

Extension for SOMA-CLP for Competition on Bound Constrained Single Objective Numerical Optimization Benchmark

A competition entry on Bound Constrained Single Objective Numerical Optimization at The Genetic and Evolutionary Computation Conference (GECCO) 2021

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ABSTRACT

This paper is an extension to the original article and contains all the required result tables for CEC 2021 competition on bound constrained single objective numerical optimization at The Genetic and Evolutionary Computation Conference (GECCO) 2021.

KEYWORDS

SOMA, k-means, clustering, CEC 2021

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1 EXPERIMENTAL SETTING

The Special Session and Competition on Single Objective Bound Constrained Optimization [1] is accompanied by a technical report which describes the benchmark itself together with instructions on how to approach the problems presented in it. It also provides test function definitions and describes the evaluation criteria with a manual on measuring the time complexity of the benchmarked algorithm.

The values of the chosen parameters for SOMA-CLP are shown in Table. 1.

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Table 1: SOMA-CLP parameter values

NP	NP_L	$step$	$step_L$	$pathLength$	$pathLength_L$
100	10	0.33	0.11	3.0	2.0

2 RESULTS

In this section, the results are provided in a format required by the benchmark suite. The error values achieved with MaxFES for tested dimension sizes are shown in the following tables. The technical report instructions also require the measurement of the algorithm time complexity. The results of this measurement are depicted in Table. 2.

Table 2: Computational Complexity

	T0	T1	T2	T2 - T1/T0
10	1.09E-02	2.12E-01	1.40E+01	1.20E+03
20	1.09E-02	6.44E-01	2.60E+01	2.33E+03

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REFERENCES

- [1] Ali Wagdy, Anas A Hadi, Ali K. Mohamed, Prachi Agrawal, Abhishek Kumar, and P. N. Suganthan. 2020. Problem Definitions and Evaluation Criteria for the CEC 2021 Special Session and Competition on Single Objective Bound Constrained Numerical Optimization. Technical Report, Nanyang Technological University, Singapore.

Table 3: Results of the Wilcoxon rank-sum test.

Dimension	SOMA-CL	SOMA-All To All	SOMA-CLP	None
10	11	0	32	37
20	8	2	40	30
Sum of wins	19	2	72	67

Table 7: Results for 10D (Translation)

Func.	Best	Worst	Median	Mean	Std
1	0.00E+00	3.07E-07	2.40E-08	5.18E-08	7.52E-08
2	2.70E-01	2.30E+01	6.92E+00	7.50E+00	6.43E+00
3	4.68E+00	1.82E+01	1.40E+01	1.38E+01	2.28E+00
4	2.62E-01	1.06E+00	6.62E-01	6.45E-01	1.79E-01
5	1.62E-02	1.54E+01	1.60E+00	2.58E+00	3.20E+00
6	4.97E-02	9.53E-01	4.35E-01	4.52E-01	2.18E-01
7	6.91E-03	1.11E+00	2.51E-01	3.10E-01	2.76E-01
8	2.18E-08	5.47E+01	1.01E-01	1.60E+01	2.04E+01
9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	5.15E+01	7.25E+01	5.20E+01	5.27E+01	3.76E+00

Table 10: Results for 10D (Rotation and Translation)

Func.	Best	Worst	Median	Mean	Std
1	0.00E+00	2.10E-06	3.67E-08	2.11E-07	5.14E-07
2	3.67E+00	3.20E+01	1.37E+01	1.56E+01	9.40E+00
3	1.09E+01	1.87E+01	1.35E+01	1.38E+01	1.59E+00
4	9.92E-03	6.09E-01	1.81E-01	2.14E-01	1.73E-01
5	3.07E-01	2.39E+01	1.20E+01	1.03E+01	6.55E+00
6	3.83E-02	8.18E-01	2.62E-01	3.33E-01	1.91E-01
7	2.48E-03	6.31E-01	2.42E-01	1.96E-01	1.67E-01
8	9.77E-01	1.00E+02	2.81E+01	3.27E+01	2.22E+01
9	3.47E+00	1.00E+02	1.00E+02	9.20E+01	2.49E+01
10	3.98E+02	4.00E+02	4.00E+02	3.99E+02	7.97E-01

Table 8: Results for 10D (Shift and Rotation)

Func.	Best	Worst	Median	Mean	Std
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	5.34E-05	1.91E-01	1.25E-01	1.06E-01	5.72E-02
3	3.12E+00	1.09E+01	1.09E+01	1.04E+01	1.81E+00
4	1.46E-06	5.04E-01	3.57E-01	3.48E-01	1.04E-01
5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6	3.81E-03	5.03E-02	2.81E-02	2.94E-02	1.00E-02
7	1.32E-05	1.61E-02	9.66E-04	2.91E-03	4.23E-03
8	6.93E-05	3.07E-02	1.34E-03	3.42E-03	5.80E-03
9	3.08E+00	1.00E+02	1.00E+02	8.68E+01	3.06E+01
10	2.02E+02	4.00E+02	4.00E+02	3.87E+02	4.91E+01

Table 11: Results for 10D (Shift, Rotation and Translation)

Func.	Best	Worst	Median	Mean	Std
1	0.00E+00	9.50E-07	2.94E-08	7.77E-08	1.79E-07
2	3.14E-01	5.03E+01	1.53E+01	1.52E+01	1.13E+01
3	1.15E+01	1.65E+01	1.35E+01	1.35E+01	1.30E+00
4	9.89E-03	7.51E-01	1.30E-01	2.00E-01	1.93E-01
5	3.66E-01	2.55E+01	1.10E+01	9.43E+00	7.02E+00
6	3.61E-02	7.34E-01	2.78E-01	2.73E-01	1.56E-01
7	2.88E-03	6.38E-01	1.22E-01	1.84E-01	1.69E-01
8	1.45E-01	1.00E+02	2.81E+01	2.81E+01	1.98E+01
9	3.70E+00	1.01E+02	1.00E+02	9.69E+01	1.76E+01
10	1.11E+02	4.00E+02	3.98E+02	3.89E+02	5.25E+01

Table 9: Results for 10D (Shift and Translation)

Func.	Best	Worst	Median	Mean	Std
1	0.00E+00	6.91E-07	2.24E-08	7.06E-08	1.38E-07
2	3.02E-01	2.21E+01	5.23E+00	6.13E+00	5.27E+00
3	8.67E+00	1.83E+01	1.36E+01	1.37E+01	1.98E+00
4	2.58E-01	1.12E+00	6.61E-01	6.69E-01	1.81E-01
5	2.12E-01	9.33E+00	2.03E+00	2.77E+00	2.33E+00
6	7.12E-02	9.80E-01	4.54E-01	4.62E-01	2.21E-01
7	2.98E-03	8.11E-01	3.21E-01	3.07E-01	2.08E-01
8	3.94E-05	4.88E+01	3.44E+01	2.47E+01	1.82E+01
9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	5.15E+01	5.32E+01	5.21E+01	5.21E+01	3.74E-01

Table 12: Results for 20D (Basic)

Func.	Best	Worst	Median	Mean	Std
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	3.12E-02	3.12E-01	1.87E-01	1.73E-01	5.88E-02
3	0.00E+00	5.97E+00	1.99E+00	2.16E+00	1.63E+00
4	5.37E-01	1.04E+00	9.33E-01	8.88E-01	1.45E-01
5	0.00E+00	2.08E-01	0.00E+00	3.47E-02	5.69E-02
6	5.30E-02	6.01E-01	4.28E-01	3.92E-01	1.58E-01
7	1.60E-02	2.61E-01	6.64E-02	8.84E-02	5.52E-02
8	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	4.88E+01	4.89E+01	4.88E+01	4.88E+01	4.59E-02

Table 17: Results for 20D (Shift and Translation)

Func.	Best	Worst	Median	Mean	Std
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	1.87E-01	6.04E+00	1.94E+00	1.88E+00	1.51E+00
3	5.97E+00	2.35E+01	1.21E+01	1.33E+01	5.09E+00
4	6.69E-01	1.78E+00	1.13E+00	1.18E+00	2.23E-01
5	3.86E+00	1.33E+03	1.87E+02	2.04E+02	2.54E+02
6	2.73E-01	9.88E-01	6.30E-01	6.38E-01	1.79E-01
7	3.91E-01	6.12E+01	5.95E+00	1.11E+01	1.45E+01
8	5.24E+01	3.03E+02	1.33E+02	1.44E+02	5.45E+01
9	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
10	6.31E+01	6.79E+01	6.41E+01	6.44E+01	1.02E+00

Table 18: Results for 20D (Rotation and Translation)

Func.	Best	Worst	Median	Mean	Std
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	1.43E-01	9.63E+00	2.85E+00	3.74E+00	2.73E+00
3	2.04E+01	2.23E+01	2.11E+01	2.12E+01	6.14E-01
4	7.94E-01	1.85E+00	1.22E+00	1.25E+00	2.60E-01
5	1.37E+02	4.02E+03	9.81E+02	1.20E+03	9.49E+02
6	2.18E-01	1.63E+00	1.02E+00	9.69E-01	4.09E-01
7	9.26E+00	2.52E+02	2.94E+01	3.75E+01	4.44E+01
8	4.00E+01	1.02E+02	1.00E+02	9.03E+01	1.84E+01
9	1.00E+02	4.34E+02	1.00E+02	1.78E+02	1.38E+02
10	4.01E+02	4.14E+02	4.14E+02	4.13E+02	2.39E+00

Table 19: Results for 20D (Shift, Rotation and Translation)

Func.	Best	Worst	Median	Mean	Std
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	2.19E-01	1.34E+01	3.66E+00	4.50E+00	3.46E+00
3	2.04E+01	2.24E+01	2.12E+01	2.13E+01	6.40E-01
4	5.07E-01	1.73E+00	1.16E+00	1.17E+00	2.78E-01
5	1.67E+02	8.88E+03	7.78E+02	1.43E+03	1.74E+03
6	2.06E-01	1.69E+00	7.96E-01	9.00E-01	4.03E-01
7	3.11E+00	1.37E+02	2.77E+01	3.74E+01	2.90E+01
8	3.64E+01	1.01E+02	1.00E+02	9.53E+01	1.35E+01
9	1.00E+02	4.31E+02	1.00E+02	1.43E+02	1.00E+02
10	4.00E+02	4.14E+02	4.14E+02	4.13E+02	2.45E+00