

Improvement on Lion Optimization Algorithm (LOA)

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Lion Optimization Algorithm is one of the many algorithms that tackles on optimization. The main feature of the Lion Optimization Algorithm is its degree of adaptability tightly coupled on the parameters used.

An improvement is made to extend the functionality of the Lion Optimization Algorithm. The improvement utilizes more information that is generated within the algorithm to further improve on its functionality.

The following is a list of improvements made on the algorithm:

- Group Direction in Prides
- Fitness Weighted Mating
- Simulated Annealing in Nomads
- Order Pressured Random Selection
- Center Pressured Randomization

Testing: Rastrigin

Using the following function and parameters, results are made and shown in the table.

$$f(x) = 10 + x_1^2 - 10 \cos(2\pi x_1)$$

Max Iter. = 50; Population = 50; Space = [-5, 5]; Prides = 4; % Nomad = 0.2;

% Sex = 0.8; % Roaming = 0.2; % Mating = 0.2; % Mutate = 0.2; % Immigration = 0.8;

% Group Influence = 0.4; Annealing: True; Order Pres. = 2; Center Pres. = 2;

	(Old) Run 1	(Old) Run 2	(Old) Run 3
End Fitness	1.62623e-07	1.14059e-07	4.26805e-11
Best Lion	-2.86305e-05	-2.39775e-05	-4.63826e-07
Fun. Evaluations	3277	3481	3429
	(New) Run 4	(New) Run 5	(New) Run 6
End Fitness	3.28999e-11	2.8102e-12	7.47846e-13
Best Lion	-4.07233e-07	1.19016e-07	-6.13836e-08
Fun. Evaluations	2804	2665	2809

Testing: Rosenbrock

Using the following function and parameters, results are made and shown in the table.

$$f(x) = (1 - x_1)^2 + 100(x_2 - x_1^2)^2$$

Max Iter. = 50; Population = 50; Space = [-5, 5]; Prides = 4; % Nomad = 0.2;

% Sex = 0.8; % Roaming = 0.2; % Mating = 0.2; % Mutate = 0.2; % Immigration = 0.8;

% Group Influence = 0.4; Annealing: True; Order Pres. = 2; Center Pres. = 2;

	(Old) Run 1	(Old) Run 2	(Old) Run 3
End Fitness	0.00193738	0.0103586	0.0295752
Best Lion	1.04206, 1.08718	1.05594, 1.12351	0.912438, 0.817742
Fun. Evaluations	3297	3310	3391
	(New) Run 4	(New) Run 5	(New) Run 6
End Fitness	0.00443017	5.42547e-05	2.18533e-05
Best Lion	1.06647, 1.1377	0.99285, 0.985929	0.997266, 0.994918
Fun. Evaluations	2788	2836	2891

Testing: Griewank

Using the following function and parameters, results are made and shown in the table.

$$f(x) = 1 + \frac{1}{4000}x_1^2 - \cos(x_1)$$

Max Iter. = 50; Population = 50; Space = [-100, 100]; Prides = 4; % Nomad = 0.2;
% Sex = 0.8; % Roaming = 0.2; % Mating = 0.2; % Mutate = 0.2; % Immigration = 0.8;
% Group Influence = 0.4; Annealing: True; Order Pres. = 2; Center Pres. = 2;

	(Old) Run 1	(Old) Run 2	(Old) Run 3
End Fitness	4.22439e-07	1.19733e-05	2.15247e-08
Best Lion	-0.000918943	-0.00489231	-0.000207432
Fun. Evaluations	3421	3516	3512
	(New) Run 4	(New) Run 5	(New) Run 6
End Fitness	8.27745e-09	8.28981e-12	1.84039e-11
Best Lion	-0.000128634	4.07076e-06	-6.06545e-06
Fun. Evaluations	2919	2833	2623