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Entrepreneur: Artificial Human Optimization

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ABSTRACT

A new field titled 'Artificial Human Optimization' is introduced in this paper. All optimization methods which were proposed based on Artificial Humans will come under this new field. Less than 20 papers were published in this field so far. The goal of this paper is to introduce 'Artificial Human Optimization' and to show abstracts of papers published in this new field. The nick name given to this work is 'ENTREPRENEUR'.

Index Terms— Optimization, Artificial Humans, Genetic Algorithm, Particle Swarm Optimization, Optimization methods based on Humans

1 Introduction

Very less amount of work has been done based on Artificial Humans when compared to optimization methods based on other beings like ants, birds, bees, fishes etc. Genetic Algorithm was proposed in 1970s. But the first optimization method based on humans was proposed in 2012. There is lot of scope to explore and create optimization methods based on Humans. Hence a new field titled 'Artificial Human Optimization' is introduced in this paper.

2 Abstracts of Papers

This section shows abstracts of papers published in 'Artificial Human Optimization' field.

The abstract given in [1] is shown below as it is:

"The interactions and influence taking place in the society could be a source of rich inspiration for the development of novel computational methods. In this paper a new optimization method called "Adaptive social behavior optimization (ASBO)" derived from abstract inherent characteristics of competition, influence and self-confidence which are involved behind making a successful social life especially with human society is presented. The characteristics of dynamic leadership and dynamic logical neighbors along with experienced self capability are taken as fundamental social factors to define the growth of individual and in result of whole society. For each entity of a society, characteristics and affect of these three factors are not being constant for whole life span, rather than function of time and present status. To define this dynamic characteristic under a social life, in ASBO, help of self-adaptive mutation strategy is opted. To establish the applicability of proposed method various benchmark optimization problems are taken to obtain the global solutions. Performance comparison between ASBO and various variation of PSO, which is another well established optimization method based on swarm social behavior, is also

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presented. Proposed method is simple, more generalized and free from parameters setting in working and very efficient from performance perspectives to achieve the global solution".

The abstract given in [2] is shown below as it is:

"This paper is dedicated to everyone who is interested in the Artificial Intelligence. John Henry Holland proposed Genetic Algorithm in the early 1970s. Ant Colony Optimization was proposed by Marco Dorigo in 1992. Particle Swarm Optimization was introduced by Kennedy and Eberhart in 1995. Storn and Price introduced Differential Evolution in 1996. K.M. Passino introduced Bacterial Foraging Optimization Algorithm in 2002. In 2003, X.L. Li proposed

Artificial Fish Swarm Algorithm. Artificial Bee Colony algorithm was introduced by Karaboga in 2005. In the past, researchers have explored behavior of chromosomes, birds, fishes, ants, bacteria, bees and so on to create excellent optimization methods for solving complex optimization problems. In this paper, Satish Gajawada proposed The Human Optimization. Humans progressed like anything. They help each other. There are so many plus points in Humans. In fact all optimization algorithms based on other beings are created by Humans. There is so much to explore in behavior of Human for creating awesome optimization algorithms. Artificial Fishes, birds, ants, bees etc have solved optimization problems. Similarly, optimization method based on Humans is expected to solve complex problems. This paper sets the trend for all optimization algorithms that come in future based on Humans".

The abstract given in [3] is shown below as it is:

"Particle swarm optimization (PSO) has attracted many researchers interested in dealing with various optimization problems, owing to its easy implementation, few tuned parameters, and acceptable performance. However, the algorithm is easy to trap in the local optima because of rapid losing of the population diversity. Therefore, improving the performance of PSO and decreasing the dependence on parameters are two important research hot points. In this paper, we present a human behavior-based PSO, which is called HPSO. There are two remarkable differences between PSO and HPSO. First, the global worst particle was introduced into the velocity equation of PSO, which is endowed with random weight which obeys the standard normal distribution; this strategy is conducive to trade off exploration and exploitation ability of PSO. Second, we eliminate the two acceleration coefficients c1 and c2 in the standard PSO (SPSO) to reduce the parameters sensitivity of solved problems. Experimental results on 28 benchmark functions, which consist of unimodal, multimodal, rotated, and shifted high-dimensional functions, demonstrate the high performance of the proposed algorithm in terms of convergence accuracy and speed with lower computation cost".

The abstract given in [4] is shown below as it is:

"The global optimization have the very extensive applications in econometrics, science and engineering. However, the global optimization for non-convex objective functions is particularly difficult since most of the existing global optimization methods depend on the local linear search algorithms that easily traps into a local point, or the random search strategies that may frequently not produce good off-springs. According to human behavior, a one-dimensional global search method in the global optimization should adopt alternating descent and ascent (up-hill and downhill) strategies. This paper proposes the human behavior algorithms (HBA) based on alternating descent and ascent approaches along a direction or multiple different directions. Very fortunately, the proposed HBA make a global optimization method

have high possibility for finding a global minimum point. Several benchmark experiments test that our HBA are highly effective for solving some benchmark optimization problems".

The abstract given in [5] is shown below as it is:

"Optimization techniques, especially evolutionary algorithms, have been widely used for solving various scientific and engineering optimization problems because of their flexibility and simplicity. In this paper, a novel metaheuristic optimization method, namely human behavior-based optimization (HBBO), is presented. Despite many of the optimization algorithms that use nature as the principal source of inspiration, HBBO uses the human behavior as the main source of inspiration. In this paper, first some human behaviors that are needed to understand the algorithm are discussed and after that it is shown that how it can be used for solving the practical optimization problems. HBBO is capable of solving many types of optimization problems such as high-dimensional multimodal functions, which have multiple local minima, and unimodal functions. In order to demonstrate the performance of HBBO, the proposed algorithm has been tested on a set of well-known benchmark functions and compared with other optimization algorithms. The results have been shown that this algorithm outperforms other optimization algorithms in terms of algorithm reliability, result accuracy and convergence speed".

The abstract given in [6] is shown below as it is:

"This study proposes the Human-brain Simulated Particle Swarm Optimization (HSPSO) and its Further Improved algorithm (HSPSO-FI), in order to improve the evolutionary performance of PSO and PSO-variants. Inspired by human simulated properties, modifications proposed in this article are as follows: Firstly, accumulating historical cognition by the deep extended memory; Secondly, introducing a new learning method of cognition and a new updating strategy of velocity; Finally, defining and analyzing the "forgetting function", "forgetting factor" and "extended memory depth". Evidence from simulations indicates that the extended memory and new velocity choosing and updating strategies can give the moving direction to each particle more intelligently and help them avoid trapping into local optimum effectively, and the novel algorithms have a better performance in convergence speed and optimization accuracy on the test of several benchmark functions".

The abstract given in [7] is shown below as it is:

"This paper presents a human cognition inspired particle swarm optimization algorithm, and is referred as Cognition Inspired Particle Swarm Optimization (CIPSO). As suggested by the human learning psychology, the particles control the cognition based on their global performance and also the social cognition does not influence one-self directly based on his current knowledge. Hence, in the proposed CIPSO, the particle with global best explores more by only using cognitive component with increasing inertia and self-cognition, where as other particles use explore and exploit using self with entire dimension selection and random social cognition with randomly selected dimensions for updating velocities. The performance of the proposed CIPSO is evaluated using 10 benchmark test functions as suggested in CEC2005 [3]. The performance is also compared with different variants of PSO algorithms reported in the literature. The results clearly indicate that human cognition inspired PSO performs better for most functions than other PSO algorithms reported in the literature".

The abstract given in [8] is shown below as it is:

"This paper presents a human meta-cognition inspired search based optimization algorithm, referred to as a Human Meta-cognition inspired Collaborative Search algorithm for optimization problems (HMICSO). Meta-cognition enables self-regulation and collaboration for effective learning and problem solving skills. Meta-cognition has been successfully applied in machine learning algorithms for providing better solutions. Taking an inspiration from this, we present a human meta-cognition inspired, population based collaborative search algorithm for optimization problems. In this algorithm, a group of people will move in a certain direction and choose an appropriate strategy for their new direction and position to lead them towards the optimum solution. The performance of the proposed HMICSO is evaluated using 4 benchmark test functions from the CEC2005 [23] competition. The performance is also compared with other existing search based optimization algorithms reported in the literature. The results clearly indicate better performance of HMICSO algorithm over other existing search based optimization algorithms".

The abstract given in [9] is shown below as it is:

"In this paper, we propose a new particle swarm optimization algorithm incorporating the best human learning strategies for finding the optimum solution, referred to as a Self Regulating Particle Swarm Optimization (SRPSO) algorithm. Studies in human cognitive psychology have indicated that the best planners regulate their strategies with respect to the current state and their perception of the best experiences from others. Using these ideas, we propose two learning strategies for the PSO algorithm. The first one uses a self-regulating inertia weight and the second uses the self-perception on the global search direction. The self-regulating inertia weight is employed by the best particle for better exploration and the self-perception of the global search direction is employed by the rest of the particles for intelligent exploitation of the solution space. SRPSO algorithm has been evaluated using the 25 benchmark functions from CEC2005 and a real-world problem for a radar system design. The results have been compared with six state-of-the-art PSO variants like Bare Bones PSO (BBPSO), Comprehensive Learning PSO (CLPSO), etc. The two proposed learning strategies help SRPSO to achieve faster convergence and provide better solutions in most of the problems. Further, a statistical analysis on performance evaluation of the different algorithms on CEC2005 problems indicates that SRPSO is better than other algorithms with a 95% confidence level".

The abstract given in [10] is shown below as it is:

"This paper presents an improved version of the recently proposed Self Regulating Particle Swarm Optimization (SRPSO) algorithm referred to as improved Self Regulating Particle Swarm Optimization (iSRPSO) algorithm. In the iSRPSO algorithm, the last two least performing particles are observed with different perception and they adopt a different learning strategy for velocity update. These particles get a directional update from the best particle and the next top three better performing particles for divergence of their search directions towards better solutions. This provides direction and momentum to these least performing particles and enhances their awareness of the search space. Performance of iSRPSO has been compared with SRPSO on a unimodal and a multimodal benchmark function from CEC2005 where a significant performance improvement closer to the optimum solution has been observed. Further, the performance of iSRPSO has been investigated using both the 10D and 30D CEC2015 bound constrained single-objective computationally expensive numerical optimization problems. The performance of iSRPSO on 10D problems have been compared with both the PSO and SRPSO algorithms where the solutions of iSRPSO are closer to the true optimum value compared to the other two algorithms".

The abstract given in [11] is shown below as it is:

"Clustering concept is a very powerful and useful technique in data mining. Various ways this can be utilized from application perspective. Clustering of similar topic from text documents is an important task in organizing information, search engine results obtaining from user query, enhancing web crawling and information retrieval. Generally partitional clustering algorithms are reported performing well on document clustering like family of k-means. In this case clustering problem can be consider as an optimization process of grouping documents into k clusters so that a particular criterion function is minimized or maximized. Existing algorithms for k-means clustering converge to different local minima based on the initializations and creation of empty clusters as a clustering solution. To solve this problem, we applied the newly developed optimization method based on human social behavior called adaptive social behavior optimization (ASBO), which contains simplicity in computational model and deliver global solution. Proposed method is compared with the result of another well established swarm social optimization method namely particle swarm optimization (PSO) and frequently applied K-means algorithm. Performance criteria is very critical in deciding the quality of clusters hence two mostly dominating criteria which are well accepted by research community, F-measure and purity of cluster evaluated with proposed results in all cases. Vector space model applied to represent the documents mathematically. Our experimental results demonstrated that our proposed methods can significantly improve the performance of document clustering in terms of accuracy and robustness without increasing the execution time much".

The abstract given in [12] is shown below as it is:

"Despite the popularity and usability of proportional–integral-derivative (PID) controllers in industrial applications, still its auto tuning is a challenge for researchers in terms of applied algorithmic efficiency and optimal definition of performance index. With a belief, compare to other species society, at present human society is more properly organized and developed; a new optimization method based on human social behavior called adaptive social behavior optimization (ASBO) has applied in this paper to auto tune the PID controller parameters in regards to achieving the global solution. A robust fitness function as performance index has also designed to get better exploration for optimal tuning in terms of various performance parameters. Experiments have given, with a number of systems having different types of characteristics and complexity like quadrotor, automatic voltage regulator (AVR) and DC motor systems etc. To understand the relative benefits of the proposed method, performance comparison with the number of other frequently applied algorithms in literatures like Genetic algorithm (GA) and its variant called self organize genetic algorithm (SOGA), Differential Evolution (DE), an extension of probabilistic distribution based Chaotic estimation of distribution algorithms (CEDA),Chaotic optimization and Convex-Concave optimization have presented with various practically applied fitness criteria's in practice. Proposed method of auto tuning has shown the generalized applicability for PID controller design with different types of systems in optimum manner".

The abstract given in [13] is shown below as it is:

"The application of different engineering fields in the discovery and development of new materials, especially of new catalyst, is changing the conventional research methodology in materials science. For Heterogeneous catalysts, their catalytic activity and selectivity are dependant on chemical composition, micro structure and reaction conditions. Therefore, it is worth to do the research over the composition of

the catalyst and the reaction conditions that will boost its performance. This paper proposes a computational intelligence approach based on adaptive social behavior optimization (ASBO) for catalyst composition optimization to enhance the resulting yield or achieving objective maximal. The proposed approach is especially useful in the combinatorial catalysis optimization wherein the fitness function is unknown, in result cost and time can be drastically reduced with intelligent search method instead of applying real time chemical reaction. Challenge of handling higher dimensionality and achieving a global solution can be fulfilled by ASBO which is based on human behavior under social structure which makes human as a most successful species in nature. Two different mathematical models of the catalyst composition problem, which contains the optimal complexity and represents practical scenarios have taken to explore the quality of solution. Particle swarm optimization (PSO) which is considered as a successful heuristic method among others has also been applied to get the comparative performance analysis in detail".

3 Conclusion

All the optimization methods which were proposed based on Artificial Humans will come under new field titled 'Artificial Human Optimization' which is introduced in this paper. 13 abstracts of papers which come under this new field are shown in this paper. The first paper in 'Artificial Human Optimization' was proposed in 2012. This paper shows how to propose a new field which has less number of papers published under it.

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