Genetic Learning Particle Swarm Optimization

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Abstract Social learning in particle swarm optimization (PSO) helps collective efficiency, whereas individual reproduction in ger. algorithm (GA) facilitates global effectiveness. This observatio

recently leads to hybridizing PSO with GA for performance enhancement. However, existing work uses a mechanistic parallel superposition and research has shown that construction of superior exemplars in PSO is more effective. Hence, this paper first develops a new framework so as to organically hybridize PSO with another optimization technique for "learning." This leads to a generalized "learning PSO" paradigm, the *L-PSO. The paradigm is composed of two cascading layers, the first for exemplar generation and the second for particle updates as per a normal PSO algorithm. Using genetic evolution to breed promising exemplars for PSO, a specific novel *L-PSO algorithm is proposed in the paper, termed genetic learning PSO (GL-PSO). In particular, genetic operators are used to generate exemplars from which particles learn and, in turn, historical search information of particles provides guidance to the evolution of the exemplars. By performing crossover, mutation, and selection on the historical information of particles, the constructed exemplars are not only well diversified, but also high qualified. Under such guidance, the global search ability and search efficiency of PSO are both enhanced. The proposed GL-PSO is tested on 42 benchmark functions widely adopted in the literature. Experimental results verify the effectiveness, efficiency, robustness, and scalability of the GL-PSO.

Keywords

Author Keywords: Exemplar construction; genetic algorithm (GA); hybrid method; learning scheme; particle swarm optimization (PSO)

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