Artificial Bee Colony Algorithm in Software Testing

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***Abstract*— This paper represents an artificial bee colony algorithm, which can be basically used for automatic test data generation. The SDLC Model starts from the Requirement Gathering phrase and ends till Maintenance phrase. In between comes, the Testing phrase. In the literature, it is found that testing is a continuous process. The software needs to test (either manually or automatically) to debarred and demolish the de-bugs completely. The Artificial Bee Colony works on the technique of integrating the smart and intelligent bees. These bees try to help each other in finding appropriate and prominent nodes in the software code. The proposed algorithm can compete with all other existing strategies or algorithm(s) in terms of generating optimal test case.**

***Index Terms*— ABC Algorithm, testing, test cases generation.**

I. INTRODUCTION

Like other NIC-based algorithm, the ABC algorithm is also biologically inspired technique. It comes under the umbrella of Swarm Intelligence, used for searching mechanism. It has been acquired and inspired from the behavior of bees. The maximum time of the bees are utilized in searching and extracting the honey. Such nature-based methodology has been incorporated in the proposed algorithm.

In this algorithm, the bees are basically categorized into three categories – Search bee, Selector bee and Scout bee. These three kinds of bees can also be termed as –

- Search Agent, i.e., Search Bee
- Selector Agent, i.e., Selector Bee
- Replace Agent, i.e., Scout Bee

Further, it can be elaborated with a suitable arrow diagram with respect to Software Testing –

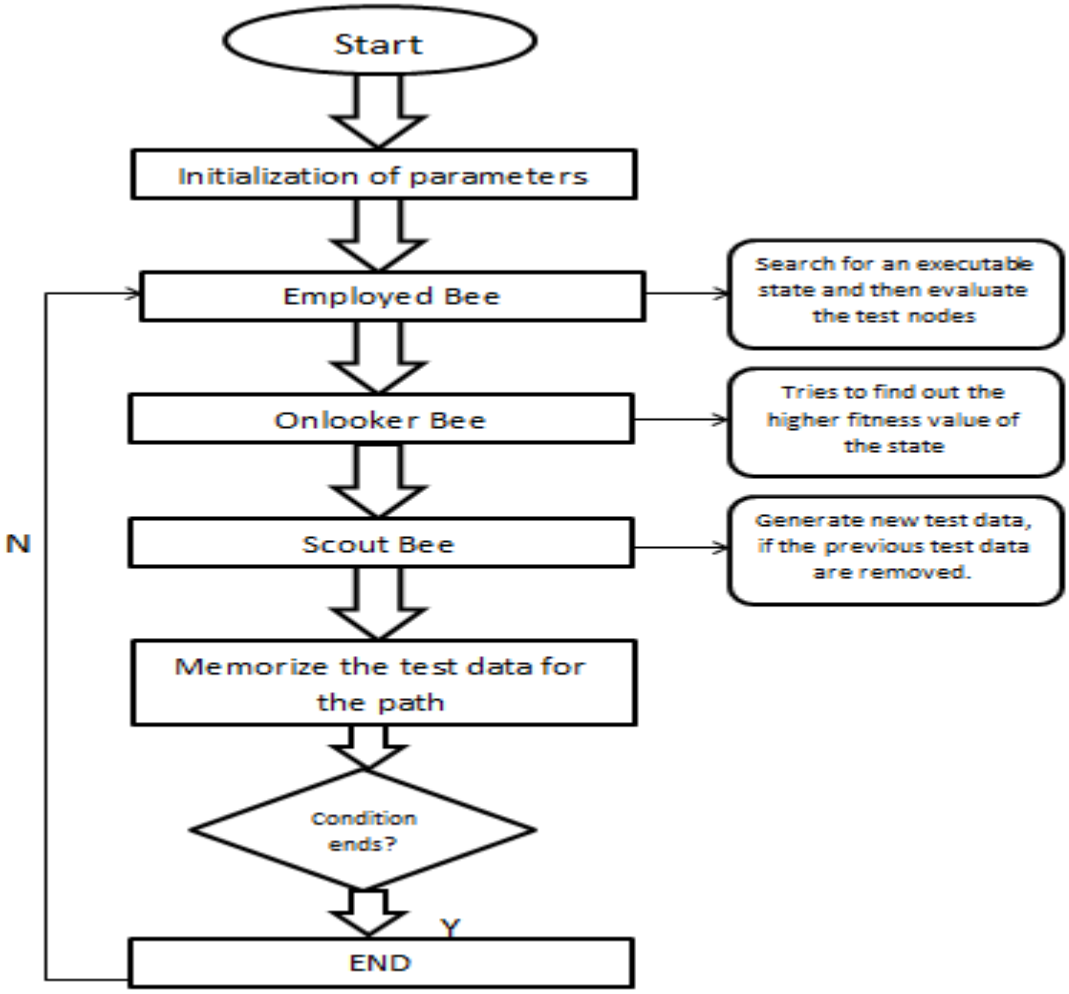

Figure 1 – Arrow Diagram of ABC Algorithm

With respect to the above diagram, the search bees generally initialize the test cases with the test data [1]. This can be assist with the help of boundary value analysis and equivalence partitioning [2]. This bee searches for the implementation state of the SUT (System Under Test). In each test node, search bee computes the fitness value. Search bee pass on the fittest value to the nearest nodes to the selector bee. The selector bee then compares the fittest value of the nearest node's value. It continues until it finds out the highest fitness value. Then the node with the highest fittest value, which is finally stored and saves successfully in the optimal test case repository [1]. The scout bee generates the new test data, if the previous test data are declined. Such algorithm can be utilized for optimizing the test cases.

To understand the in-depth working of the Artificial Bee Colony (ABC) Algorithm, different phases are listed below with a diagram–

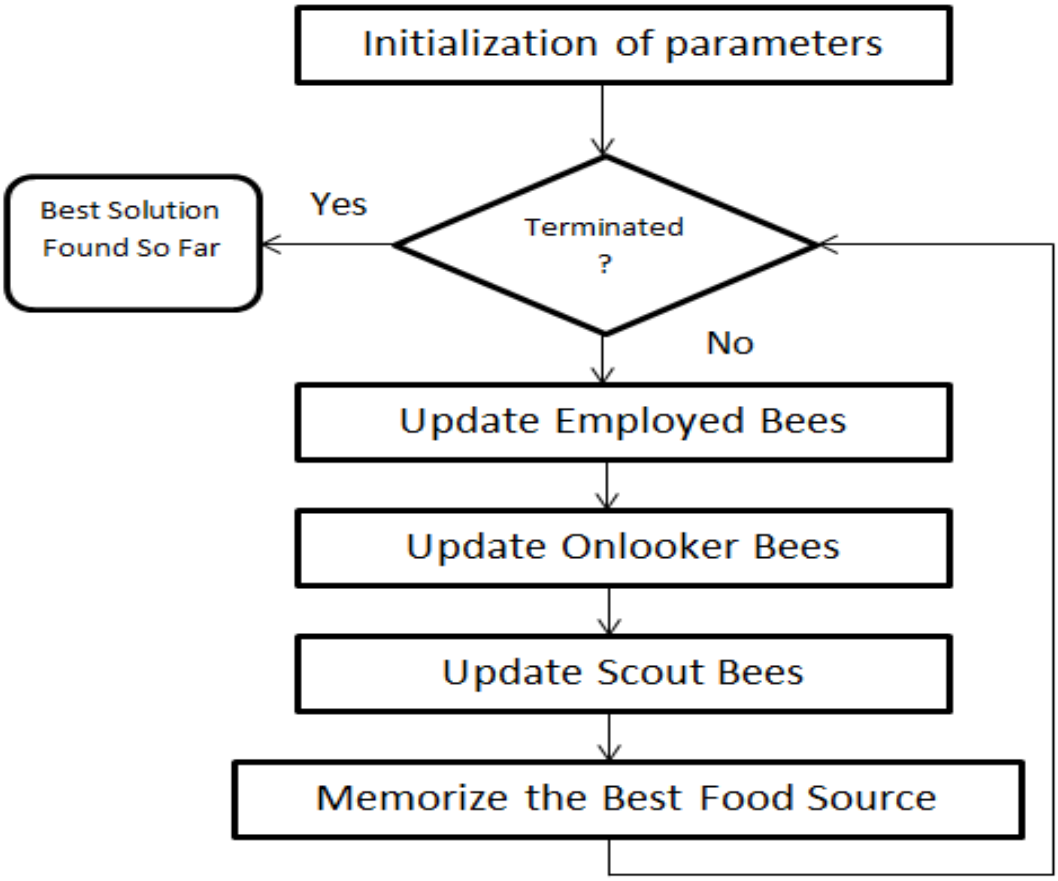

Figure 2 – Different phases of ABC Algorithm

It can be applied in different computing fields. It can be elaborated with a pictorial diagram –

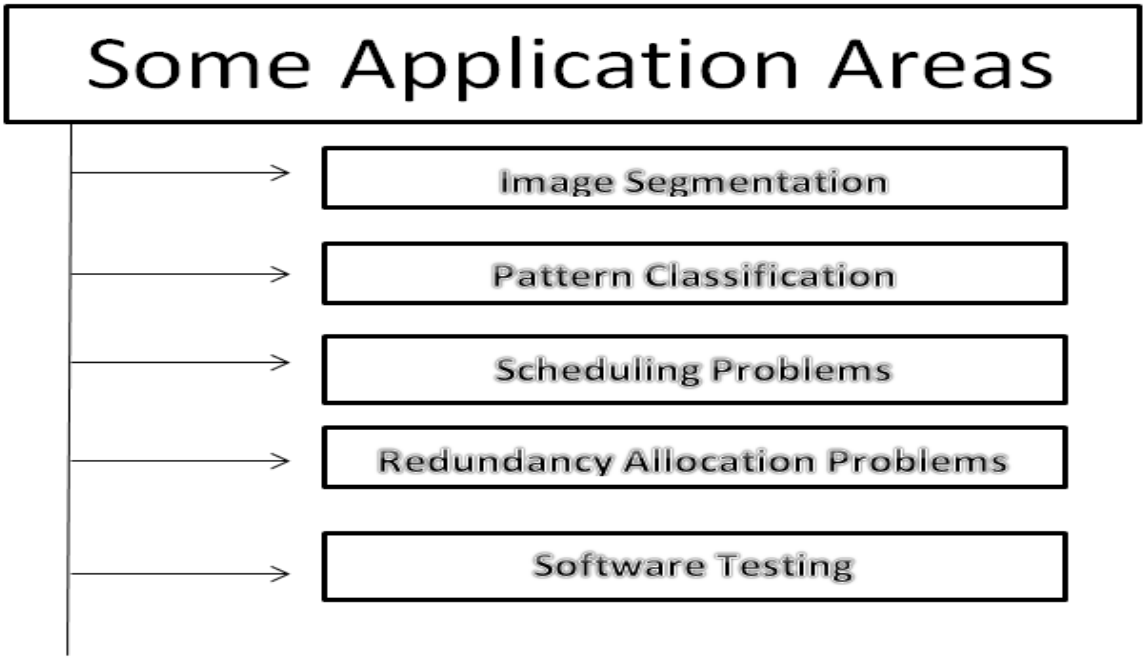

Figure 3 – Application areas of ABC Algorithm

In the literature, it is found that compare to other biologically-inspired algorithms, ABC algorithm can compute properly in terms of generating optimize test data.

II. LITERATURE SURVEY

Kulkarni NJ et. al. in [1] discussed about artificial bee colony algorithm. It can be used for software test case optimization technique [1]. Since it is evolved upon the behavior of bees, such mechanism can be applied for finding optimal test cases.

Dahiya SS et. al. in [3] generates test cases with the assist of branch distance based objective function [3]. The proposed algorithm examined in ten (10) different real world programs like triangle classifier, line-rectangle classifier, binary search, bubble sort and many more.

Garg D et. al. in [4] discussed about how scalable the proposed algorithm is, in finding out the minimal test data generation. Here, the artificial bees helps each other to figure out the nodes (with highest fittest value) in the software code.

Huang L et. al. in [5] focused on software fault localization automatically using ABC algorithm. It is used to predict the best food source and largest fitness value [5]. This can be accomplished by summarizing average fitness of the employed bees [5].

Zhang P et. al. in [6] proposed a new algorithm termed Global Artificial Bee Colony algorithm. It is based upon crossover. It enhances global optimization ability and upgrades the convergence rate [6].

Ali MS et. al. in [7] tries to incorporate artificial bee colony (ABC) with t-way testing test suit. With the usage of t-way testing mechanism, the best possible test case can be generated.

Alazzawi AK et. al. in [8] optimization algorithms (OA) is utilized with t-way test suite generation strategy. It gradually suggested a new strategy called Artificial Bee Colony Strategy (ABCS). Several experimental results conclude that it provides good solutions against the existing strategies.

Gharehchopogh FS et. al. in [9] estimated the software cost by utilizing a hybrid model of GA (Genetic Algorithm) and ABC (Artificial Bee Colony). Software Cost Estimation (SCE) is the import aspects in the cycle of developing the software [9]. The author tries to use COCOMO model for such tasks in the development phase of the software.

Crawford B et. al. in [10] discussed about the set covering problem. This problem is the part of theory of computational complexity [10]. Such complex set covering problem can be re-solved for better solutions by using Artificial Bee Colony Algorithm.

III. Conclusion –

In this paper, artificial bee colony algorithm has been studied in-depth. The flowchart and different phases of this algorithm has been incorporated in this paper. On the basis of intelligent behavior bees, such algorithm has been introduced by Karaboga in 2005. Optimal test cases for test data generation can be manipulated automatically by using the advanced and adequate ABC algorithm.

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