PARTICLE SWARM OPTIMIZATION (PSO) AND ITS APPLICATIONS-A REVIEW

Er. Harish kundra,[1] Er. Anika Rana[2]
[1]Head of Department, [2]Research Scholer
[1,2]Department of Computer Science & Engineering, Rayat College Of Engineering & Information Technology, Ropar, (Punjab) India
[1]hodcseit@rayatbahra.com, [2]nkrana9@gmail.com,

***ABSTRACT* : In this Paper we have discussed various applications of a multi-agent-based particle swarm optimisation techniques. In Artificial Intelligence; Particle Swarm Optimization is a computational method that optimizes a problem by trying to improve candidate solution with regard to a given measure of quality. PSO optimizes a problem by having a population of candidate solutions, dubbed particles, and moving these particles around in the search-space according to simple mathematical formulae over the particle's position and velocity. All agents search parallel in an equally distributed lattice-like structure to save energy and computational time. Thus making use of deterministic search, multi-agent and bee PSO, the hybrid multi-agent particle swarm optimization (HMAPSO) realises the purpose of optimisation.**

***KEYWORDS* : Particle Swarm Optimization (PSO), Multi-Agent Systems (MAS), Swarm Intelligence, Agent-Based Systems, Bio-Inspired Computation**

I. INTRODUCTION

Ingenious technique of artificial intelligence i.e. swarm intelligence that is focused due to prodigious efficiency and incredible abilities of social insects to sort out their simple food or shelter concerned problems and now it is considered as the most efficient optimization technique. In 1989, swarm intelligence was introduced by Beni and Wang in the global optimization framework as a set of algorithms for controlling robotic swarm. Her, we are applying the hybridisation of particle swam optimization (PSO) for natural terrain feature extraction. PSO is a met heuristic because of the reason that it makes very few or no assumptions about the complexities after being optimized and can search large spaces of candidate solution. However, met heuristic such as particle swarm optimization does not guarantee an optimal solution is ever found. It is a population-based search algorithm that finds optimal solution using a set of flying particles. Particle Swarm Optimization (PSO) was introduced by Russell Eberhart, an electrical engineer, and James Kennedy, a social psychologist, in 1995. PSO was originally used to solve non-linear continuous optimization problems, but more recently it has been used in many practical, real-life application problems. PSO ties influence from sociological attitude associated with bird flocking. It is believed to be innate conclusion that birds can fly in large groups with no collision for protracted long distances, making use of their effort to maintain an optimum distance between are usually influenced by food. They have dramatic capabilities in flocking all together for food seeking and long-radius migration. This section involves some details about birds in nature and analyse their capabilities and their sociological flocking behaviour. Perceptions studied as most vital impression for flock alignment. The eyes of maximum of birds are on both fronts of their heads, granting to visualize objects on each side at the same time. The larger diameter of bird eyes analogous to other animal groups is a reason that why birds have the most exceedingly matured impression of perception in the animal kingdom. As a conclusion of such large sizes of bird eyes and the way their heads and eyes are formed, maximum species of birds have broad field of aspect.

1.1 General Algorithm:

1. For every particle Initialize particle with available random number
   END
   Do
2. For every particle. Evaluate the fitness value. If, fitness value is good than the finest fitness value (pbest) in past.
   Set on-going value as the new pbest
   End
3. Select the particle with finest fitness value of all particles as the gbest. For every particle evaluate particle velocity as per the velocity modified equation
4. Modify particle position as per the position modified equation
   End
5. While maximum no. of iterations or minimum error criteria is not attained

II. PARTICLE SWARM OPTIMIZATION AND ITS APPLICATION

2.1 Hybrid Algorithm of Cuckoo Search and Particle Swarm Optimization for Natural Terrain Feature Extraction

H. Kundra et al. 2015: Swarm intelligence is a global research area to improve the optimization of various soft computing and nature inspired techniques. In this study, we have applied

the hybrid algorithm of Cuckoo Search (CS) and Particle Swarm Optimization (PSO) for remote sensing image classification of natural terrain features. Remote sensing is the method of acquiring, processing and interpreting the satellite images and related geo-spatial data without any physical contact of that region. The main advantage of using the hybrid concept is that the search strategy used in CS for finding the best host nest for cuckoo egg is resolved by the best position of PSO concept. By using this proposed algorithm, it becomes easier to classify the terrain features and obtained results shows the higher efficiency and greater kappa coefficient value as compare to other swarm intelligence techniques. We have successfully applied the hybridization of Cuckoo Search (CS) and Particle Swarm Optimization (PSO) for classifying diversified land cover areas in a remote sensing satellite image.

2.2 PBBO: A New hybrid algorithm for satellite image classification

H. Kundra et al. 2012: From last two decades many optimization techniques have been evolved. PSO and BBO are the two techniques that have been widely used in Swarm Optimization. PSO is better than many genetic algorithms. PSO has applications in various areas like Optimization, Neural Networks training, Fuzzy controls and etc. BBO is based on science of biogeography. BBO has some features common to PSO and Genetic algorithms but it has some important features that make it more reliable than others. In this paper, we have proposed new algorithm that combines the features of PSO and BBO. It will help in providing more reliability in optimization world.

2.3 Application of Swarm Intelligence Computation Techniques in PID Controller Tuning

S. Ghosal et al. 2012: Swarm Intelligence Computation system is one of the contemporary and progressive research propositions in the acreage of Artificial Intelligence. This nature –inspired, global optimization process is used rapidly in different acreages, specifically it has developed into one of the better beneficial manner for ability renovation of discipline and distributed optimization attitude. An analysis application on "tuning of PID controller" with sufficient and satisfactory achievement observations via various swarm intelligence computation system in paper. Tuning of PID from traditional approach and genetic algorithm and their constraints in appropriate tuning, various structures of PID controllers with the objectives for PID tuning and an efficient intelligent PID controller design is conferred in the inauguration of this problem. Formerly, a concise literature survey on PID tuning with various Swarm Intelligence(SI) techniques i.e. Ant Colony Optimization(ACO), Particle Swarm Optimization(PSO), and Bacterial Foraging Optimization Algorithm(BFOA) and their advantages as well as disadvantages in appropriate tuning is conferred in the afterwards. And lastly a performance comparing with simulation conclusions of PID tuning via ZN, GA, PSO, BFOA are analysed on four set of procedure transfer functions and are analysed for sufficient analysis.

2.4 Particle Swarm Optimization: Technique, System and Challenges

D. Riniet et al. 2011: Particle Swarm Optimization (PSO) is a biologically activated computational exploration and optimization process developed in 1995 by Eberhart and Kennedy depending on the social attitude of birds flocking or fish schooling. A count of basic discrepancy has been refined due to better speed of concurrency and aspect of result explored by the PSO. On the other side, basic PSO is much further proper to static method, basic optimization ambiguities. Modification PSO is refined for sorting out the simple PSO problem. The analysis and review 46 concerned reviews in the period between 2002 and 2010 concentrating on function of PSO, pros and cons of PSO, the simple alternative of PSO, Changes of PSO and the applications that have been applied using PSO. The utilization can present which one the modified or alternative PSO that haven't been done and which of the changed or alternative PSO that will be refined.

2.5 Modified Particle Swarm Optimization for Blind De convolution and Identification of Multichannel FIR Filters

V. Khanagha et al. 2010: It direct she problem of blind recognition of multi-input-multi-output (MIMO) medium in the accustomed scheme Blind identification of MIMO FIR systems has broadly achieved considerations in different acreages of wireless data communications. Here, we used Particle Swarm Optimization (PSO) as the modified mechanism of the very well-known contrary filtering access and we present its better efficiency when compared to original process. Specifically, the scheduled process is presented to be more potent against curtailed SNR schemes or in scenarios with lesser lengths of feasible data records. Also, an updated version of PSO is shown which more improves the potent and accurateness of PSO algorithm. However the utmost important agreement of the updated version is its radical much faster convergence when compared to standard application of PSO.

2.6 Face Recognition Using Particle Swarm Optimization-Based Selected Features

***R. Ramadan et al. 2009*:** Feature selection (FS) is an overall optimization dilemma in machine learning that curtails the count of features, disallows irrelevant, noisy and duplicate data, and concludes in acceptable recognition correctness. It is an important step that influences the performance of a pattern recognition process. This section presents an innovative feature selection algorithm depending on particle swarm optimization (PSO). PSO is a computational paradigm depending on the innovation of collaborative attitude inspired by the social attitude of bird flocking or fish schooling. The algorithm is implemented to coefficients extracted by two

feature extraction processes: the discrete cosine transformations (DCT) and the discrete wavelet transformation (DWT). The proposed PSO-based aspect selection algorithm is applied to find the feature space for the optimal aspect subset where features are precisely chosen out as per to a well-defined favouritism criterion. Evolution is directed by a strengthen function defined in caption of maximizing the class bifurcation (scatter index). The classifier efficiency and the length of chosen feature vector are studied for performance assessment using the ORL face database. Experimental conclusions show that the PSO-based aspect selection algorithm was searched to generate excellent recognition conclusions with the minimum set of selected aspects.

2.7 Solving Bi-level Problems Using Modified Particle Swarm Optimization Algorithm

***A. El-Hefnawy et al.*: T**he bi-level programming problem (BLPP) is studied to be NP-hard problem. This paper suggests an updated particle swarm optimizer (MPSO) for sorting out fuzzy bi-level single and multi-objective dilemma. In this path the BLPP managed as fuzzy multi-objective problem. Most traditional algorithms arranged for special versions or depending on specific results in the BLPP, thus it is ambiguous to boost the diversity and broaden the exploration space of the particle. For such dilemma, new approach for the flexible inertia weight in PSO is expected to control the domain of the particle oscillation as per to fitness function, and to remove the requirement for velocity clamping. In more, fuzzy utility membership function addresses to extract the finest adjustments solution depending on fuzzy set theory. Certainly, simulation conclusions will be shown for six test dilemma and distinguishes them with other algorithms to demonstrate the performance of the proposed algorithm.

2.8 Particle Swarm Optimization with Flexible Swarm for Unconstrained Optimization

***H. Kahramanli et al.*:** Particle Swarm Optimization (PSO) algorithm innovated from attitude of bird flocking and fish schooling. It is very well-known algorithm which has been used in many fields successfully. However sometimes it endures from premature convergence. In last few years' researches have been addressed as a various paths to avoid of this dilemma. This section shows the particle swarm optimization algorithm with adaptable swarm (PSO-FS). The new algorithm was calculated on 14 functions very often utilized to benchmark the efficiency of optimization algorithms. PSO-FS algorithm was distinguished to some other changes of PSO. The conclusions show that PSO-FS has always been performed one of the better results.

2.9 Particle swarm optimization for N-queens problem

A. shaikh et al.: The N-Queen is one of the outstanding toy dilemmas for performance evaluation in the domain of Computational Intelligence. The dilemma can examine the disparate aspects of sorting out techniques; number the potential of achieving feasible solution and time & space complications. The well-defined set of limitation sketches out the global problem. The Queen has different attacking options over the chessboard. In point of concern, it can walk off over the column, row and 2 diagonal. The available solution of N-Queens plea the non-attacking placements across the chessboard. This research sorts the effectiveness of Particle Swarm Optimization to solve the ambiguity. In PSO, the particle have an altogether set of Queen Placements. On-going position of particle is very well pointed by the pest and best parameters, both are new generation achieves more converged cluster of particles. The partial but enhanced outcome that promotes and furnishes to acquiring generation while the substandard may be eliminated. The inspected results make familiar the dynamic aspects of PSO and eventually verify the effectiveness of research guidance.

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