Nature-Inspired Algorithms: Critical Study

Shilpa Kukreja, Surjeet Dalal

Department of CSE, SRM University, Sonipat

Abstract: **Nature-Inspired Algorithms are becoming very popular to solve the complex optimization problems computationally.Nature algorithms simulates some natural phenomenon that provides higher efficiency, reliability, effectiveness and robustness to the given problem. Nature-Inspired Algorithms are the set of bio-Inspired and Swarm Optimization Algorithms which has novel problem-solving methodology to provide good performance. My contributiuon in this paper is to provide newly arrived algorithms in nature-inspired recent development.**

Keywords: **Nature-Inspired Algorithms, Optimization, Artificila Intelligence**

I. INTRODUCTION

An algorithm is a well-defined procedure that takes a set of values as input and produces the set of values as an output. Thus, an algorithm is the sequence of steps that transforms input data into some meaningful information which is the output[1]. An algorithm describes the actual steps and procedures for achieving the input/output relationship. An algorithm is said to be **correct** if it gives the correct output for every input instance and it can be **incorrect** if it produces the incorrect output for the given set of inputs.

Optimization of Algorithm: An optimization algorithm is an iterative procedure which is executed to compare various solutions till the satisfactory solution is found.

II.   NATURE-INSPIRED ALGORITHMS

Nature- Inspired algorithms are more powerful and are able to find the solution of the computational optimization problems numerically. There are some natural entities like insects, plants, territorial animals, birds, flowers, etc. having some characteristics to solve the optimization problems. These characteristics motivate the user to apply them in the field of science, engineering, management. Nature-inspired algorithms (NIA) ease the task of mathematical modeling of any complex problem by following the rules and characteristics.
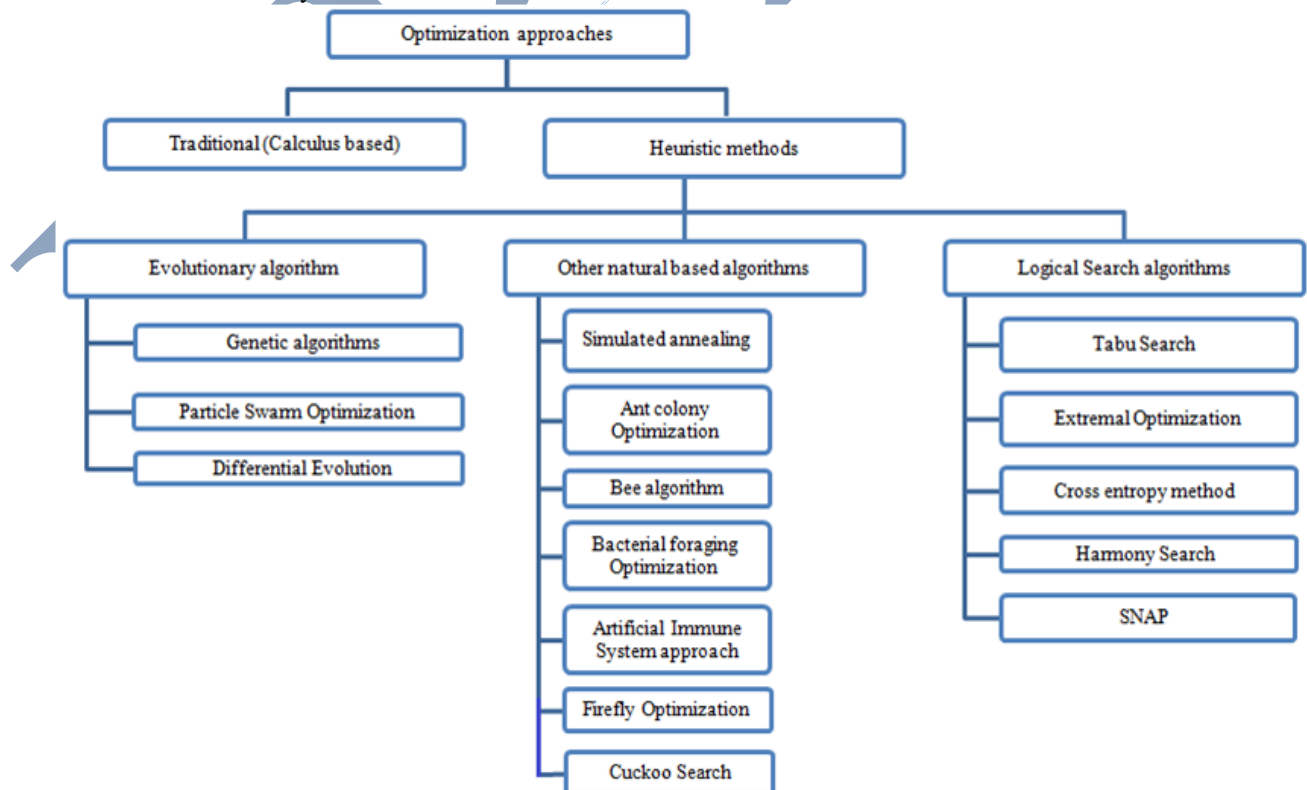

Fig: Classification of Nature-Inspired Algorithms[10]

Source of Inspiration: The main source of inspiration is nature itself. The two broad categories of NIA have made a positive impact of majority of using nature-inspired approach into their field. NIA is classified as

- Bio-Inspired Algorithms
- Swarm Intelligence Algorithms

In fact swarm intelligence belongs to a wider class of bio-inspired algorithm that forms the majority of nature-inspired algorithms. Swarm intelligence is a subset of bio-inspired algorithms and bio-inspired ias a subset of nature-inspired algorithms.

III. SOME NATURE-INSPIRED ALGORITHMS

Cuttlefish Algorithm: A new meta-heuristic bio-inspired algorithm was developed by Adel Sabry Easa [2] that was based on the color changing mechanism of the fish to solve the optimization problems. Due to the reflection and visibility cuttlefish produces a large array of colors. The major steps of cuttlefish algorithm are:

Algorithm:

Step 1: Randomly initialize the population of random solutions and find out the best feasible solution and average value of the best solution points.

Step 2: perform global search to generate a new solution on the basis of reflection and visibility.

Step 3: perform local search to produce the set of new solutions depending on the reflection of light and visibility of matching patterns.

Steps 4: again perform global search to find the optimal solution randomly using the reflection of incoming light.

Cuckoo Optimization Algorithm

Cuckoo search is one of the famous nature-inspired algorithm developed by Sumandeep Aujla [3]. Cuckoos are the beautiful birds and the cuckoo search algorithm is based on the brood parasitic behavior of the species with the levy flight behavior. Cuckoo lay their eggs in their nest, which are chosen by the levy flights. The best nest with the high quality eggs (solutions) will be followed to generate next. The basic cuckoo search algorithm is given below:

Algorithm:

Step 1: Initialize the population of host nest.

Step 2: get a cuckoo and generate a new solution by levy flights.

Step 3: perform new nest having a high quality of eggs.

Step 4: replace the new solution by the chosen nest.

Step 5: keep the best solution and rank them and find the current best.

Group Search Optimizer

Group search optimizer is a population based optimization algorithm designed for optimum searching strategies and inspired by the animal foraging behavior [4]. In Group search optimizer, population is called group and individual in the population is called a member. A group has three kinds of members:

Producers: producers search for the food and has strong producing strategy.

Scroungers:keep those resources into account which are left by the others.

Rangers: random walks are employed by the rangers and get dispersed from the current location means not fixed at the same location.

Here in this algorithm, after a large number of iterations, if the producer does not find the best solution, it will return back to zero.

Firefly Algorithm

Firefly algorithm was developed on the basis of their flashing characteristics and the behavior of the fireflies [5]. Firefly algorithm is swarm-based heuristic algorithm and constitutes a population-based iterative procedure to solve an optimization problem concurrently. Three basic rules of the algorithm are:

- All the fireflies are unisex and are attracted towards the brightness regardless of the sex.
- The less brighter firefly moves to the more brighter firefly. If the firefly does not find more attractive or brighter firefly than itself than it starts moving randomly.
- The brightness of the firefly is determined by the objective function of the given problem.

Krill-herd Optimization Algorithm

A novel biological approach proposed by Amir Hossein Gandomi [6] for the optimization of tasks. The algorithm is based on the simulating herding of the krill swarms. The herding of the krills is a multi-objective process that includes two main goals: increasing krill density and reaching the food. Steps of the algorithm are:

Algorithm:

Step 1: Define upper and lower bound and parameters to determine the working of the algorithm.

Step 2: Initialize the population in search space.

Step 3: Implement Crossover, mutation and selection operations.

Step 4: update the position of krill herd in the search space.

IV. CONCLUSION

We have discussed newly proposed nature-inspired algorithms in this paper. The algorithms are efficient, desirable, effective and reliable and robust to solve the complex optimization tasks. Firefly algorithm can be modified to solve the multi-objective optimization algorithm and is based on the random. In future, I will develop a hybrid bio-inspired algorithm that will provide efficient solution to optimize the task.

V. REFERENCES

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