融合社会学习和莱维飞行的改进 QPSO 算法

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摘　要：量子行为粒子群(QPSO)算法势阱中心被限制在局部最优位置和全局最优位置构成的超矩形中，粒子间信息共享机制单一，算法存在易早熟收敛、优化效率低等问题.为解决该问题，提出一种改进 QPSO 算法，即融合社会学习和莱维飞行的 QPSO(LSL　QPSO)算法.首先，利用社会学习策略更新非最优粒子，增强种群多样性，提高算法全局搜索能力；然后，引入莱维飞行策略，克服社会学习机制中最优粒子无更新的缺点，进一步提高算法收敛精度和收敛速度.最后，通过 4 个典型 Benchmark 函数进行测试，结果表明 LSL　QPSO 算法的收敛精度、收敛速度和普适性领先于 QPSO 和其他同类 QPSO 改进算法.

关键词：量子行为粒子群算法；势阱中心；社会学习；莱维飞行

An Improved QPSO Algorithm Integrating Social Learning With Lévy Flights

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Abstract：The Quantum-behavior Particle Swarm Optimization (QPSO) potential well center is restricted to the super rectangle which is made up of the local optimal position and the global optimal position. The information sharing mechanism among particles is simple, and the algorithm has the problems of premature convergence and low optimization efficiency. To solve this problem, an improved QPSO algorithm, namely the QPSO algorithm (LSL-QPSO) which integrates social learning and Lévy flights. Firstly, the social learning strategy is used to update the non optimal particle and improve the global search ability. Then, the Lévy flights strategy is introduced to overcome the shortcoming of the low efficiency of the optimal particle in the social learning mechanism, and further improve the convergence accuracy and search efficiency of the algorithm. Finally, four typical Benchmark functions are tested. The results show that the convergence accuracy, search efficiency and universality of the LSL-QPSO algorithm are ahead of QPSO and other similar QPSO improved algorithms.

Key words：quantum-behaved particle swarm optimization(QPSO) algorithm; potential trap center; social learning; lévy flights

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