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A mapping study on test case selection based on nature-inspired algorithms

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ABSTRACT

After delivery of software product for modification, in order to correct faults or for improving the performance or other attributes, we calculate software maintenance. For this there is need for regression testing, regression testing is used to check that no upcoming errors have been found throughout the maintenance phase. The abundant number of test suites consist of some repetitions/redundancies as the same fault/error may be covered by many test cases. Hence, it is recommended /advisable to decrease/reduce the test suite. Test case selection is one of the techniques used for reducing the number of test cases by selecting only those test cases from test suite which can detect all those faults which were detected by the whole test. This paper calculates the execution/performance of two Meta heuristic algorithm – Cuckoo search and Bat algorithm for selecting test cases. Performance evaluation deciding factors are no. of faults detected and execution time. Results are achieved by conducting experiments on a large scale.

Keywords: *Software Testing, Regression Testing, Bat Algorithm, Cuckoo Search Algorithm, Software Maintenance*

1. INTRODUCTION

Enhancement is required in each domain of life. A large portion of genuine enhancement issues is multi-objective. Relapse experiment determination is one such multi-target enhancement issue that has pulled in the analysts since most recent three decades due to the following reasons:

a) Executing all the Test cases will require an unsuitable measure of time though there will be the weight of conveyance courses of events.
b) Many Team Members should be adjusted for testing which is again impractical.
c) Both the above will prompt a critical measure of time each time the Regression Testing is finished.

More current metagraphy calculations roused by nature are developing and they turn out to be progressively famous. For instance, particles swarm optimization (PSO) was roused by fish and winged creature swarm insight, while the Firefly Algorithm was motivated by the glimmering example of tropical fireflies [2], [3], [6], [19], [20]. These nature-motivated metagraphy calculations have been utilized as, part of an extensive variety of improvement issues, including NP-difficult issues, for example, the voyaging salesperson issue [2], [3], [6]. The energy of all advanced metagraphy originates from the way that they copy the best element in nature, particularly organic frameworks developed from regular choice more than millions of years. Two vital qualities are a determination of the fittest and adjustment to nature. Numerically, these can be converted into two pivotal qualities of the cutting edge metagraphy: increase and expansion [3]. Heightening plans to look around the present best arrangements and select the best competitors or arrangements, while enhancement ensures the calculation can investigate the inquiry space effectively. This paper intends to plan another calculation, called Cuckoo Search (CS), in light of the intriguing rearing behavior for example, brood parasitism of specific types of cuckoos. We will initially present the rearing behavior of cuckoos, what's more, the attributes of L'evy flights of a few fowls and natural product flies, and afterward figure the new CS, trailed by its usage. At long last, we will

think about the proposed look procedure with other prominent advancement calculations, what's more, talk about our discoveries and their suggestions for different advancement issues.

A. BAT ALGORITHM

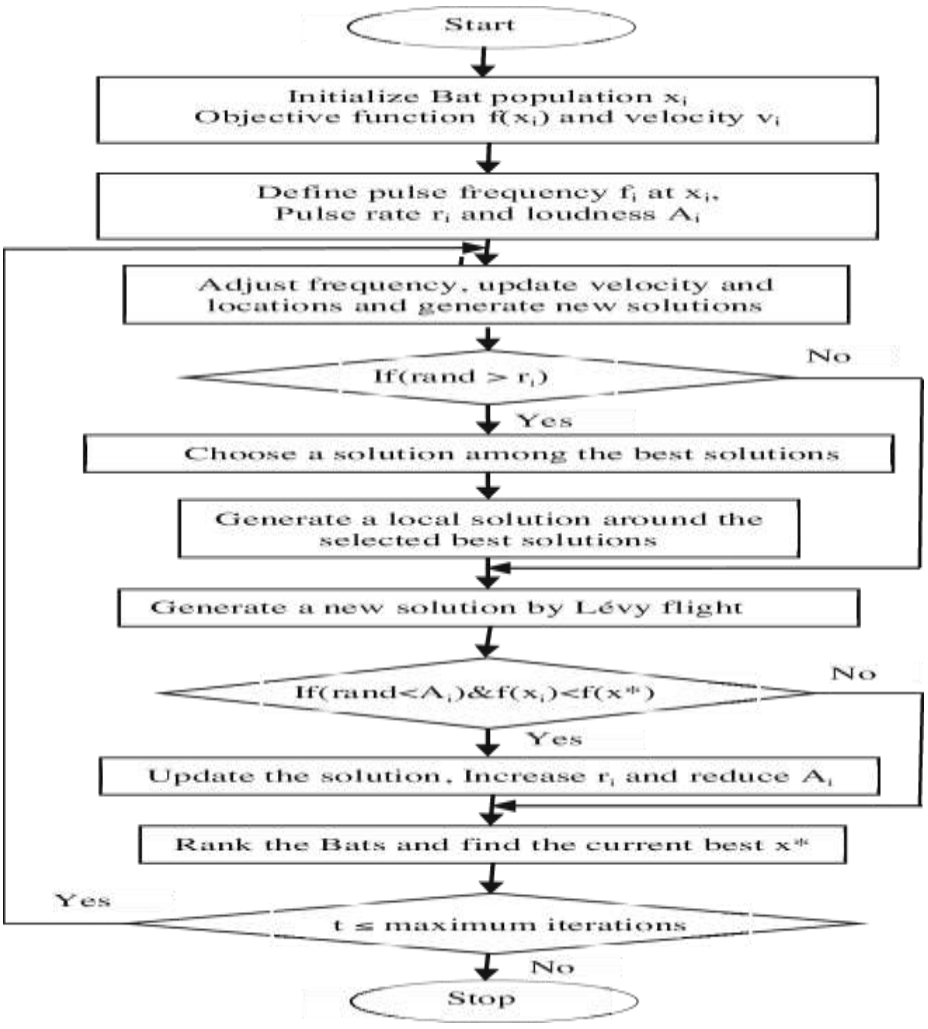
Bat Algorithm consolidates the great highlights of other nature propelled metaheuristics like Harmony Search, Firefly Algorithm and Simulated Annealing [21]. Bat Metaheuristic Algorithm depends on the echolocation property of miniaturized scale bats. This property controls the searching conduct of small-scale bats and causes them to discover their prey and enables them to recognize distinctive kinds of bugs regardless of whether it is excessively dull [22].

(i) ECHOLOCATION PROPERTY OF BATS

Most of the micro bats eat creepy crawlies [21]. They influence utilization of the echolocation to speak with each other, to perceive kind of bugs, assess the separation to the prey, and to stay away from snags oblivious [22]. Bats tune in for the reverberate bobbed again from the encompassing objects of the boisterous sound heartbeats produced by them [21]. These heartbeats differ in recurrence and enable them to choose their chasing procedure [21]. These are short heartbeats. The din is high while scanning for the prey and declines as they home towards the prey [21]. Micro bats construct a three-dimensional situation of their encompassing by utilizing the time distinction between the emanation of the beat and getting off the reverberate. With this, they can estimate the separation, introduction, type and furthermore the moving pace of their objective creepy crawly. For effortlessness, following suppositions have been made:

1. Echolocation property is utilized by every one of the bats to compute separation to the prey and can separate between nourishment/prey and the foundation snags.
2. Bats fly in arbitrary ways to scan for their prey with starting speed, position, recurrence, and wavelength and heartbeat commotion. Wavelength or recurrence and heartbeat outflow rate r are consequently balanced by the vicinity of the objective.
3. The loudness of produced beats fluctuates from an expansive positive esteem A_0 to a base esteem A_{min}.

(ii) Flow chart 1:



B. CUCKOO SEARCH ALGORITHM

Cuckoo Search algorithm additionally has a place with the Nature roused advancement metaheuristic. It was presented by Young and Deb in 2009 and has ended up being exceptionally encouraging for explaining numerous hard real-world optimization issues [23]. Forceful generation procedure is the primary fascination of the cuckoos. They trust in parasitic reproducing. It is a sort of parasitism in which a cuckoo lays its eggs in the home of host species. Some cuckoo species lay their eggs in other fledgling's homes and may expel the have fledgling's eggs to expand the incubating likelihood of their own eggs [23]. Some host flying creatures don't care for interlopers and struggle with them. For this situation either the host winged creature will toss their eggs out or may essentially relinquish its home and fabricate another home at some other place.

(i) DESCRIPTION OF THE ALGORITHM

Each egg corresponds to a potential solution in cuckoo search innovation. Natural systems are complex and simplification of natural systems is required to successfully implement them by computer innovations. We make the following assumptions to simplify the cuckoo search innovation:

1. Each cuckoo lays only one egg at a time and can leave this egg in a randomly chosen nest.

2. In order to maintain the elitist property, the best nest with the highest quality of eggs (solutions) will make it to the next generations.

(ii) Flow chart 2:

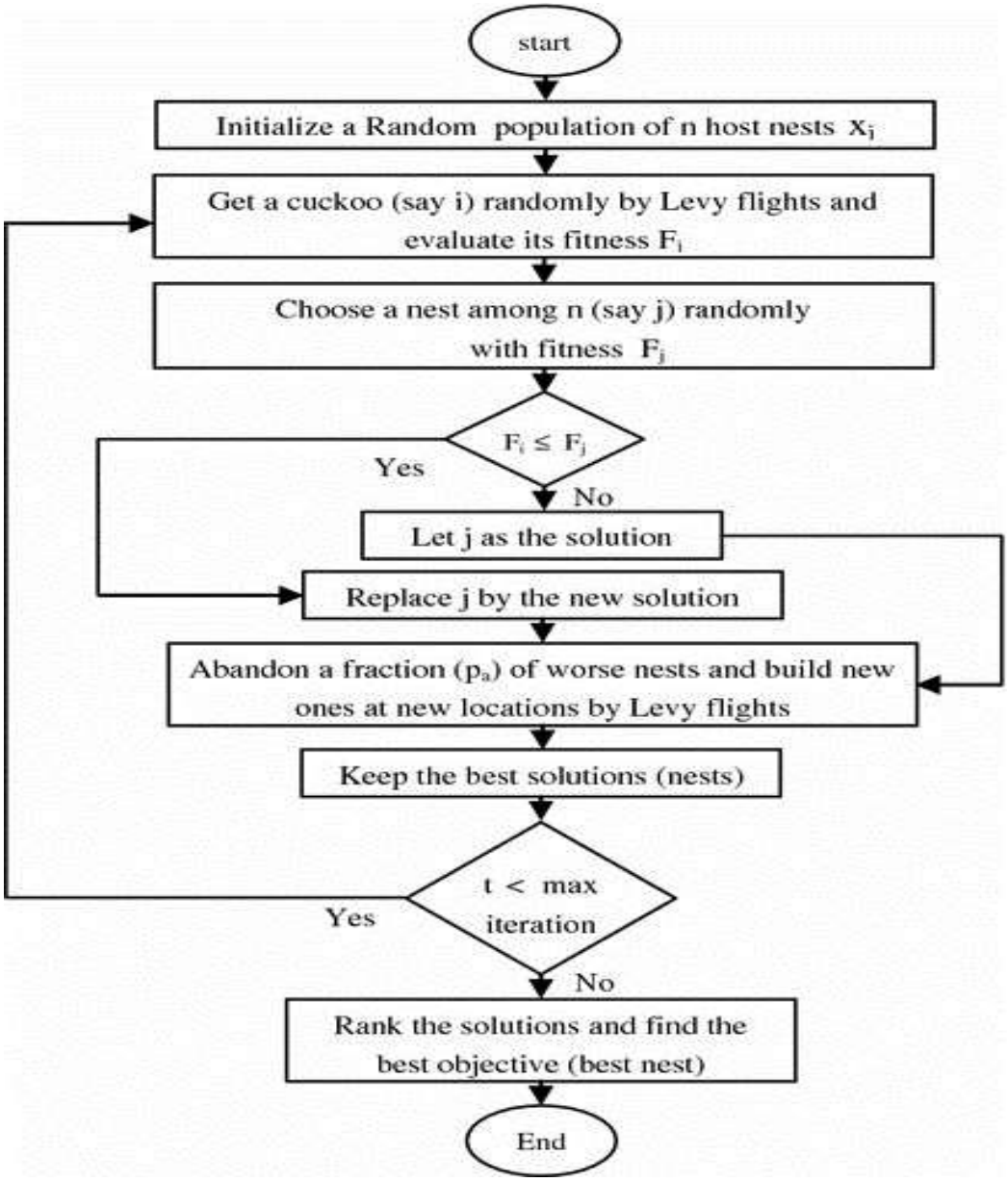


Table 1: Quick Review

Author	Year	Technique used	Objective	Limitations	Title
Biswas et al	2012	Test case prioritization technique	To execute the modified lines of code with a minimum number of test cases	Version specific prioritization is performed after a set of changes have been made and may be less effective on subsequent releases	Test case prioritization algorithm based upon modified code coverage regression testing
De Souza et al	2013	Particle Swarm Optimization (PSO) algorithm	Formulation of the TC selection problem as a constrained search-based optimization task, using requirements coverage as the fitness function to be maximized, the execution effort (time) of the selected TCs as a constraint in the search process.	The current research provides a framework for future developments that are intended to progressively improve the quality of the selection process	Search based constrained test case selection using execution effort
Feng et al	2014	Improved hybrid encoding cuckoo search algorithm (ICS) with greedy strategy	Updating new position which is designed and genetic mutation with a small probability is introduced	(a)It is required to take a long time to get a satisfactory solution. (b)Sometimes the time increases exponentially with the increment of the size of the instance.	An Improved Hybrid Encoding Cuckoo Search Algorithm for 0-1 Knapsack Problems
Feng et al	2014(a)	Hybrid cuckoo search algorithm(CS) with improved shuffled frog-leaping algorithm (ISFLA)	To improve the convergence speed and enhance the exploitation ability, a novel CS model is proposed with considering the specific advantages of Levy flights and frog-leap operator	The superiority of CS and ISFLA over GA, DE, and CS in solving six types of Knapsack Problem instances are quite difficult.	An Effective Hybrid Cuckoo Search Algorithm with Improved Shuffled Frog Leaping Algorithm for 0-1 Knapsack Problems
Srivastava et al	2014	Meta-heuristic bat algorithm	To estimate the test effort and the proposed model is then used to optimize the effort by iteratively improving the solutions	Need more tests for comparisons	An empirical study of test effort estimation based on bat algorithm
Yang et al	2014	Cuckoo search algorithm	To analyze the algorithm and gain insight into its search mechanisms and find out why it is efficient.	All applications of Cuckoo search are not explained in this.	Cuckoo search: recent advances and applications.
Guo et al	2014	A promising Thermo-dynamical Selection Based Discrete Differential	To exhibit better search performance than many other evolutionary algorithms in terms of convergence speed and	The traditional Differential Evolution (DE) cannot directly handle the combinatorial optimization problems.	A Thermo dynamical Selection-Based Discrete Differential Evolution for the

		Evolution (TDDE) using an enhanced selection scheme (MFES) minimal free energy scheme	solution accuracy in many practical applications.		0-1 Knapsack Problem
Wang et al	2014	The Stud Selection and Crossover(SSC) operator has been introduced into the Krill Herd(KH) approach called Stud Krill Herd (SKH)	The SSC operator, containing selection and crossover operation is applied to choose a good candidate solution in place of a not-so-good solution in order to enhance its reliability and accurateness dealing with optimization problems	Function optimization, there are a variety of problems that still deserve further scrutiny, and many more robust optimization approaches should be developed aiming to the specific problem	Stud krill herd algorithm
Reddy et al	2015	Bat Algorithm	To propose a technique that is easy to implement and capable of finding feasible near global optimal solution with less computational effort.	The proposed algorithm had been successfully applied to ELD with valve-point loading effect and included a few constraints, the practical ELD problems should consider multiple fuels as well as spinning reserve, power flow constraint and ramp up & down rate constraints and also for hydrothermal scheduling problems	Application of BAT Algorithm for Optimal Power Dispatch
Huang et al	2016	Improved Krill Herd(KH)	To test the proposed algorithm on the ten test function and get better performance when compared with the basic KH algorithm, PSO, DE and GA algorithm.	There should be an improvement of the KH algorithm and the application for the other complex optimization problems	An Effective Krill Herd Algorithm for Numerical Optimization
Wang et al	2017	Cuckoo search algorithm	The parameters of CS and propose an adaptive cuckoo search algorithm to enhance the convergence rate and accuracy of the CS.	The parameters of CS are fixed constants which may result in affecting the algorithm efficiency.	Adaptive Cuckoo Search Algorithm for the Speed Control System of Induction Motor
Kaur et al	2017	Meta heuristic algorithms- Bat Algorithm and Cuckoo Search Algorithm	To investigate the performance of both algorithms using fault convergence time parameters.	To perform the same experiments on a large number of programs in order to verify whether the obtained results are equivalent to those presented here.	A Comparative Study of Bat and Cuckoo Search Algorithm for Regression Test Case Selection

2. CONCLUSION

The principle commitment of this paper was to research the execution of Bat and Cuckoo Search calculations to choose test cases from test suites considering both the no. of faults detected and execution time. Bat calculation was an unpredicted exploration in our experimental study. The two algorithm are not bounded for these two cases only rather they can be adapted for other cases too. Subsequently we presume that cuckoo search calculation performs superior to bat calculation as far as number of faults secured metric however as indicated by calculation running time, bat calculation performs superior to anything cuckoo seek calculation. So there is a tradeoff between the number of faults and execution time.

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