

A Review on Particle Swarm Optimization Algorithm

Sharandeep Singh

Abstract— During last few decades researchers and young scientists have presented different versions of PSO approach. Scientists have successfully solved several real life, industrial, insurance and other marketing problems with the help of these versions. In this article a review of several hybrid versions of PSO have been presented.

Index Terms— Confidence factor, inertia constant, PSO.

1 INTRODUCTION

IN PSO version the members of the crowd in the global space search the global optimal point. The new direction of the member is dependent on self and neighborhood member performance. Following are the equations responsible to update the velocity of each member of the crowd and new movement of each member of the crowd in the global search area:

$$v_{ij}^{t+1} = w \times v_{ij}^t + c_1 r_{1j}^t (p_{best,i}^{t+1} - x_{ij}^t) + c_2 r_{2j}^t (G_{best} - x_{ij}^t) \quad (1)$$

$$x_{ij}^{t+1} = x_{ij}^t + v_{ij}^{t+1} \quad (2)$$

2 REVIEW OF PSO

PSO version in 1995 has been originated by James Kennedy and R.C. Eberhart. After this achievement there are several number of researcher has been modified PSO approach and presented the distinct types of hybrid versions. In 1997 Kennedy and Eberhart presented a Binary-PSO. In this version particle's position is discrete but its velocity is continuous. Shi. et al. (1998) has modified the version of PSO and it is called the Standard Particle Swarm Optimization. This version controls the exploration and exploitation by inertia constant. Shi et al. (1998) has studied the execution of PSO and improved convergence quality of PSO on the basis of tested performance on several types of classical function. Naka, S. (2003) has originated the Hybrid Particle Swarm Optimization (HPSO) for a practical distribution state estimation. This version considers nonlinear characteristics of the practical equipment and actual limited measurements in distribution systems. The results indicate the applicability of the proposed state estimation method to the practical distribution systems.

Cai, Zang, Cui & Tan (2007) have originated a novel velocity threshold automation strategy by incorporating a Levy probability distribution. On the basis of numerical experiments it is concluded that the existing version is efficient and effective.

Marco A.A., (2008) has presented the Fully Informed Particle Swarm Optimization (FIPS) approach which is most sensitive to modify crowd topology. The velocity update step applied in fully informed particle swarm optimization considers each of the member in neighbourhood to modify

its velocity instead of just the best one which is done in most other variants. It has been argued that this rule induces a random behavior of the particle swarm when a fully connected topology is used. This argument could explain the often observed poor execution of the version under that circumstance. It searches more suitable point on even on small search regions.

Quyung, A. et al. (2009) has presented the another version of Hybrid Particle Swarm Optimization (HPSO) algorithm. This was originated by combining two separate approaches Nelder Mead Simplex and PSO approach. By this modified version it is possible to solve nonlinear functions and to find good initial guess for Simplex approach. Lu & Qiu (2010) have presented a probabilistic PSO approach. In this version distinct types of probability conditions have been implemented. These conditions improve the movement of each particle in the global search space. Shieh, H.L. (2011) has proposed another hybrid approach. It has been developed by combining two separate approaches of PSO with simulated annealing behavior. The performance of this approach has been tested on 20 classical functions. On the basis of results obtained it is concluded that the quality of solution is improved in this version.

K.Thanushkidi et al. (2011) has been presented modified PSO and used to multi-processor job scheduling. With the help of this version the waiting time and finishing time are better controlled as comparison to other PSO approaches.

Singh, N. et al. (2012) developed a Personal Best Position Particle Swarm Optimization (PBPPSO) algorithm. This algorithm has been developed by vanishing the global best term in the velocity update equation of SPSO. The performance of this algorithm has been tested on several benchmark problems. The results indicate that the proposed algorithm performs better than SPSO.

Hemlata S. et al. (2012) has originated the concept of Dynamic Particle Swarm Optimization (DPSO) approach. The performance of this algorithm has been tested on several benchmark problems. The results indicate that the dynamic algorithm performs better than simple PSO.

Bahman B. et al. (2012) has developed a Modified PSO based on Economic Dispatch. The execution of existing version has been demonstrated on one test case with three generating units.

Palanivelu, L.M. (2012) investigated the function of optimizing space for multi application smart card applying compression approaches.

Song, Y.U. (2012) has originated the new hybrid approach of PSO known as HPSO. This has been developed by combining space transformation search with new updated velocity model. This modified version has been tested on several types of classical functions. It is concluded that this approach has a good hold on unimodal and multi modal functions. Ahmed, A.A. (2013) has been presented a hybrid PSO approach (HPSOM). It has improved the quality of SPSO. The idea of existing approach is to integrate the particle swarm optimization with GA version mutation technique. On the behalf of obtained results it is concluded that the approach has a balance of abilities for global and local search.

Singh & Singh (2013) have proposed Hazard Function Particle swarm Optimization (HF-PSO). In this version the position of each particle is updated by DED- HF condition. The execution of this version has been compared by SPSO technique. On the basis of results obtained it is concluded that this algorithm provides the best quality of solutions and outperform SPSO. He, J. et al. (2013) took the gradient descent approach as a member of the crowd in the global search space operator embedded in PSO, and at the same period apply to attenuation wall version to make fly off the global space of the member of the crowd of size remain unrepeatd and ignore the local global optimal solution. Yao, J. et al. (2013) presented the new version of PSO called Barebones PSO. In this approach convergence rate of the each particle the global search space has been improved. Experiments are conducted on 12 classical functions and a real-world function of ship design. Simulation results demonstrate that this modified approach outperforms the SPSO, BPSO, and 6 several modified PSO versions. Jing, W. (2013) presented mutation PSO version. It is designed by genetic approach. The performance of existing version is concentrated on scene classification. On the basis of experimental results it is proved that the existing version is better than other approaches of an MLP.

Tabassum, M.N. et al. (2013) introduced a comparatively new technique of PSO. The basic approach SPSO is updated in a unique way to come up with B-positive PSO. This existing version has been simulated in Matlab letting the particles to move in a multi-dimensional space in an overall positive direction. Its performance has been tested on several types of function in terms of mean and S.D. values for global minimum and mean time.

Tiwari, S. et al. (2013) has presented an overview of basic PSO to provide a comprehensive survey on the function of economic load dispatch as an optimization function. The study is carried out for 3 unit test system and then for 6 unit generating system with and without loss cases. Hardiansyah (2013) modified PSO mechanism to deal with the equality and inequality constraints in the ELD functions through the application of Gaussian and Cauchy probability distributions. On the basis of obtained results it has been examined that existing approach reveal the efficiently and robustness as comparison to other approaches of PSO.

Jana, N.D. (2013) has proposed a new approach of PSO. In this approach the velocity equation of PSO has been modified. A new term is added with the original velocity update equation by calculating difference between the global best of swarm and local best of particles. It is tested on several types of functions and it is concluded that existing version outperforms the SPSO in terms of convergence, speed and quality

Yang, C.I. et al. (2014) have proposed a hybrid Taguchi based PSO approach for calculating multi-objective flow-shop scheduling functions. Through Taguchi based crossover one can avoid scheduling conflicts. Several types of numerical function have been tested with this approach and found a good execution.

Garsva, G. et al. (2014) have presented linear support vector machines classifier optimization combining its selection from a family of similar classifiers with parameter optimization. On the behalf of obtained results it is concluded that existing approach perform better to similar techniques and approaches.

3 FUTURE SCOPE AND CONCLUSIONS

Nowadays the practical problems are becoming complex day by day. We need to develop such an algorithm which can successfully solve unimodel as well multimodel optimization problems. The present paper reviews some important developments in the field of PSO which may help the researchers and scientists to study the recent developments in this field and to propose some better versions of PSO.

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