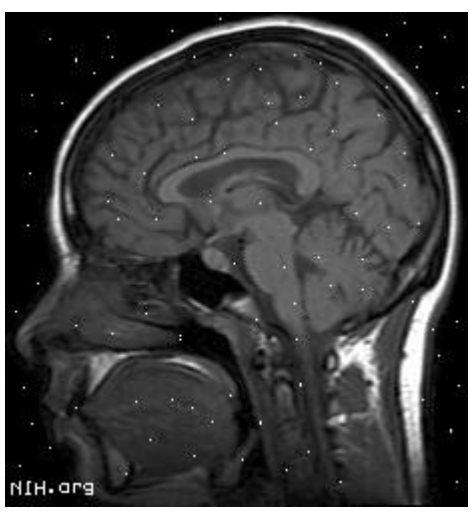
Below is the image after applying histogram stretching:



- We still need to increase the contrast of the image, at last we will deal with salt and pepper noise.
- Now we used power law transformation with gamma value 1.5.
- When gamma value is greater than 1, power law transformation will compress the darker range and stretch the brighter range.
- The formula used for Gamma correction is given below,

$$\text{Corrected pixel} = 255 \times (\text{image pixel} / 255)^{\,1 / \text{gamma value}}$$

After applying Power Law Transformation:

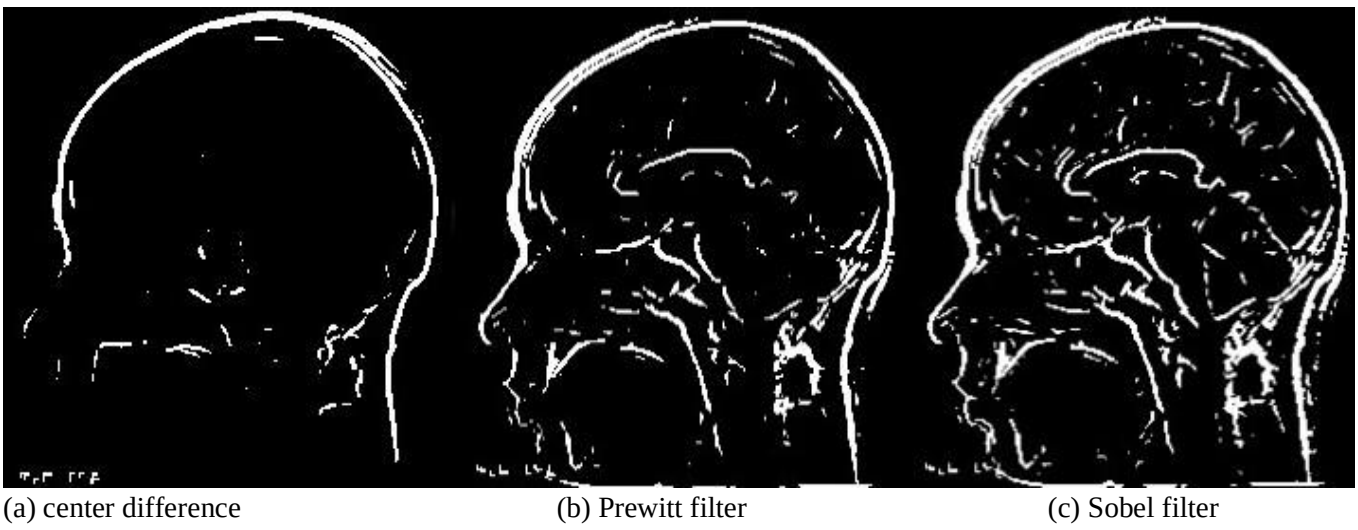


- As you can, all the features are enhanced, and the image has become more brighter now.
- To removes salt and pepper noise we use median filter.

After applying Median Filter:

- As you can see the image looks clean and all the features are enhanced. Now, we can apply edge detection methods.
- All the salt and pepper noise were removed using Median filter.
- We used 3x3 Median filter.

Below is the comparison between 3 Edge Detectors:



(a) center difference (b) Prewitt filter (c) Sobel filter

- We applied Prewitt filter, Sobel filter and center difference on the image for edge detection.
- The differentiation values calculated using the filter contains arbitrary values. Hence, they are converted to range of 0 to 255. The slope at which the thresholding happens is given in the code.
- The vertical and horizontal edge detected images are combined.
- When we compared the results, we found Sobel filter performed quite well in detecting edges.
- Sobel performed well in detecting the edges.