Computational Load Analysis

1. Analysis of Computational Load in Big-O Notation

The computational load of CLPSO (In Big-O notation):
Initialization: \( O(ND) \)
Evaluate: \( O(ND) \)
Update: \( O(ND) \)
Overall: \( O(ND) \)

The computational load of ML-CLPSO-AM
Initialization: \( O(ND) + O(N^2) = O(ND + N^2) \)
Evaluate: \( O(ND) \)
Update: \( O(ND) + O(N^2) + O(D) = O(ND + N^2) \)
Overall: \( O(ND + N^2) \)

The computational load of Multi-leader strategy: \( O(N^2) \)
The computational load of adaptive mutation strategy: \( O(D) \)

Note: \( N, D \) denote for the swarm size and the dimensionality, respectively.

Discussion: In most of the cases, \( N \) and \( D \) have the same order of magnitudes. Hence the computational loads of ML-CLPSO-AM and CLPSO are almost the same.

2. Comparison of Computing Time on CEC 2017 Functions

![Figure S1. Mean computing time of PSO algorithms (Unit: Second).](image)

The experiment of computing time is carried out on PC with Intel i7-4790 CPU, Win7 Ultimate 64-bit OS, Matlab R2014b. Each algorithm is run for 51 indecent runs and the mean computing times are given in Figure S1.

Discussion: Figure S1 shows that the computing time of ML-CLPSO-AM is shorter than PSO-cf, FIPS, FDR-PSO, CLPSO, EL-PSO and EPSO, longer than SL-PSO, GL-PSO and HCLPSO.

With multi-leader and adaptive mutation strategies, ML-CLPSO-AM can search the potential promising area efficiently, its computing time is shorter than CLPSO.