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EE6227 Genetic Algorithms & Machine Learning - Assignment 1, AY2019 -2020

EVALUATIONS OF PARTICLE SWARM OPTIMIZERS FOR MULTIMODAL FUNCTION OPTIMIZATION

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ABSTRACT:

This programming assignment presents the evaluations and comparisons of several particle swarm optimization (PSO) algorithms learnt during the graduate-level course EE6227: Genetic Algorithms and Machine Learning. Specifically, four PSOs, i.e., the classic PSO, the comprehensive learning-based PSO (CLPSO) [1], the unified PSO (UPSO) [2], and the fitness-distance-ratio-based PSO (FDR-PSO) [3] are evaluated on eight test functions. With different tuning parameters, the convergence performances of these PSO algorithms are sincerely compared and discussed. What is more, the mean and variance of each algorithm, as well as the convergence curve, is illustrated and compared. Experimental results verify the effectiveness and superiority of the CLPSO and FDR-PSO algorithms for solving multimodal function optimization problems.

KEYWORDS: Particle Swarm Optimization, Multimodal Functions, Convergence.

1. PARTICLE SWARM OPTIMIZATION

Particle swarm optimization (PSO), an evolution method based on computational intelligence, is conceptually simple and easy to implement [4,5]. The stochastic search strategy of PSO stimulates biological activities in nature and exhibit excellent performance in solving global optimization problems of multimodal functions. With parallel search capability, PSO algorithms is more efficient than evolutionary algorithms. The basic procedures (as shown in Figure. 1) of PSO algorithms can be summarized as follows:

1. Initialize all particles and randomly generate the position and velocity particles. Parameter *pbest* of the individual particle is set as the historical optimal value of the best position explored in the current group, and parameter *gbest* of the individual particle is set as the historical optimal value of the best position explored in the all groups.
2. Calculate the fitness value of each particle.

