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TO DESIGN AND IMPLEMENT IMPROVED FIREFLY BASED SHANNON THRESHOLD TECHNIQUE FOR IMAGE SEGMENTATION

Ezoo Sachdev*[1] & Vinay Chopra[2]

[*1]Research Scholar, Computer Science and Engineering, DAV Institute of Engineering and Technology, India

[2]Assistant Professor, Computer Science and Engineering, DAV Institute of Engineering and Technology, India

ABSTRACT

A novel image segmentation technique is proposed to enhance the quality of the image. The FAST technique is based on Shannon Entropy and Minimum Mean Brightness Error Bi-Histogram Equalization (MMBBHE) mechanism to enhance the image and along with this for the purpose of optimization; the Firefly optimization and State Transition optimization technique is applied. For performance analysis the FAST image segmentation technique is compared with the existing FA mechanism of image segmentation. On the basis of the simulated results the FAST is observed to be outstanding in contrast to the existing FA technique.

Keywords: *Image Segmentation, Shannon Entropy, Firefly optimization, State Transition Optimization.*

I. INTRODUCTION

In the research network image segmentation is an important area. So much work has been done in research under this area but still more advancement is needed in the mechanisms. In image segmentation some parts of the image are highlighted that are more significant and useful. The definition of segmentation is to divide something into parts or sections so it is used to segmented the image into number of sections that are known as pixels. For image segmentation so many paradigms are created.

The procedure of segmentation is to segmenting or dividing the digital image into a number of sections that are known as pixels. After segmentation the resultant image achieved is more instructive, unambiguous and meaningful which simply represents the data there in the pixel. The image segmentation process is used to detect the lines, boundaries and curves that are occurred in the image. The image segmentation provides the output of segmented section or the set of the shapes that are also taken from the image .Due to various properties (like color, texture or intensity) the pixels of the image are linked to each other. The image segmentation is applied in each and every field where the images play an important role for decision making. Some of the major applications of image segmentation are as follows:

- It is used in measuring the tissue and their volumes
- Diagnosis
- Studying of abnormal structure
- Tumors detection process
- Surgery done by using computer systems.
- Treatment plans
- Fingerprints recognition
- Detect objects in satellite images like mountains, tracks, trees, etc.
- Automatic traffic controlling systems
- Face recognition
- Machine vision

A large number of image segmentation techniques are available and each have some positive and negative points. This study developed a Shannon entropy MMB-BHE technique that is optimized with hybrid optimization technique i.e. firefly optimization and state transition algorithm. The major objective of the work is to protect the images from environmental conditions.

II. PROBLEM FORMULATION

Image segmentation can be done by using various techniques like clustering methods, DSHIE, compression based schemes and split and merge etc. These techniques were quite relevant but the preference was given to the entropy based thresholding techniques. After having a review to the traditional Shannon entropy based threshold methods, it is observed that existing technique have several downsides which needs to be filled for further enhancements. The gaps found in traditional technique are; Shannon entropy based technique used previously was quite efficient only when the quality of input images is high. But in case if the input images suffers from the environmental effects due to which the brightness of the image gets effected then in such cases the system have to faces the problem for locating the particular threshold in the effected images. Considering, an image pre-processing MMBE-BHE technique will be proposed so that environmental conditions does not affect the quality of the image and provides exact value of evaluated threshold. Another backlog was that in order to optimize the results only firefly optimization was applied to the system which was less efficient when used individually. Thus there is a requirement to develop such a system which can enhance the working of firefly by collaborating it with the prominent optimization mechanism and also has the ability to perform the image preprocessing operations. In order to fill this gap, firefly optimization is combined with the state transition optimization technique in order to optimize the results.

III. PROPOSED WORK

When an image is segmented into several parts and the parts ought to be meaningful, it is called as image segmentation

The conventional techniques had several drawbacks like it lowers the quality of image from visual perspective.

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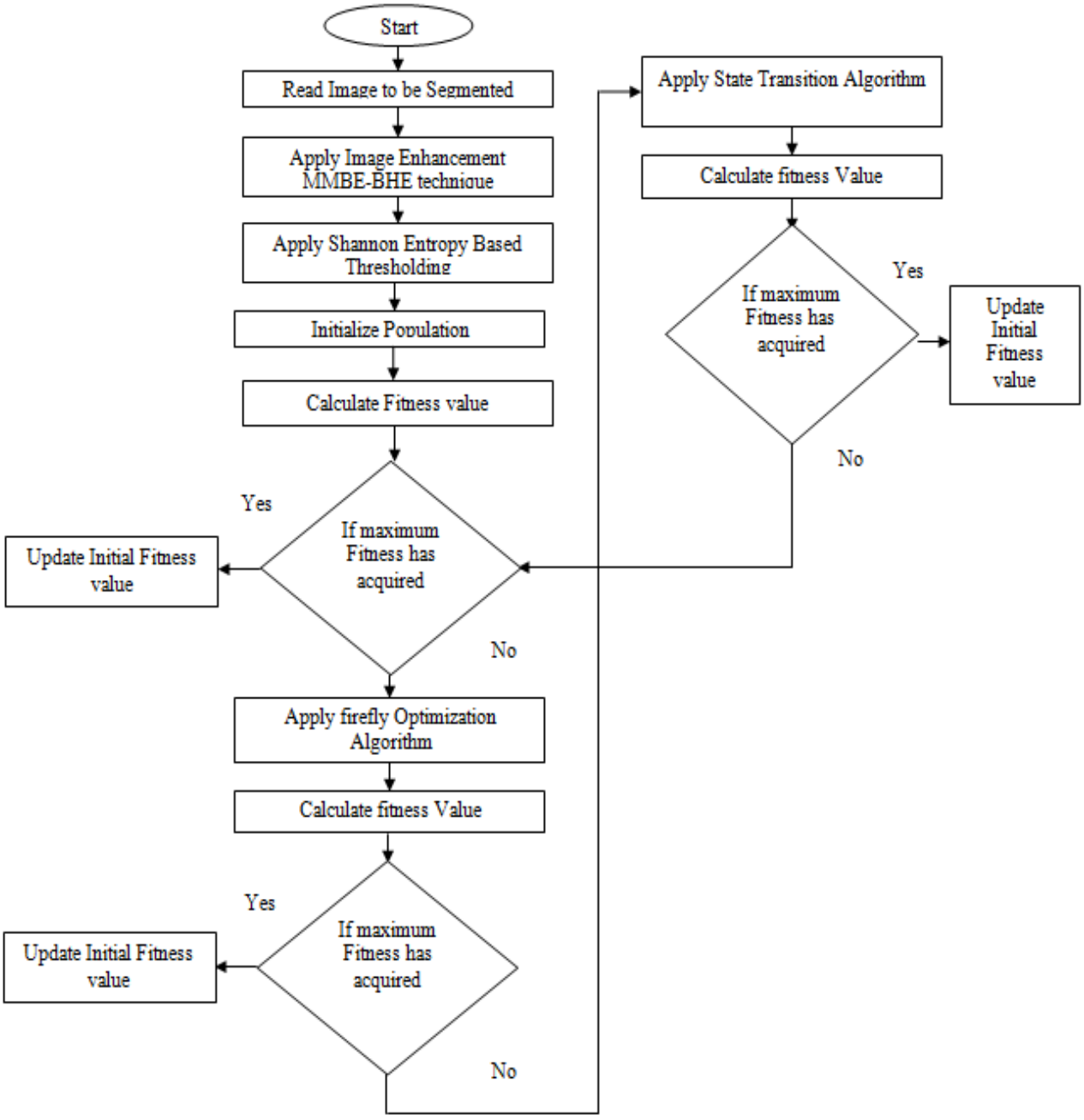

Figure 1 Framework of Proposed Work

It was not capable to recover the brightness of the image if it gets dull from environmental effects. Thus to overcome the issues of traditional work as listed above, the proposed work implements the Minimum Mean Brightness Error Bi-Histogram Equalization in order to enhance the quality of image by reducing the dullness of the image, along with this the Shannon entropy based thresholding technique is applied in this work. In order to resolve the issues related to the traditional firefly optimization algorithm, the state transition optimization mechanism is collaborated with it. The proposed segmentation mechanism is simulated on MATLAB in the terms of error and PSNR.

1. For the purpose of implementing image segmentation scheme, the first step is to input an digital image. The image can be of any format i.e. RGB, Grayscale and Black and White. This image is used for further processing.
2. Next step is to apply MMBBHE technique to input image. As MMBBHE technique works on grey scale image, thus before implementing it, the input image is converted to the gray scale image. The MMBBHE evaluates the absolute mean error at each grey level of the image.
3. Now apply Shannon Entropy to the image.
4. In this step the fitness value is evaluated on the basis of image that is generated by using Shannon entropy based thresholding technique.
5. In this step the evaluated fitness value is checked and if it is found to be greater then, the fitness value is updated and if it is found to be smaller than the firefly optimization is applied to update the fitness value.
6. In this step it is evaluated that if the maximum fitness value is achieved or not, if it is maximum then the initial fitness value is updated with new ones.
7. If the achieved fitness value is not the maximum one, then the State transition is applied to evaluate it further.
8. If state transition also fails to achieve the maximum one then the control will shifted towards the step 4. This process will continue until the maximum fitness is not achieved.

IV. RESULTS AND EXPERIMENTS

The proposed work implements the FAST mechanism for image segmentation. It implements the Firefly optimization along with state transition optimization algorithm.

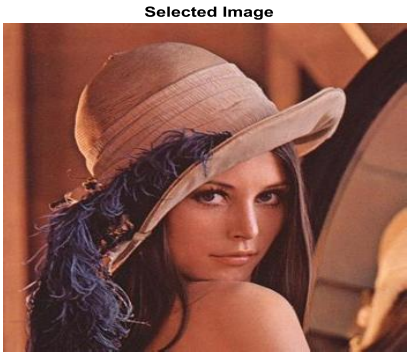

Figure 2 Sample of Input image

After electing the input image next step is to apply the further processing such as to read the image, to apply MMBBHE and Shannon entropy mechanism etc to it in order to enhance it. The figure 3 delineates the original image and enhanced image that is observed after applying the FAST image segmentation mechanism.

Figure 3 Original and Enhanced Images

After enhancing the image, the enhanced image is used for segmentation. The final segmented image is shown in figure 4.

Figure 4 FAST based segmented image

PSNR (Peak Signal to Noise Ratio) is a parameter used to evaluate the noise in the image or signal with respect to signal. It defines as a ratio between the maximum signal and the noise. Signal in the process is considered as an original data and noise is the error in the data. PSNR can be expressed as an equation in db:

$$\text{PSNR} = 10.\ log_{10}\left(\frac{MAX_1^2}{MSE}\right) \ldots\ldots\ldots (1)$$

$$= 20.log_{10}\left(\frac{MAX_1}{\sqrt{MSE}}\right) \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$= 20.log_{10}(MAX_1) - 10.\ log_{10}(MSE) \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

In the above equation, Max is the maximum possible value of the image and MSE is the sum over all squared value differences which is divided by the size of an image. The

graph in figure 5 shows the comparison of proposed and traditional work on the basis of the PSNR. The PSNR of proposed work is 9.26 and traditional work is 8.12.

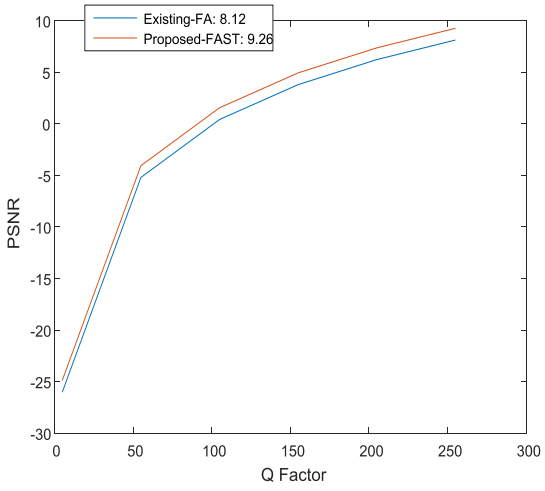

Figure 5 Comparison Analysis of PSNR

The graph in figure 6 shows the comparison analysis of traditional and proposed technique on the basis of the BER (Bit Error Rate). The BER is used to measure the bit wise errors in the signals. The BER should be low always. The bit error rate (BER) is the count of bit errors per unit time. The bit error ratio (also BER) is the number of bit errors divided by the total number of transferred bits throughout a deliberate time interval. Bit error ratio is a unit less presentation measure, often articulated as a percentage. The BER of proposed work is 0.10 and for traditional work it is 0.12. Thus the proposed work comprised of less number of errors in the signal in comparison to the traditional technique

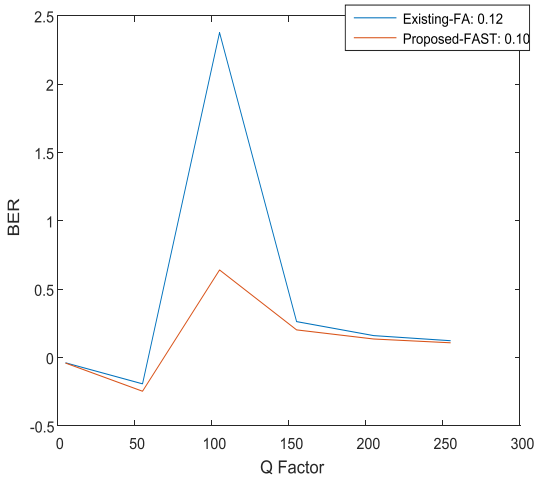

Figure 6 Comparison of BER

V. CONCLUSION

To sum up, a novel optimized image segmentation approach is developed in this work by utilizing the Minimum Mean Brightness Error Bi-Histogram Equalization, Shannon Entropy, Firefly Optimization and State Transition Optimization technique. The motive of this study is to improve the quality of the image by eliminating the dullness. The concept of ROI is also implemented to get more sharp edges for segmentation purpose. The results of the previous section delineate the excellence of FAST technique (proposed work) over Existing FA algorithm.

This work provides higher PSNR and Better Bit Error Results. In future the present work can be enhanced by applying recent advanced optimization techniques.

VI. ACKNOWLEDGEMENTS

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