International Journal of Enhanced Research in ScienceTechnology & Engineering
ISSN: 2319-7463, Vol. 5 Issue 8, August-2016

Enhancement of MRI brain images using FPA and Histogram Equalization

Hardeep Kaur[1], Jyoti Rani[2]

[1]Computer Science& Engineering, GZS campus college of Engg. & Tech. Bathinda, Punjab, India
[2]Assistant Professor, Computer Science& Engineering, GZS campus college of Engg. & Tech. Bathinda, Punjab, India

ABSTRACT

In this era, Computerized field in digital imageprocessing needs efficient medical image with less noise and improved contrast of image. Magnetic resonance imaging (MRI) is excellent medical technology provide more appropriate information regarding human brain soft tissue, cancer, stroke and various another diseases. MRI has very low contrast ratio to improve the contrast of MRI brain images enhancement is needed.In this paper, MRI brain image enhancement using histogram equalization and flower pollination algorithm techniques are implemented. In the Proposed methods, Flower pollination algorithm is used to enhance the contrast of image along with histogram equalization. Histogram equalization usually increases the contrast of images. In addition to this technique, the Flower Pollination Technique (FPA) is used to enhance the contrast of MRI images. This technique is inspired by pollination process of flowering techniques. In FPA, Local and global pollination methods are used which are based on two clusters. These clusters implemented through fuzzy k means clustering. The obtained results from the Histogram Equalization method is compared with Flower pollination algorithm (FPA) and results are analyzed with the help of metrics parameter like chi square, Intersection, square chord, dnon-IS, E-Can Berra, Euclidean.

Keywords: MRI brain images, contrast enhancement, Flower Pollination algorithm , Histogram Equalization, metrics parameter.

1. INTRODUCTION

Magnetic resonance imaging is non-invasive imaging technology that produces three dimensional definite anatomical images without the utilization of harming radiation. It is often uses for diseases detection, diagnosis and treatment monitoring. MRI (Magnetic resonance imaging) is the test that uses magnetic field and pulses of radio wave energy to make the image of organs and structures inside the body is called magnetic resonance imaging. Basically, the MRI technique of imaging is employed in medical field to generate very good result and quality images of the human body parts. The MRI is utilized for many purposes such as diagnosing brain tumors, multiple diseases and spatial infections to visualize shoulder injuries, tumor in bones and strokes.

In which, MRI images has a very low contrast ratio to improve the contrast of MRI images enhancement techniques are used. The image enhancement is a technique to remove the distortion due to low contrast ratio, remove unwanted noise, improper intensity or color ratio, blurring effect etc. The image enhancement technique used to remove the hidden noise or information that is contained in images. The main function of the image enhancement is to remove the hidden part of an image and also enhance the contrast ratio of image [2]. The techniques used for image enhancement are Histogram Equalization and Flower Pollination Algorithm (FPA).

A histogram is a graphical representation of distribution of numerical data. It is an estimate of the probability distribution of continuous variable. Histogram equalization is a technique to plot the number of occurrences of gray levels in image against the gray level values is called histogram equalization. This method usually increase the contrast of image. There are two main criteria that are used to measure the visibility quality of image and preservation of edges. In addition to Flower Pollination algorithm (FPA) was developed by Xin She Yang in 2012. The flower pollination algorithm based on the pollination process of flowering plants. Flower pollination algorithm has been achieved by global and local pollination [1].

2. PROPOSED METHOD

The various methods are proposed to improve the contrast of MRI image. The proposed methods are Histogram Equalization (HE) and Flower Pollination Algorithm.

A. Histogram Equalization

The Histogram of an image is a sequence of number of events of gray levels in the MRI image against the gray level qualities. The histogram provides suitable outline of the intensities in an image, yet it can't give any information regarding spatial relationships between pixels. The definition of Histogram Equalization is as "Mapping of every pixel of input image into relating pixel of prepared output image is defined as Histogram". HE can be described as in equation (1):

$$P_n = \frac{\text{no.of pixels with intensity } n_k}{\text{total no.of pixel } n} \quad (1)$$

n= [0…L-1] is range of the gray level values of the MRI image.

B. Flower Pollination Algorithm

FPA was developed by Xin-She Yang in 2012. FPA based on the flower pollination process of flowering plants [1]. Flower pollination algorithm has been achieved by global and local pollination. FPA introduced four rules are defined as:

1. Biotic and cross-pollination is considered as global pollination process, and pollen carrying pollinators performing Levy flights (Rule 1).
2. Abiotic pollination and self-pollination are considered as local pollination process (Rule 2).
3. Flower constancy can be considered as the reproduction system is proportional to similarity of two flowers (Rule 3).
4. Local and global pollination is managed by a switch probability p[0,1] (Rule 4).

For instance, in the global pollination step, flower pollen are carried by pollinators, for example, insects, and pollen can travel over a long distance since insects can frequently fly and move in any longer range. The Rule 1 and flower constancy (Rule 3) can be performed using equation (2):

$$x_t^{t+1} = x_i^t + \gamma L(\lambda)(g_* - x_i^t) \quad (2)$$

3. PROPOSED ALGORITHM

Step 1. Read the input image (MRI images).

Step 2. Convert the input MRI image into Gray level MRI image.

Step 3. Apply the Histogram Equalization technique on the input image (MRI image) to enhance the contrast of the image.

Step 4. Apply the FPA technique rules.

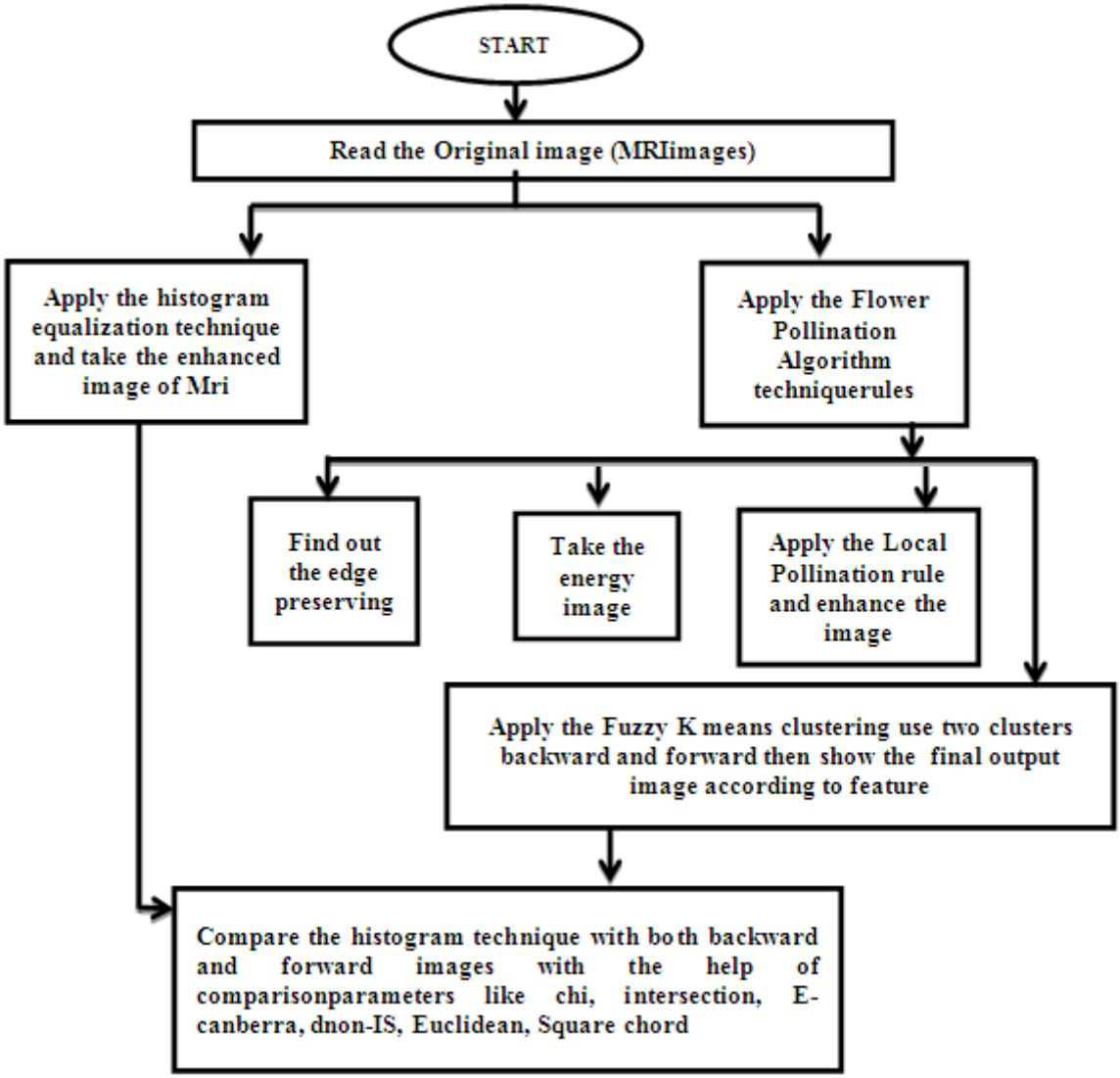
- Find out the edge preserving in which energy transfer in edges.
- Take the energy image.
- Apply Local Pollination rule and take the enhanced image of input image with the help of Local pollination rule.
- In which , Fuzzy k means clustering is used. It used two clusters Backward and forward. It will switch the image according to greater feature of the image and provide the final output.
- Apply Global Pollination rule and take the enhanced image of input image with the help of Global pollination rule. It shows the forward image.
- Compare both the Global and Local pollination and take the enhanced image. It shows the backward image.

Step 5. Compare

(a) histogram equalization and backward images
(b) Histogram Equalization and Forward image

with the help of comparison parameters like chi, Intersection, dnon-IS, Square chord, E-canberra, Euclidean.

4. PROPOSED FLOW CHART



5. RESULTS AND DISCUSSION

In this proposed MRI brain image enhancement using Flower Pollination algorithm and Histogram Equalization techniques resultant images are shown as following:

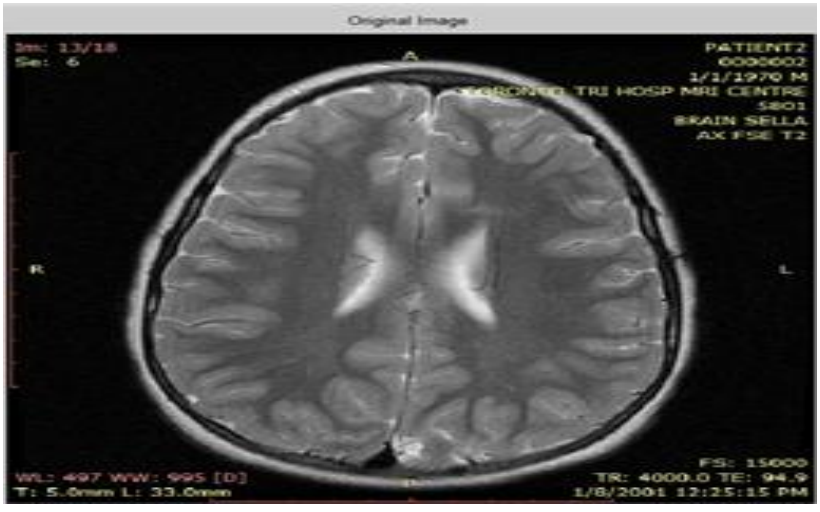


Fig1. Original image of MRI images

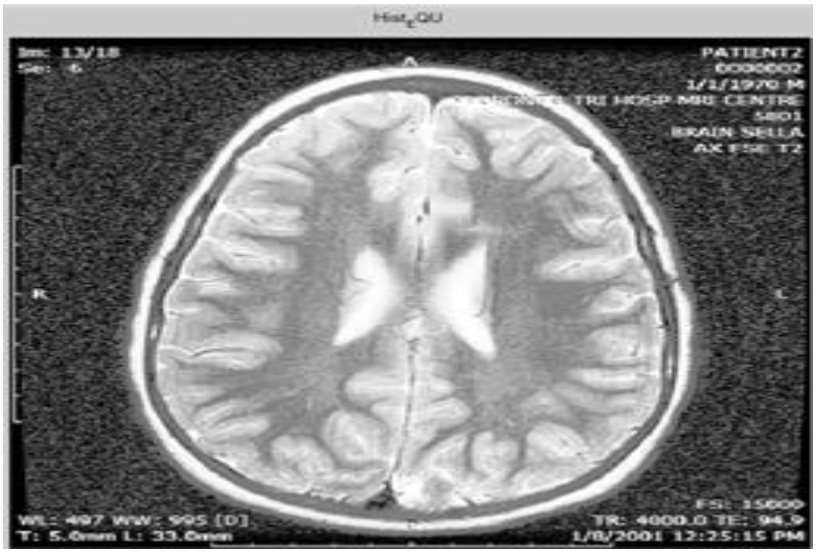


Fig2. Histogram Equalization image

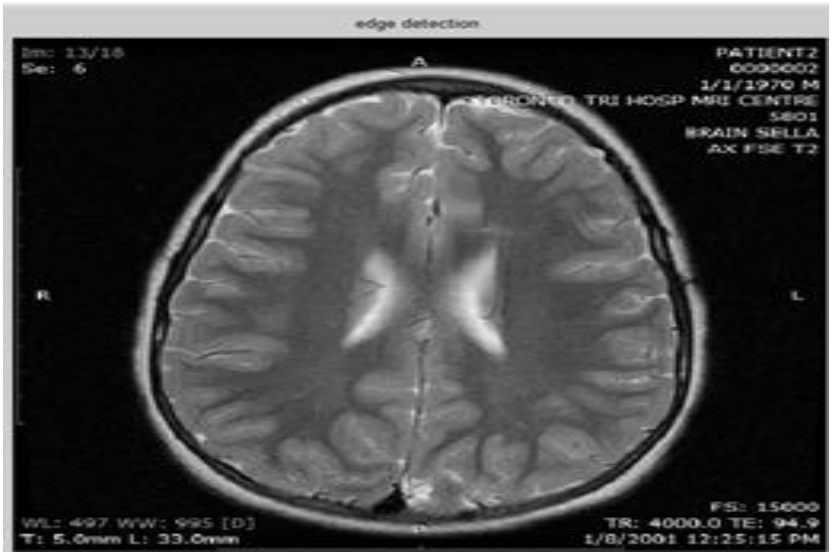


Fig3. Edge detection image

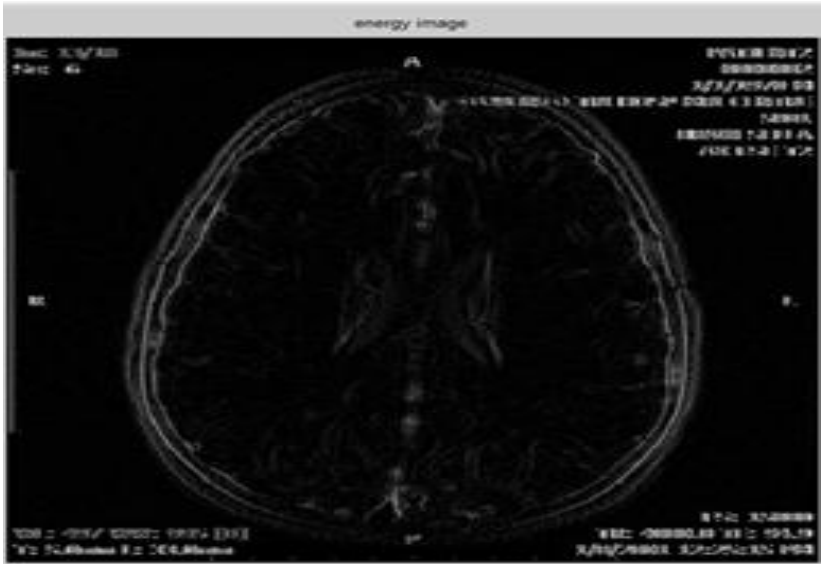


Fig. 4: Energy image

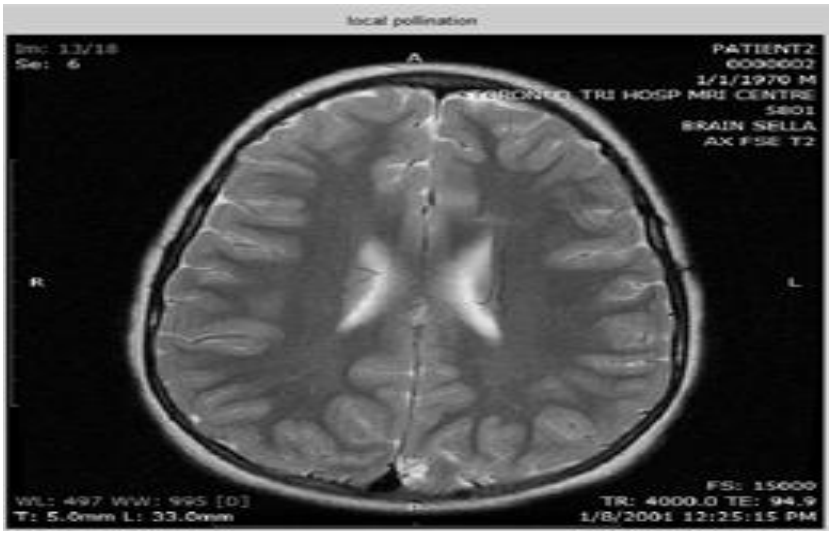


Fig5. Local Pollination image

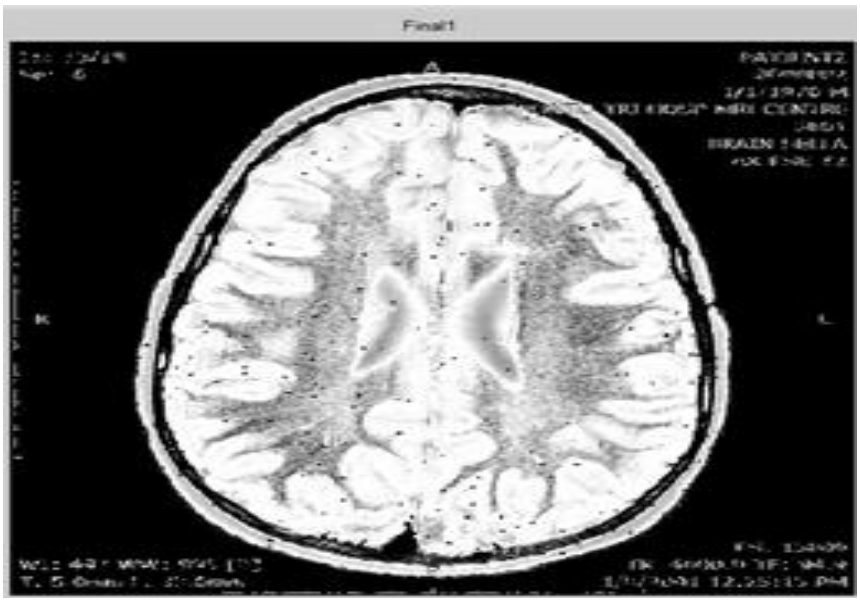


Fig. 6. Global pollination image (Forward Image)

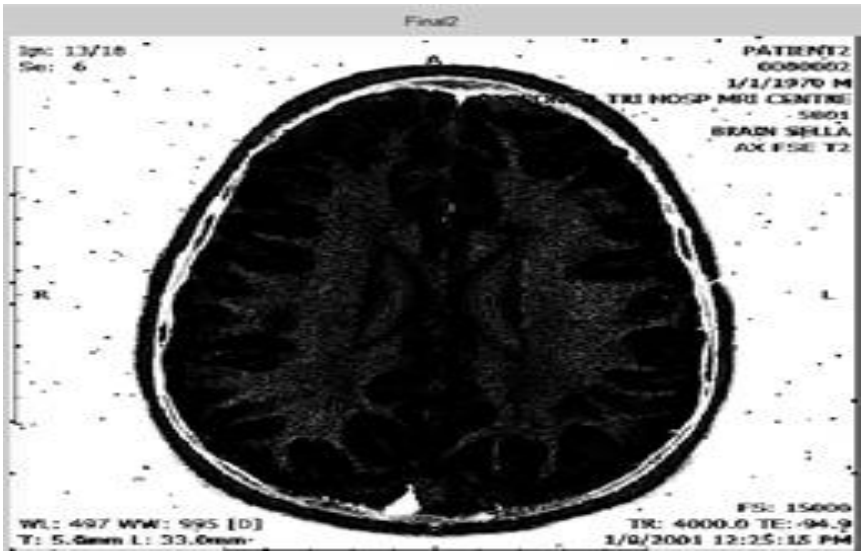


Fig7. Final 2 image (Comparison of Local and Global Pollination or backward image)

	Hist_Final1
Chi	2.5628e+04
InterSection	28120
dnon-IS	234024
Square-Chord	4.0679e+05
E-CanBerra	4.4294
Euclidean	1.1591e+05

Fig. 8. Comparison of Histogram equalization and Final 1 image

	Hist_Final2
Chi	1.6005e+04
InterSection	13019
dnon-IS	249125
Square-Chord	4.2094e+05
E-CanBerra	10.0074
Euclidean	9.1604e+04

Fig9. Comparison of Histogram equalization andFinal 2 image (Backward image)

CONCLUSION AND FUTURE SCOPE

The proposed system works on the Histogram Equalization and Flower Pollination Technique (FPA). Histogram equalization is simple and effective technique but accurately changes the brightness of image. The Flower Pollination Algorithm (FPA) is inspired by pollination process of flowering plants. In which, FPA perform Local and Global pollination. Histogram equalization compare with both Local and Global pollination techniques with the help of metrics parameters. Global Pollination of FPA technique is better than Histogram equalization.

In the proposed system, the techniques consume more time to enhance the contrast of MRI images. In future, overcome the time consumed through techniques or build a new technique to enhance the image and also overcome the time consumption.

REFERENCES

[1] Xin-She Yang, “Flower pollination algorithm for global optimization”, in: Unconventional Computation and Natural Computation 2012, Lecture Notes in Computer Science, Vol. 7445, pp. 240-249, 2012.
[2] Senthikumaran N, “Histogram equalization on image enhancement using MRI brain image”, IEEE World Congress on Computing andCommunication Technologies2014.
[3] E. Emary, Hossam M. Zawbaa, Aboul Ella Hassanien1 , Mohamed F. Tolba and Vaclav Snasel, “Retinal vessel segmentation based on flower pollination search algorithm”, 2011.
[4] Sinan Melih Nigdeli, Gebrail Bekdaş, Xin-She Yang, “Application of the Flower Pollination Algorithm in Structural Engineering”, Springer International Publishing, 2016.
[5] Szymon Łukasik, Piotr A. Kowalski, “Study of Flower Pollination Algorithm for Continuous Optimization”, Springer International Publishing Switzerland, 2014.
[6] Rajulath BanuA. K ,“Contrast enhancement of MRI image: a review ”, International journal of engineering technology and advancedengineering, vol. 5, issue 6, June 2015.
[7] Rajesh Garg, “Histogram Equalization techniques for image enhancement”, iject, vol. 2, March 2011.
[8] Pavlyukevich I., “Levy flights, non-local search and simulated annealing”, J. Computational Physics, 226, 1830-1844, 2007.

[9] N Senthilkumaran1 and J Thimmiaraja2, "A Study on Histogram Equalization for MRI Brain Image Enhancement" Association of Computer Electronics and Electrical Engineers, 2014.
[10] PraticVinayak Oak, "Contrast enhancement of MRI brain image using Histogram based technique", International journal of innovative researchin electronics, instrumentation and control engineering, vol. 1, June 2013.
[11] M.M. Fraz, P. Remagnino, A. Hoppe, B. Uyyanonvara, A.R. Rudnicka, C.G. Owen, S.A. Barman, "Blood vessel segmentation methodologies in retinal images A survey", computer methods and programs in biomedicine, vol. 108, pp. 407433, 2012.
[12] Samarjit Das, "Pattern Recognition using the Fuzzy c-means Technique" International Journal of Energy, Information and Communications vol. 4, Issue 1, February, 2013
[13] Nikhil R. Pal, Kuhu Pal, James M. Keller, and James C. Bezdek, "A Possibilistic Fuzzy c-Means Clustering Algorithm", IEEE Trans. on Fuzzy systems, vol. 13(4), pp. 517-530, 2005.
[14] Ravindrapalsingh, " Histogram equalization: A technique for image enhancement", international journal of signal processing, imageprocessing and pattern recognition.