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Feature extraction using Bat Algorithm for Brain Cancer

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Abstract: *The brain is a very essential part of the human body. The brain is composed of soft nervous tissue in the skull that helps vertebrates to perform various functions. Cancer is a complex and delicate disease that requires us to know if a person is infected or not quickly because not knowing leads to the death of a person. In this paper, the tumor will be extracted by extracting the strong characteristics of the brain after the process of extraction of the important area. This is done using a bat algorithm, which is one of the smart methods that give the optimal solution for each generation that has been generated. Thus, after extracting the strong characteristics of the tumor can be employed in any way to find out if the person is infected or not.*

Keywords*: Bat Algorithm, Gaussian filter, an Adaptive thresholding technique, Region of Interest.*

i. INTRODUCTION

Brain tumor or tumors occur within the skull when abnormal cells are formed within the brain. There are two basic types of tumors: serious or harmful tumors and large tumors. Malignant tumors can be separated into the underlying tumors that begin within the brain, and help tumors that spread from another place, known as thermal brain tumors. These deals mostly with tumors that begin within the mind. A wide range of brain tumors may offer indicators that fluctuate on the part of the brain. These can include brain pains, seizures, matter with vision, climbing, and mental changes. A migraine is traditionally more horrible in the morning and leaves with freezing. More specific problems may include a problem with walking, speaking, and feeling. As the disease progresses, clarity may occur [1]. The reason behind most brain tumors is mysterious. Risk numbers that may be included from time to time include many acquired cases referred to as fibroblastoma as well as an introduce to mechanical compound vinyl chloride, Epstein's disease, and ionizing radiation. While concern has been raised about the utilization of phones, the proof is vague. Most common types for primary tumors of adults have meningococcal tumors (generally generous), and astrocytomas, such as, glioblastomas. In children, the most widely recognized type is a serious thyroid tumor. Research is as a rule through a reconciliatory examination along with computed tomography or echo imaging. This is then often confirmed by biopsy. In the light of discoveries, tumors are divided into different assessments of seriousness [2].

Treatment may include some combination of surgery, radiation therapy, and chemotherapy. An anticonvulsant drug may be required if seizures occur. Dexamethasone and furosemide can be used to reduce the swelling that occurs around the tumor. Some tumors develop step by step, require only verification, and do not require any other transparency. Medications Treatments are being considered using these safe frames for men. The result varies greatly depending on the type and extent of the tumor in the analysis [3].

Often there are no bad results while meningococcal tumors often have great results. The average five-year survival rate for the malignant mind in the United States is 33%. Selective or metastatic brain tumors are more normal than primary brain tumors, with a portion of the tumors arising from lung disease. Major brain tumors occur in around 250,000 people

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annually at the international level, accounting for less than 2% of diseases. In more than 15 young people, brain tumors are second only to intensive lymphocytic leukemia as a cause of malignancy [4].

ii. LITERATURE REVIEW

In this paragraph, we will review the range of research that has been used bat algorithms shown below :-

- In [5],(2015), G. Jeba Roseline, E. Ben George, D. Gnana Rajesh et.al has been presented Brain Tumor Segmentation using Cuckoo Search Optimization for Magnetic Resonance Images" This paper was investigated in the CS calculation, by conducting a major investigation into its own investigational components to discover how well-versed in tumor identification and comparing results and other regularly used optimization algorithms.
- In [6],(2015), Kusum Gupta ,Yogita Gigras, Vandana, Kavita Choudhary et.al has been presented "A Comparison between Bat Algorithm and Cuckoo Search for Path Planning"In this paper, both the cuckoo search and the bat algorithm are linked to the proposed problem and seen in simulation results. The systems are associated with a number of populations, and the bat algorithm gives better results when compared to the cuckoo search.
- In [7],(2015), Dr. P.Subashini and S. Jansi et.al had presented "A Novel Fuzzy Clustering based Modified Firefly Algorithm with Chaotic Map for MRI Brain Tissue Segmentation" This paper talks to a randomly-based optimization algorithm, called strategies that use troubled factors rather than informal chaotic optimization algorithm. At this point, a set of anarchist Firefly algorithm is implemented alongside the Fuzzy C Means slicing to divide the MRI brain tissue to expand the global quest for diversity. This experiment comes to demonstrate that the proposed account gives better performance for symmetry. The Firefly algorithm uses Fuzzy C Means and Fuzzy C Means by using assessment measures, for example, Under Segmentation, Over Segmentation, and Incorrect Segmentation.
- In [8],(2014), Umakant Majhi, Rajeshwar Nalbalwar, Raj Patil, Prof. Sudhanshu Gonge et.a have been presented "Detection of Brain Tumor by using ANN" In this paper, a system for the detection and classification of brain tumors has been identified and established. This frame uses PC-based methods to identify tumor segments and characterize the type of tumor used for the artificial neural network in MRI images for different patients suffering from brain tumors. Image processing methods were produced, for example, evening histogram, image division, image enhancement, extraction feature for identification
- In [9],(2014), R.Preetha, G.R.Suresh et.al have been presented "Performance Analysis of Fuzzy C Means Algorithm in Automated Detection of Brain Tumor". In this paper, the proposed strategy is characterized by high arithmetic complexity and refers to the prevailing results in division and convergence. C implies ambiguous compilation with an extracted feature and an exceptionally encouraging arrangement in the field of brain tumor recognition.

iii. THE PROPOSED METHOD

The proposed method consists of four main stages namely: preprocessing image, segmentation, region of interest and feature extraction as shown in Figure (1).

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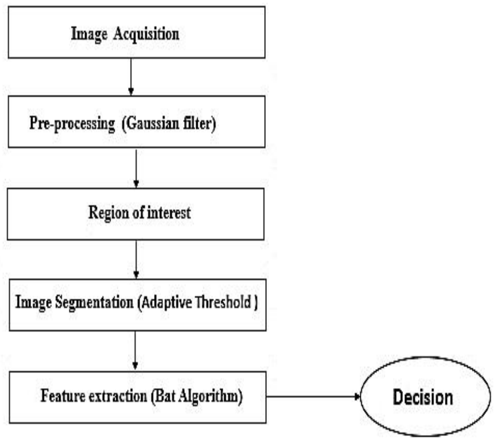

Fig.1: The main steps of the proposed technique

***A*. Acquisition of the image**

The image is always obtained where visibility systems begin to complete the selected task. Once obtained, there are many different processing methods that can be used to perform many tasks with respect to the image. The reason that acquisition images is always the first step in a workflow sequence is that if there is no image, the processing will be impossible. There are many ways to acquire images including but not limited to, using scanners and MRI. The image acquired needs to retain all the features.

***B*. Pre-processing**

Pre-processing the image has the purpose of improving it and giving the best results because, for some of the images, content noise or the pixels are unnecessary. In the proposed technique for image enhancement, the Gaussian method used the image for the purpose of displaying the details of the image well because sometimes the image contains noise. we apply a Gaussian filter which will blur the image and remove different noises from the image. after removing noise used region of interest by Extraction of the important region (the affected region).

***C*. Image Segmentation**

Image Segmentation divides up an image into distinct regions. Each region contains pixels with similar attributes. The regions must relate strongly to the depicted object or the feature of interest in order to be meaningful and useful for analysis and interpretation. After the processing of the image at a low level, creating relevant segments is beginning. The stage involves taking a greyscale or colored picture and transferring it into one or more new images and then to an image of high quality in regards to features, things, and scenes. Whether the analysis of the image will bring a successful outcome depends heavily on the reliability of segmentation. The main goal of segmentation wants a meaningful segment of the image and many objects to differ in appearance from others and change the representation of an image. In most cases, image segmentation is used to find where borders or objects are in a given image.

***a*. Adaptive thresholding technique**

The main idea of the adaptive threshold technique for each pixel is compared with the average of the surrounding pixel. In particular, an approximate moving average is calculated for another pixel that is viewed as the image passes. If the current pixel-ist value is below the average and is set to black, otherwise it is set to white. This method works because pixel comparison to the near-pixel medium preserves the fixed contrast lines and ignores the gradient changes. The advantage of this method is that it only takes one pass through the image. In addition, the moving average does not represent a good representation of ocean pixels at each step because live samples are not evenly distributed in all directions. By using the integrated image (and sacrificing additional iterations through one image), we offer a solution that does not suffer from these problems Our method is clean, clear, easy to code, and produces the same output independently of how the image is processed. Instead of calculating the average running of another pixel s, the average sex window is calculated for pixel-centric pixels. This is the best average for comparison because it looks at neighboring pixels from all sides. The average in linear time is calculated using an integrated image.

Algorithm Adaptive Threshold

1. We calculate the integrated image through the input image.
2. We calculate the average s x s using the integrated image per pixel at a fixed time and then make a comparison.
3. If the current pixel percent value is lower than this average then it is set to black, otherwise it is set to white.

D. Feature Extraction

During the feature extraction stage, the number of resources needed in order to describe a large set of data is reduced. When analyzing complex data, one of the major problems stems from the number of variables which are involved in the process. To analyze something with many variables usually requires a huge memory space and lots of computation power. It may also cause the algorithm to overlook better or more important samples and generalize the more poorly samples. Then, the algorithm transforms the readings into a feature pack. The process is known as feature extraction. If selective choosing is kept in mind while extracting features, the feature set will most likely take useful readings from the input data in order so that it can undergo its duties much faster with a reduced amount of data rather than the full input.

3.4.1 Bat Algorithm

If we improve some brain cancer images, we can develop bat algorithms or algorithms inspired by a bat. For simplicity, we now use the following approximate or typical rules:

a). All bats use echolocation for sensing distance, and they "know" the difference between food/prey and back barriers magically;

b). Bats fly randomly with velocity vi at position xi with a fixed frequency fmin, varying wavelength λ and loudness A0 to search for prey. They can automatically adjust the wavelength (or frequency) of their emitted pulses and adjust the rate of pulse emission $r \in [0,1]$, depending on the proximity of their target;

c). Although the loudness can vary in many ways, we assume that the loudness range varies from A 0 (positive) to a large constant value Amin.

Another obvious simplification is that no ray tracing is used in estimating the time delay and three-dimensional topography. Though this might be a good feature for the application in computational geometry, however, we will not use this as it is more computationally extensive in multidimensional cases. In addition to these simplified assumptions, we also use the following approximations, for simplicity. In general, the frequency f in a range [fmin,fmax] corresponds to a range of wavelengths [λmin,λmax].

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Algorithm Bat Algorithm

1. Initialize Bat population: Xi (i = 1, 2, ..., n)
2. Define frequency Fi and velocity Vi
3. Initialize pulse rates ri and the loudness Ai
4. while t< Maximum iterations do
5. update frequency and velocity
6. Calculate transfer function values using Eq. 2

fi = fmin + (fmax − fmin) β, (2)

7. Update Vi, Xi, and Fi using Eq.3 to 4

$v_i^t = v_i^{t-1} + (x_i^t - x_*) f_i$ (3)

$x_i^t = x_i^{t-1} + v_i^t$ (4)

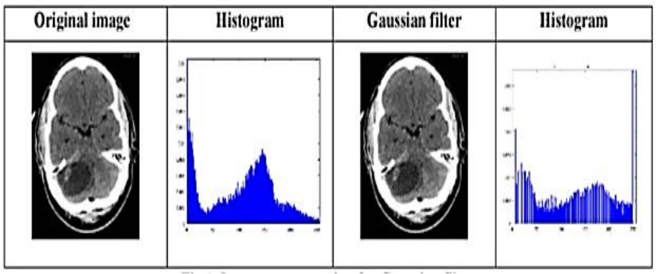
8. if (rand >ri) then
9. Select the global best solution (Gbest) among the available best solutio

the available Gbest dimensions modify the dimensions of Xi randomly.

10. end
11. Generate new solution randomly Eq (5)

$x_{new} = x_{old} + \in A^i$

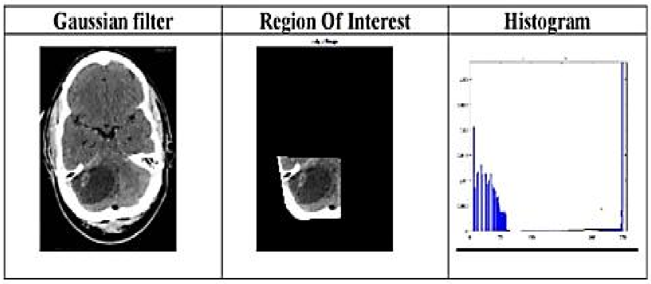
12. if ((rand <Ai) and (F (Xi)<F(Gbest)) then
13. Accept the new solutions Increase ri and reduce Aiusing
14. end
15. Find the current Gbest Bat algorithm



iv. EXPERIMENTAL RESULTS

1. pre-processing: The figure1 below illustrates the image preprocessing.

Fig.1. Image preprocessing for Gaussian filter



2. Region of Interest:- The figure2 below illustrates the process of the region of interest.

Fig2. Region Of Interest.

3. Segmentation image: The figure2 below illustrates the process of the segmentation using an algorithm adaptive threshold.

Fig3. Adaptive Threshold Segmentation.

4. Feature Extraction using bat algorithm: - The use of the proposed bat algorithm shown in figure 4, of the table as shown in Table 1 where the table includes the following specifications feature and matching where they show their efficiency.

Table 1. Best Solution for Bat Algorithm

Best Solution 1	-0.16385
Best Solution2	-0.91987
Best Solution3	1.38968
Best Solution4	-1.35780
Best Solution5	1.55699
Best Solution6	-0.27405
Best Solution7	-1.27819
Best Solution8	2.42628
Best Solution9	-0.11872
Best Solution10	-1.63393

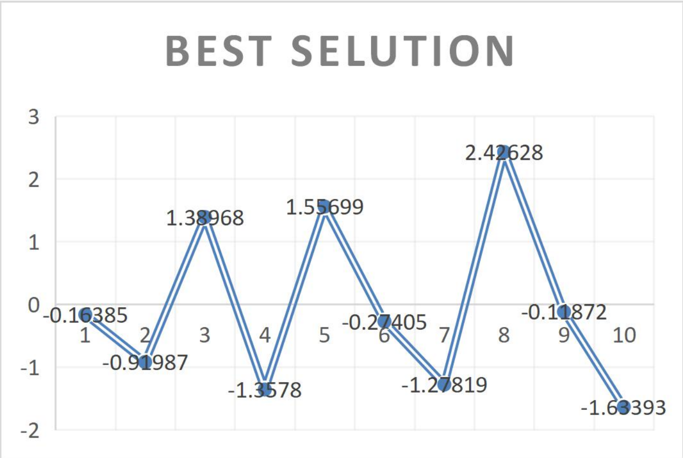
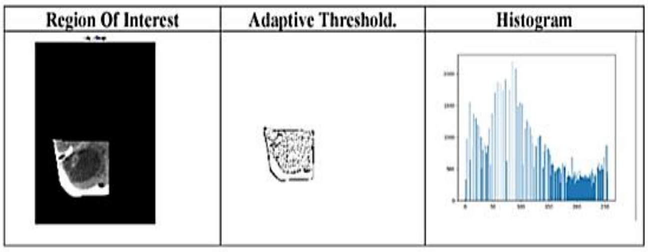


fig.4 best solution for bat algorithm

v. CONCLUSION

A BAT swarm -based optimization algorithm was developed and its application was studied to detect brain tumors and compare them with other existing techniques. Initially, CT-SCAN brain images were smoothed and improved by the Gaussian filter. In the CT-SCAN segmentation of the brain, the optimal weight is used to label the image pixel and calculate the values of its functions. The BAT optimization algorithm determines the optimal classification of images. The result shows that BAT performs a superior feature extraction of tumors from CT-SCAN.



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