Competition on Single Objective Bound Constrained Numerical Optimization

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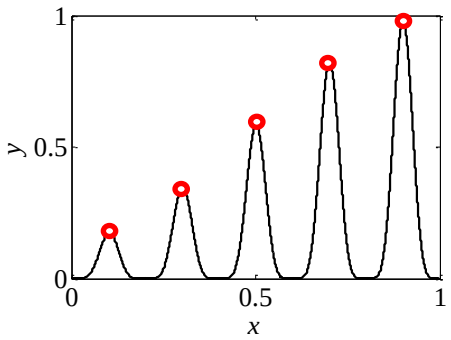
Introduction

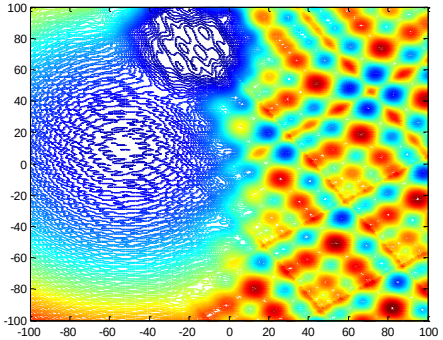
Single objective optimization algorithms are the foundation upon which more complex methods.

In the recent years various kinds of novel optimization algorithms have been proposed to solve real-parameter optimization problems.

Improved methods and problems sometimes require updating traditional testing criteria.



Multimodal single objective optimization



Complex single objective optimization

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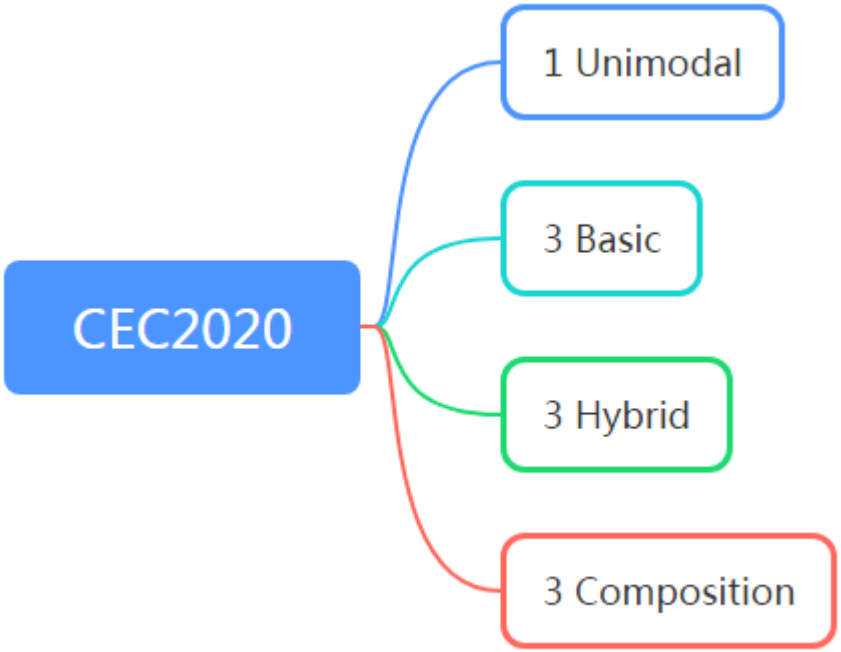
- **A review for CEC2020 benchmark problems**
- Accepted algorithms
- Evaluation criteria
- Ranking result

A review for CEC2020 benchmark problems



This competition significantly increases the maximum number of allowed function evaluations

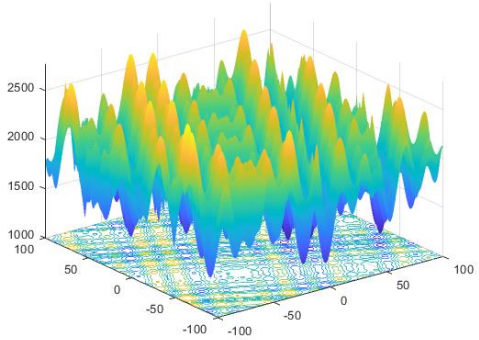
A review for CEC2020 benchmark problems

Information and features of the MMO test problems suite

	No.	Functions	$F_i^* = F_i(x^*)$
Unimodal Function	1	Shifted and Rotated Bent Cigar Function (CEC 2017 F1)	100
Basic Functions	2	Shifted and Rotated Schwefel's Function (CEC 2014 F11)	1100
	3	Shifted and Rotated Lunacek bi-Rastrigin Function (CEC 2017 F7)	700
	4	Expanded Rosenbrock's plus Griewangk's Function (CEC2017 f_{19})	1900
Hybrid Functions	5	Hybrid Function 1 (N = 3) (CEC 2014 F17)	1700
	6	Hybrid Function 2 (N = 4) (CEC 2017 F16)	1600
	7	Hybrid Function 3 (N = 5) (CEC 2014 F21)	2100
Composition Functions	8	Composition Function 1 (N = 3) (CEC 2017 F22)	2200
	9	Composition Function 2 (N = 4) (CEC 2017 F24)	2400
	10	Composition Function 3 (N = 5) (CEC 2017 F25)	2500
Search range: $[-100,100]^D$			

A review for CEC2020 benchmark problems

3-*D* map for some of functions in CEC2020



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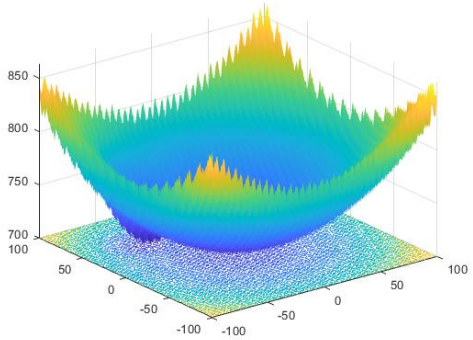

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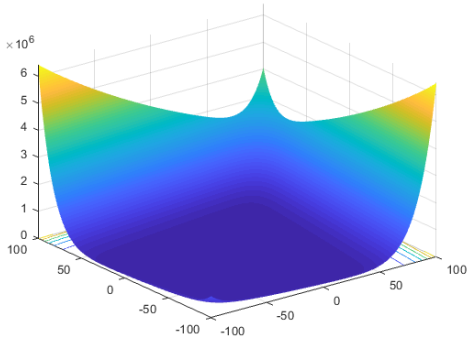

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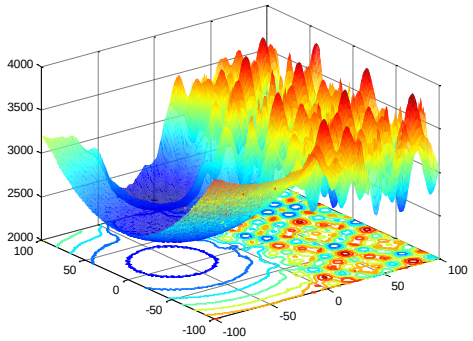

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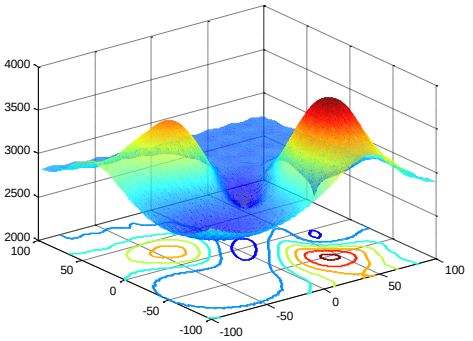

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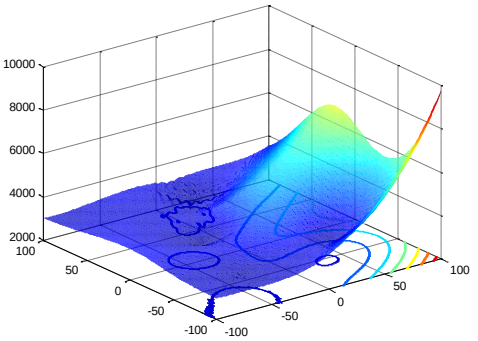

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Accepted Algorithms

	Paper ID	Algorithm	Paper Title
1	E-24139	CSsin	Improving Cuckoo Search: Incorporating Changes for CEC 2017 and CEC 2020 Benchmark Problems
2	E-24165	MP-EEH	A Multi-Population Exploration-only Exploitation-only Hybrid on CEC-2020 Single Objective Bound Constrained Problems
3	E-24355	RASP-SHADE	Ranked Archive Differential Evolution with Selective Pressure for CEC 2020 Numerical Optimization
4	E-24365	IMODE	Improved Multi-operator Differential Evolution Algorithm for Solving Unconstrained Problems
5	E-24380	DISH-XX	DISH–XX Solving CEC2020 Single Objective Bound Constrained Numerical Optimization Benchmark

Accepted Algorithms

	Paper ID	Algorithm	Paper Title
6	E-24505	AGSK	Evaluating the Performance of Adaptive Gaining-Sharing Knowledge Based Algorithm on CEC 2020 Benchmark Problems
7	E-24518	j2020	Differential Evolution Algorithm for Single Objective Bound-Constrained Optimization: Algorithm j2020
8	E-24559	jDE100e	Eigenvector Crossover in jDE100 Algorithm
9	E-24597	OLSHADE	Large Initial Population and Neighborhood Search incoporated in LSHADE to solve CEC2020 Benchmark Problems
10	E-24623	mpmL-SHADE	Multi-population Modified L-SHADE for Single Objective Bound Constrained Optimization
11	GECCO	SOMA_CL	SOMA-CL for Competition on Single Objective Bound Constrained Numerical Optimization Benchmark

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- **Evaluation criteria**
- Ranking result

Evaluation Criteria

SE: Summation of Errors → $Score_1$

$$SE = 0.1\sum_{i=1}^{8} ef_{5D} + 0.2\sum_{i=1}^{10} ef_{10D} + 0.3\sum_{i=1}^{10} ef_{15D} + 0.4\sum_{i=1}^{10} ef_{20D}$$

$$Score_1 = \left(1 - \frac{SE - SE_{\min}}{SE}\right) \times 50$$

SR: Summation of Rankings → $Score_2$

$$SR = 0.1\sum_{i=1}^{8} rank_{5D} + 0.2\sum_{i=1}^{10} rank_{10D} + 0.3\sum_{i=1}^{10} rank_{15D} + 0.4\sum_{i=1}^{10} rank_{20D}$$

$$Score_2 = \left(1 - \frac{SR - SR_{\min}}{SR}\right) \times 50$$

$Score = Score_1 + Score_2$

The evaluation method is based on the final score ranging from 1 to 100. Higher weights are given for higher dimensions.

Contents

- Introduction
- Test problems suite
- Indicators and rules
- Participators
- Comparison method
- **Ranking result**

Ranking Result

Final Ranking of the accepted algorithms

Algorithm	$Score_1$	$Score_2$	Score	Ranking
CSsin	6.78E-06	29.16667	29.16667	11
MP-EEH	30.57321	25.07622	55.64943	9
RASP-SHADE	33.53738	33.2996	66.83698	6
IMODE	50	50	100	1
DISH-XX	27.02844	23.63506	50.6635	10
AGSK	46.24309	48.38235	94.62544	2
j2020	43.74743	45.94972	89.69715	3
jDE100e	33.23064	38.52459	71.75523	5
OLSHADE	48.74519	30.57621	79.32139	4
mpmL-SHADE	30.55587	34.92569	65.48156	7
SOMA_CL	30.78516	25.50388	56.28903	8

Thanks for your attention!