International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

MRI Image Enhancement

Sumaya[1], Zena Vatsa[2]

Abstract: ***Magnetic Resonance Imaging is one of the vital techniques used in medical image processing and offers crucial information about the anatomy of human soft tissue. The MRI is used in detection of various brain related serious disorders and hence image enhancement of the obtained brain images is observed to be given importance by a large number of researchers in the field of medicine and technology. Every image has some noise which does not get eliminated easily on processing. Many researchers have developed a number of techniques to eliminate noise from satellite images and medical images. Still many researchers are coming up with enhanced techniques of various existing image processing and de- noising techniques.***

Keywords: MRI, contrast, image-enhancement, de-noising, histogram.

1. Introduction

The image processing techniques, image enhancement techniques and de- noising techniques are widely used in the field of medical imaging, especially Magnetic Resonance Imaging (MRI). The test that makes use of magnetic field and radio pulses to capture images of body especially that of the brain is called Magnetic Resonance Imaging. The MRI is superior to the X- ray and Computed Tomography or CT scan, as it can provide information of body tissues that cannot be provided by the others. Basically, the MRI technique of imaging is employed in medicinal backgrounds to generate high quality images of the human body parts. The MRI works on the principle of Nuclear Magnetic Resonance (NMR), which is a spectroscopic technique used by the scientists to acquire microscopic information about the molecules. The MRI is now advanced and uses the volume imaging technique and Magnetic Resonance Imaging is young and is growing in the field of science. The most suitable technique for the problems of soft tissues differentiates MRI from other imaging variants in the medicinal field. An x- ray is ideal for hard tissue like bones while a MRI is ideal for soft tissue like human brain. The MRI is used for a number of purposes like diagnosing brain tumors, multiple sclerosis, and spinal infections; to visualize torn ligaments, shoulder injuries, tumors in bones, herniated discs and strokes at initial stages. The MRI images clearly show the tissues that are damaged or diseased and these images are stored on a computer for processing and further references. In order to view the MRI images clearly, sometimes a contrast material is also used and it helps to identify flow of blood, tumors and inflamed areas in the tissues. To give proper diagnosis and good results, doctors are provided with the different results of enhanced images. Enhancement is a fundamental task in digital image processing and analysis, aiming to improve the appearance of image in terms of human brightness perception. Contrast enhancement is among them and is often part of image processing systems in the pre-processing and/or post-processing stage.

2. Problem Formulation

Magnetic Resonance Imaging is one of the vital techniques used in medical image processing and offers crucial information
about the anatomy of human soft tissues, especially in the detection of various brain related serious disorders. Even though there exist a number of techniques to enhance the quality of MRI images, need for better

3. Methodology

A histogram is the estimation of the probability distribution of a particular type of data. An image histogram is a type of histogram which offers a graphical representation of the tonal distribution of the gray values in a digital image. By viewing the image's histogram, we can analyze the frequency of appearance of the different gray levels contained in the image.

There are a number of different types of histogram equalization algorithms, such as cumulative histogram equalization, normalized cumulative histogram techniques are still the same as it is critical to identify brain related disorders. This is attained via the histogram of the picture, using a method that allows the areas with low contrast to gain higher contrast by spreading out the most frequent intensity values equalization, and localized equalization. Here is a list of different histogram equalization methods:

- Histogram expansion
- Local area histogram equalization (LAHE)
- Cumulative histogram equalization
- Par sectioning
- Odd sectioning

These methods were studied and compared in order to determine which one offers the best equalization. The advantages and disadvantages of each method are shown below.

Method	*Advantage*	*Disadvantage*
Histogram expansion	Simple and enhance contrasts of an image.	If there are gray values that are physically far apart from each other in the image, then this method fails.
LAHE	Offers an excellent enhancement of image contrast.	Computationally very slow, requires a high number of operations per pixel.
Cumulative histogram equalization	Has good performance in histogram equalization.	Requires a few more operations because it is necessary to create the cumulative histogram.
Par sectioning	Easy to implement.	Better suited to hardware implementation
Odd	Offers good	Has problems with histograms

sectioning	image contrast	which cover almost the full gray scale.

Cumulative histogram equalization is proposed for implementation. This algorithm was selected due to its good performance and easy implementation.

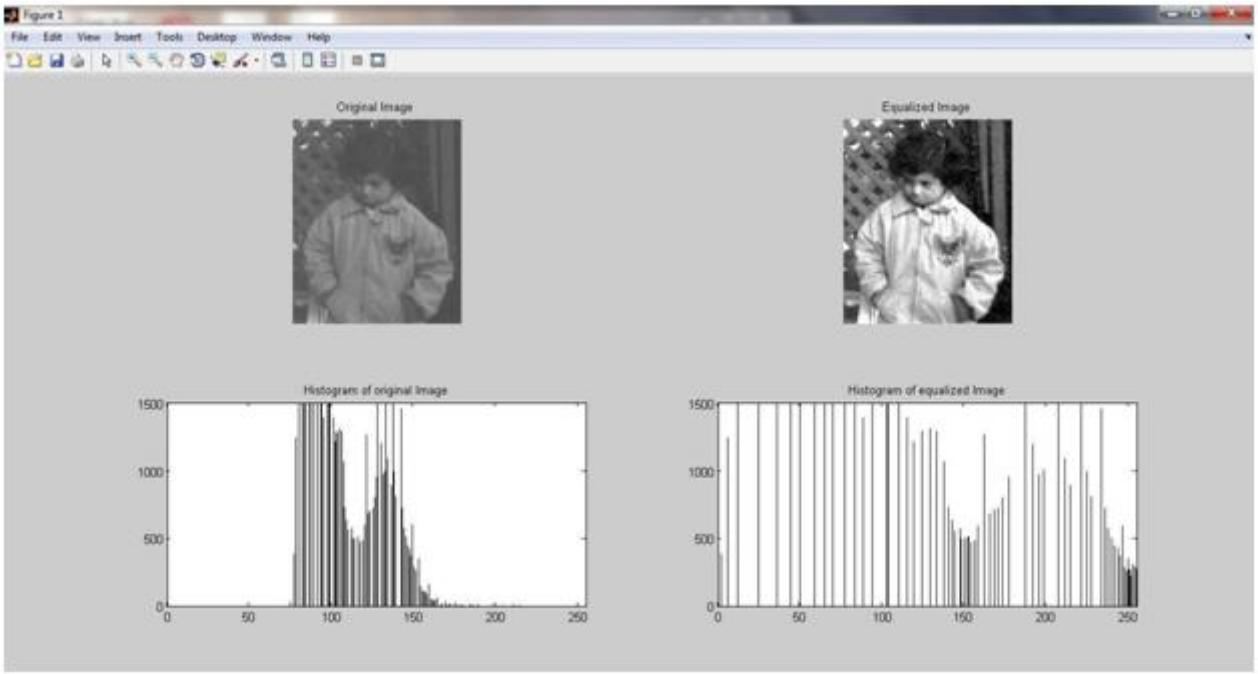
Algorithm:

The general approach for cumulative histogram equalization is described. Here are the steps for implementing this algorithm.

1. Create the histogram for the image.
2. Calculate the cumulative distribution function histogram.
3. Calculate the new values through the general histogram equalization formula.
4. Assign new values for each gray value in the image

4. Results

The final results of the proposed algorithm (for a sample image) are shown below



5. Conclusion

Histogram equalization is a straightforward image-processing technique often used to achieve better quality images in black and white scales in medical applications such as digital x-rays, MRIs and CT Scans. All these images require high definition and contrast of colors to determine the pathology that is being observed and reach a diagnosis. However, in some type of images, histogram equalization can show noise hidden in the image after the processing is done. That is why it is often used with other imaging processing techniques.

References

[1] Mussarat Yasmin, Muhammad Sharif, Saleha Masood, Mudassar Raza and Sajjad,Mohsin, "Brain Image Enhancement-A Survey." World Applied Sciences Journal 17 (9): 1192-1204, 2012.

[2] Senthilkumaran N, Thimmiaraja J, "Histogram Equalization for Image Enhancement Using MRI brain images." World Congress on Computing and Communication Technologies 2014.

[3] E. Ben George, M.Karnan, "MRI Brain Image Enhancement Using Filtering Techniques". International Journal of Computer Science & Engineering Technology (IJCSET), Vol. 3 No. 9 Sep 2012.

[4] S.Janani, R.Marisuganya,R.Nivedhi, "MRI Image Segmentation using Stationary Wavelet Transform and FCM Algorithm". International Journal of Computer Applications (0975 – 8887) International Conference on Innovations In Intelligent Instrumentation, Optimization And Signal Processing "ICIIIOSP-2013."

[5] Aswathy Mohan, Mary Linda P A, " Image Enhancement Using DWT DCT and SVD". Int. Journal of Engineering Research and Application. ISSN : 2248-9622, Vol. 4, Issue 4(Version 1), April 2014, pp.36-40.