

Chapter 59

A Survey to Nature Inspired Soft Computing

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ABSTRACT

This article describes how swarm intelligence (SI) and bio-inspired techniques shape in-vogue topics in the advancements of the latest algorithms. These algorithms can work on the basis of SI, using physical, chemical and biological frameworks. The authors can name these algorithms as SI-based, inspired by biology, physics and chemistry as per the basic concept behind the particular algorithm. A couple of calculations have ended up being exceptionally effective and consequently have turned out to be the mainstream devices for taking care of real-world issues. In this article, the reason for this survey is to show a moderately complete list of the considerable number of algorithms in order to boost research in these algorithms. This article discusses Ant Colony Optimization (ACO), the Cuckoo Search, the Firefly Algorithm, Particle Swarm Optimization and Genetic Algorithms in detail. For ACO a real-time problem, known as Travelling Salesman Problem, is considered while for other algorithms a min-sphere problem is considered, which is well known for comparison of swarm techniques.

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INTRODUCTION

Swarm intelligence and bio-inspired methodologies shape in vogue topic in the advancements of latest algorithms on the basis of natural characteristics (Engelbrecht, 2006). The above discussed algorithms can work on the basis of swarm intelligence, physical, chemical and biological frameworks. In this way, we can name these algorithms as swarm-intelligence-based, inspired by biology, physics and chemistry, as per the basic concept behind the particular algorithm. In spite of the fact that not every one of them is productive, a couple of calculations have ended up being exceptionally effective and consequently have turned out to be mainstream devices for taking care of real-world issues (Dorigo et al., 2006; Bonabeau, 1999). The reason for this survey is to show a moderately complete list of the considerable number of algorithms in the research article in order to boost up the research in these algorithms.

A number of researchers have been motivated by nature in numerous manners and therefore we can define it as a rich source of inspiration. These days, most new calculations are nature-enlivened, in light of the fact that they have been created by drawing motivation from nature. Indeed, even with the accentuation on the source of motivation, we can at present have diverse levels of orders; contingent upon how details and what number of sub sources we will require applying. We will apply the most elevated sources for the sake of simplicity. These sources are like biology, physics or chemistry.

In the extreme nonspecific term, nature is the primary inspirational source. Accordingly, all new calculations can be alluded to as nature-motivated. The larger part of nature- inspired algorithms depend on some effective attributes of organic framework. Thus, the biggest portion of nature-motivated algorithms is biology-inspired.

Among all bio-inspired algorithms discussed above, a unique category of algorithms have been produced by getting inspired from swarm intelligence. Along these lines, a portion of the bio-inspired algorithms can be termed as algorithms based on swarm-intelligence. As a matter of fact, these are most well-known algorithms. Some of the well-known examples are ant colony optimization, particle swarm optimization, cuckoo search, bat algorithm, and firefly algorithm (Yaseen and Al-Slamy, 2008; Shi, 2004; Yang and Deb, 2009; Tsai et al., 2011; Yand and He 2013).

Clearly, we can understand that all algorithms were not working on the concept of biological systems. A number of them have been produced with the help of physical and chemical systems. A few of them may even base on music. In the following sections of the research article, we will quickly classify all algorithms into various classes, and we don't guarantee that this classification is not general. This is a decent attempt to give adequately detailed references. To cover various classes of engineering applications, considered algorithms are tested on distinct problems.

ANT COLONY OPTIMIZATION

Ant Colony Optimization (ACO) is as a meta-heuristic algorithm that works on the basis of working of a combination of positive feedback, distributed computation, and greediness to discover an ideal solution for optimization issues. As its name implies, this algorithm is based on movement pattern of the ants. This algorithm is a derivative of Swarm intelligence (SI) (Colorni et al., 1992). He studied the complex social behaviour of ants and concluded that it could be very useful in solving complex optimization problems.

The principal concept behind this algorithm is based on the unique ability of ants to find the shortest route. Ants go here and there in search of food and they establish their communication with the other

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