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Hybrid Algorithm of BFO and ACO for Image Classification OfNatural Terrain Features

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***ABSTRACT:-*Bio-Inspired computing is the subset of Nature-Inspired computing. In this study, Bacterial Foraging optimization was hybridized with Ant Colony Optimization and a new technique Hybrid Bacterial Foraging Optimization to extract natural terrain features was proposed. The ideal solutions achieved by proposed Hybrid Bacterial Foraging Optimization algorithms are much better when compared with the solutions obtained by Bacterial Foraging Optimization algorithm for well-known test problems of unlike sizes. From the implementation of this research work, it could be pragmatic that the proposed Hybrid Bacterial Foraging Optimization was better than Bacterial Foraging Optimization algorithm in extraction of natural terrain features. Hybrid Bacterial Foraging Optimization is used to implement image classification using natural terrain feature extraction.**

***KEYWORDS:-*Ant Colony Optimization (ACO), Bacterial Foraging Optimization (BFO), Swarm Intelligence (SI), Natural terrain features, Hybrid Bacterial Foraging Optimization (HBFO).**

1. INTRODUCTION

Optimization implicates the task of finding the minimum andmaximum of functions, which makes it a mathematical order. Optimization coined in 1990's, while George Danzig usedMathematical techniques for producing programs for Military applications. This is a calculationproblem in which, the entity is to discover the optimum of all possible solutions [2]. In addition,find a solution in the achievable region which has the min or (max) value of the objective function.In this research paper, we will discover the most optimal solution for terrain feature extraction.The solution is proposed using the two techniques namely, Bacteria Foraging Optimization (BFO) and Ant Colony Optimization (ACO) which is a classification of a broad area under swarm intelligence. These techniques are used to investigatebehaviour of social insects. This combinational approach of Bacteria Foraging Optimization (BFO) and Ant Colony Optimization (ACO) describes independentmapping for external vehicles which includes terrain mapping [1], obstacle recognition and prevention, and goal seeking in cross-country using Swarm Intelligence. The proposed algorithm will be helpful in solving the problems related to extraction of terrain features.Nature-Inspired computing covers means to advance new computing technique which is built on nature's behaviour in solving complex problems.

2. CONCEPTUAL DEFINITION

2.0.1 Satellite Image

Digital data acquired from sensor accepted in satellite. It comprises of gathering data both in the visible and non-visible rations of the electromagnetic spectrum. Satellite images produced through remote sensing can be examined to yield a map-like layer of digital information. Comprises resting features over a digital terrain model to deliver information on features that lie on the terrain. There terrain model delivers the form of the terrain. Covered features may then contain a satellite image of the terrain to show land-use, and vector data to demonstrate features such as roads.

2.0.2 Ant Colony Optimization

Ant Colony Optimization algorithm was first suggested by M. Dorigo, in 1992. ACO Algorithm is a probabilistic technique to resolve computational problems that can be minimized to findbest paths through graphs. Dorigo summaries the foraging behaviour of ants [1].Stigmergymentions the indirect communication between a self-organizing evolvingsystemsthrough individuals adapting their local environment. Ants discover their food by realizing the optimum path between nest and a source of food. In this meta-heuristic technique, ants depend on indirect communication by laying a pheromone trail from their nest to food sources.ACO is a course of algorithms demonstrated on the behaviour of an 'ant colony'. ACO has been evolved from the foraging behaviour of ants. Social insects (ants) are usually categorised by their autonomous organisation behaviour with minimum communication or the absence of it.[10]They can gain information about environment and co-operate with the remote insects or environment indirectly, by stigmergy. An ant colony is capable to find the shortest path amongst the nest and a food source using simple local decisions. Ants use a signalling communication system based on the statement of pheromone over the path it follows, marking a trail. All these features are categorised as Swarm Intelligence.

2.0.3 Bacterial Foraging Optimization

Kevin M. Passino introduces an optimization algorithm as BFOin 2000 for distributed optimization problems [4]. Bacterial Foraging Optimization (BFO) algorithm is a new evolutionary calculation algorithm proposed based on the foraging behavior of Escherichia coli (E. coli) bacteria existing in human intestine [7]. The BFO algorithm is a naturally inspired computing technique which is established on imitating the foraging behavior of E. coli bacteria. Natural assortmentinclines to eliminate animals with poor foraging policies and favours the movement of genes of those animals that have successful foraging policies, since they are more expected to relish reproductive success [2]. After sundry generations, poor foraging approaches are either detached or moulded into good ones. This motion of foraging is used in optimization process.

Framework for BFO algorithm

- Thebacterial foraging factors and independent variable are provided as an input, then postulate lower and upper limits of the variables and start the elimination-dispersal steps, reproduction and chemotactic.
- Produce the positions of the independent variable arbitrarily for a populace of bacteria. Calculate the impartial value of each bacterium.
- Alter the place of the variables for all the bacteria using the tumbling or swimming process.Implement reproduction and elimination process.
- If the maximum number of chemotactic, reproduction and elimination-dispersal steps is achieved, then yield the variable equivalent to the overall pre-eminent bacterium.Else, repeat the process by changing the position of the variables for all the bacteria using the tumbling /swimming process.

In this study, BFO algorithm was hybridized with ACO and a novel Hybrid BacterialForaging Optimization (HBFO) algorithm was proposed.

3.PROPOSED STUDY

3.0.1 Flowchart

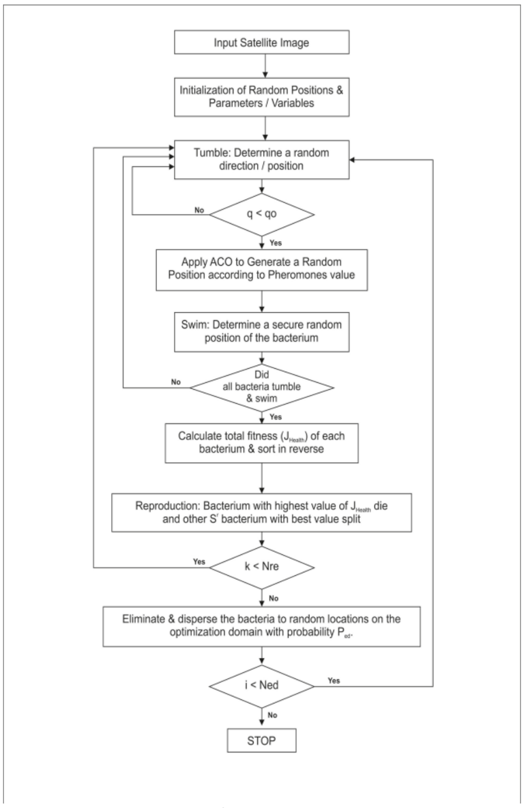

Figure 1: Flowchart of Hybrid BFO-ACO Techniques

3.0.2 Proposed Algorithm

Step 1: Input the satellite image.
Step 2: Initializing positions and parameters with some random values.
*Step 3:*Tumble Process: Determine a random position of the bacterium.
Step 4: Apply ACO technique to generate a random position according to pheromone value.
Step 5: Swim Process: Determining a secure random position of the bacterium.
*Step 6:*Calculate Total fitness of each bacteria and sort in reverse, if all bacteria tumble and swim. Else go to step 3.
Step 7: Reproduction Process: Bacterium with highest value of fitness value die and other bacterium with best value. Else go to step 3
Step 8: Elimination – dispersal Process: Eliminate and disperse the bacteria to random locations on the optimization domain with highest probability. Else go to step 3.

3. CONCLUSION

It was clearly evident from this experiment that proposed Hybrid BFO algorithm is optimal as compared with BFO algorithm. The proposed HBFO algorithm can also be used for higher examples of size.The capability of the projected Hybrid BFO algorithm was examined through the enactment of numerous runs on eminent test problems of different sizes. The results obtained by the proposed HBFO for extraction of terrain features are optimum and highly analogous to the results attained by BFO and ACO algorithms.

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