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Edge Detection with Execution Time Using Different Optimization Techniques & Their Comparative Analysis

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Abstract: ***There are many techniques of image enhancement in the image processing such as Powell's method, Fast Ostu's method, Histogram equalization (HE) method, Particle swarm optimization (PSO) and Honey bee (HB). In this paper, a new method of image enhancement using HB is implemented by specifying intensity of the edges pixels and also comparative analysis was performed to earlier reported PSO, GA results. These algorithms were tested for different images. For Our case we are using both gernal images and Tumour. The obtained results indicate that the proposed HB give better results in the terms of both the maximization of number of the pixels in the edges, fitness value and in terms of Computational time is also relatively small in the HB as compared to the PSO case which is earlier reported.***

Keyword: swarm optimization, honey bee and image enhancement

1. Introduction

Image enhancement is the simplest and most appealing areas of digital image processing. It is basically improving the interpretability or perception of information in images for human viewers and providing `better' input for other automated image processing techniques. In the simple way say that the improvement of an image appearance by increasing dominance of some features and get the suitable image at the output. In image enhancement here many techniques are available for the enhancement of an image. Those techniques are histogram equalization (HE), genetic algorithm (GE), particle swarm optimization (PSO) [1], [4] honey bee (HB).

Swarm intelligence has become a research interest to many research scientists of related fields in recent years. Bonabeau has defined the swarm intelligence as "any attempt to design algorithms or distributed problem-solving devices inspired by the collective behaviour of social insect colonies and other animal societies" [1]. Bonabeau et al. focused their viewpoint on social insects alone such as termites, bees, wasps as well as other different ant species. However, the term swarm is used in a general manner to refer to any restrained collection of interacting agents or individuals. The classical example of a swarm is bees swarming around their hive; nevertheless the metaphor can easily be extended to other systems with a similar architecture. An ant colony can be thought of as a swarm whose individual agents are ants. Similarly a flock of birds is a swarm of birds. An immune system [2] is a swarm of cells and molecules as well as a crowd is a swarm of people [3]. Particle Swarm Optimization (PSO)

Algorithm models the social behaviour of bird flocking or fish schooling [4].

Many authors exposed the use of PSO to solve variety of problems in computer science and engineering [4, 5]. In this paper, author used HB based enhancement method on medical image for tumour detection. Further results obtained after applying HB method and earlier reported results using PSO were compared.

2. Study Areas

In this paper Brain is used as study area. Brain is a soft, spongy mass of a tissue. It is protected by, the bones of skull, three layers of tissues and watery fluid which flows within the brain.

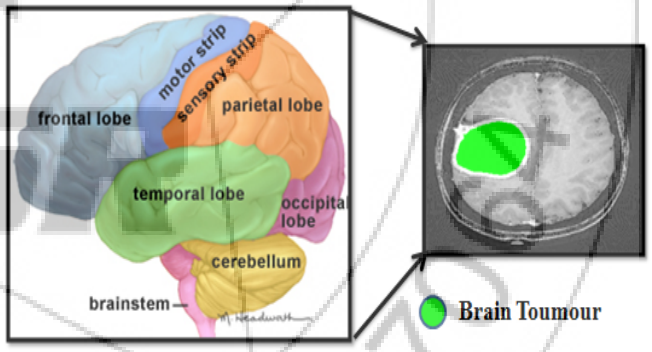

Figure 1: Study Area

Normally, cells grows old and or get damaged, finally they die. Sometimes, this doesn't happen as old cells don't die or normal cells are formed when body don't need them. This results in extra growth of cells which forms a tumor. Primary brain tumors can be benign or malignant. Benign tumor does not cause cancer. They can be cured easily as their cells can be destroyed easily. Malignant tumor can contain cancer cells. This type of tumor is more dangerous and life threatening. They grow really fast and get crowded very rapidly in the brain. People can get tumor at any age. There are many symptoms of brain tumor like headaches, nausea and vomiting, changes in speech and vision etc. Radiation therapy kills tumor cells with high energy x-rays, gamma rays, or protons. Other way to cure tumor is chemotherapy i.e. by use of drugs to kill cancer cells. Magnetic Resonance Imaging (MRI) techniques are still developing, and recent efforts have been directed primarily at improving image

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quality and speed of acquisition. MRI provides non-invasive, high quality images of neuro-anatomy and disease processes [13]. There are many sequences that can be used on MRI and the different sequences often provide different contrast between tissues so the most appropriate sequence should be chosen according to disease. Here simply using morphologic operation detect the tumour and show the coloured tumour at the output. In the detection of tumour image enhancement play important role. In this paper HB is implement of the medical image (Brain) for the TUMOR dection.

3. Proposed Enhancement Model

There are key steps when applying HB to optimization problems:

1. Place the hive of bees at the center of any place.
2. Here 1000 bees are initialized; all these bees spread from the hive for find the food.
3. When any bee is employed (knowledge of food), that employed bee came back to the hive by making the path from food place to hive with making white edges.
4. If "yes" then after coming back to the hive, the employed bees spread randomly and follow a new path which is unemployed.
5. If predefined value is less than the numbers of bees are returns to next then OK.
6. If "yes" then process is complete.
7. But if "NO" process is not done then this process is again start on the step 3.

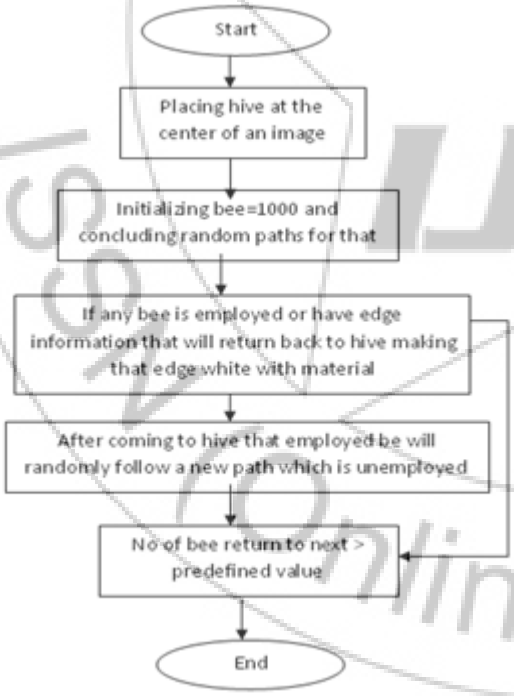

Figure 2: Flow chart of new enhanced model

4. Results and Discussion

The optimization problem considered in this paper is to solve the enhancement problem using HB. Our objective is to maximize the number of pixels in the edges, increase the overall intensity of the edges and to determine PSNR between new developed algorithm and earlier reported method. In order to evaluate the HB-based enhancement method, we have compared the proposed method with PSO-based enhancement method.

For each HB or PSO run we report three values:

- The performances of the algorithms by comparing the objective evaluation function in terms of PSNR values.
- The computational time per run of each algorithm.
- The efficiency in terms of the number of edges with gives as indication of the performance of proposed algorithm.
- The fitness value using honey bee (HB) is more when compared with the fitness value using PSO for the same number of generations.
- The computational time for PSO based enhancement was found 94.786 seconds whereas the time taken for HB based enhancement was found 11.52 seconds.(appox.)
- The computational time is less in case of HB when compared with that of PSO.
- The image that contains the highest number of edges pixels can be rated as having high detail contents as shown in Table 1 and table 2.
- One parameter here used peak signal and noise ratio (PSNR) , here after calculate the PSNR

Table 1: Comparative analysis for numbers of Edge Detect using different optimization techniques

Sr No	*Image*	*Original Image In Base paper*	*GA*	*PSO*	*HB*
A	CAMERAMAN	2485	2575	2674	6241
B	TIRE	1823	1917	2020	4038
C	TOUMOUR	Nil	Nil	545	3798

Table 2: Comparative analysis for Fitness Value using different optimization techniques

Sr No	*Image*	*GA*	*PSO*	*HB*
A	CAMERAMAN	102.988	128.821	187
B	TIRE	130.030	136.398	146
C	TOUMOUR	Nill	Nill	230

Table 3: Comparative analysis for Execution time using different optimization techniques

Sr No	*Image*	*PSO*	*HB*
A	CAMERAMAN	Nill	11.90 sec(approx)
B	TIRE	Nill	11.52 sec(approx.)
C	TOUMOUR	93.68 seconds	11.57 sec(approx.)

Note (*) Indicate that results were not provided in the base paper.

From Table 1, 2, and 3 is observed that the HB method yields better quality of solution. In this figure the brightness and contrast of enhanced image using PSO and HB appear visible. Also, it is clearly visible that brightness of enhanced image using HB is better than brightness of the enhanced image using PSO. Figure 3 show the detail of optimization techniques in images.

5. Conclusions

In this paper, a new optimization algorithm based on intelligent behaviour of honey bee swarm has been described. The new swarm algorithm is very simple and very flexible when compared to the existing swarm based algorithms. The

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objective of the algorithm was to maximize the total number of pixels in the edges thus being able to visualize more details in the images. The algorithm is tested on medical images for tumour detection. The results obtained are tabulated and compared with the results earlier reported using PSO. It is clear from the obtained results that the proposed HB based image enhancement is better than the PSO based image enhancement in terms of quality solution and computational efficiency. The proposed HB based image enhancement method may be extended in several ways, such as: fine tuning of the HB parameters in order to reduce the number of particles and reducing the maximum number of iterations.

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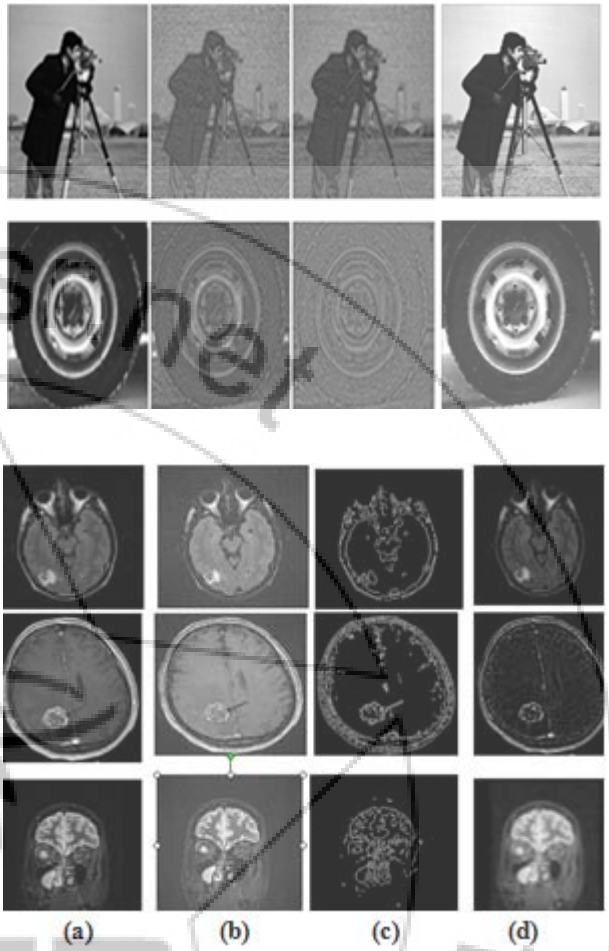

Figure 6: (a) Original image (b) GA Image (c) PSO Image (d) HB Image

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