Levy slime mould algorithm for solving numerical and engineering optimization problems

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ABSTRACT
The proposed Levy Slime Mould Algorithm (LSMA) is a novel metaheuristic algorithm that integrates the Levy distribution into a new metaheuristic called Slime Mould Algorithm (SMA) for solving numerical and engineering problems. The SMA is a newly developed metaheuristic algorithm that is inspired by the slime moulds natural oscillation mode. Adaptive weights are used in the conventional SMA to simulate the process of generating positive and negative feedback of a slime mould propagation wave centred on a bio-oscillator to shape the best path for linking food with excellent exploratory capacity and exploitation propensity. However, in solving a variety of optimization problems, SMA-like metaheuristics are often trapped in local optima. Therefore, for solving the SMA algorithm local optima problem, we used the Levy distribution rather than the conventional uniform distribution in the candidate selection procedure. We took advantage of the Levy flight, which solved the local optima problem and improved traditional SMA efficiency. The proposed LSMA algorithm performance was evaluated using 23 well-known benchmark test functions, namely unimodal benchmark functions, multimodal benchmark functions, and fixed-dimension multimodal benchmark functions, as well as compared with the traditional SMA. One classical engineering problem known as the welded beam structure problem is used to test the proposed LSMA algorithm's efficacy. Experimental findings have shown that the proposed LSMA algorithm delivers better performance with 23 benchmark test functions, and one engineering problem has been investigated regarding statistical performance evaluation and convergence curve.

KEYWORDS
Levy flight; Metaheuristic; Optimization; Slime Mould Algorithm

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