Report for Cross Entropy Method on different test functions*

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October 2020

As observing the results given from Table 1a to Table 5b, we could realize that Cross Entropy Method's family using in this case has a common characteristic which is the destabilization of the algorithm itself. In details, in spite of solving the same problem in an identical population size, both CEM and CEMv2 gave out a chaotic result: sometimes it could find the true (or nearly true) global minimum but sometimes in different seed number of the same case, the result is rather far from the previous results, which leads to the high standard deviation of the algorithms solutions. Additionally, another similarity of both CEM versions is that larger problem size often means more precise solution and this could be observed by watching the results' trends throughout a typical case of a certain objective function.

On the other hand, CEM seems to solve the problem faster but with a worse result, while CEMv2 solves the problem more accurate but with a slower time and more computational operations.

Hence, we could not jump into conclusion of whether which is better than which in an overall aspect but in a certain trade-off situation might do.

Link to my gif file is here

popsize N/λ	CEM	CEMv2
32	0.7 ± 1.1	0.01 ± 0.01
64	0.26 ± 0.4	0.01 ± 0.01
128	0.23 ± 0.4	0.01 ± 0.0
256	0.19 ± 0.3	0.01 ± 0.0
512	0.12 ± 0.13	0.01 ± 0.0
1024	0.21 ± 0.2	0.02 ± 0.0

(a)

popsize N/λ	CEM	CEMv2
32	4.58 ± 2.4	1.66 ± 1.0
64	3.72 ± 1.6	0.84 ± 0.6
128	4.4 ± 1.5	0.62 ± 0.4
256	3.34 ± 2.0	0.61 ± 0.3
512	3.05 ± 1.4	0.55 ± 0.2
1024	2.84 ± 0.6	0.46 ± 0.1

(b)

Table 1: Statistics on solution given by 2 different Cross Entropy Methods on Sphere function with 2 dimensions (a) and 10 dimensions (b)

popsize N/λ	CEM	CEMv2
32	10.17 ± 5.9	21.04 ± 27.2
64	6.0 ± 4.8	2.69 ± 1.1
128	11.74 ± 6.3	2.82 ± 0.8
256	9.18 ± 5.8	3.07 ± 0.6
512	8.49 ± 6.6	3.10 ± 0.8
1024	5.72 ± 6.9	3.18 ± 0.9

(a)

popsize N/λ	CEM	CEMv2
32	610.97 ± 499.5	721.07 ± 401.7
64	70.71 ± 13.9	1019.0 ± 390.4
128	77.09 ± 11.5	153.30 ± 100.2
256	69.59 ± 9.8	126.22 ± 81.9
512	82.31 ± 11.9	90.39 ± 24.1
1024	81.19 ± 9.8	170.83 ± 179.7

(b)

Table 2: Statistics on solution given by 2 different Cross Entropy Methods on Rastrigin function with 2 dimensions (a) and 10 dimensions (b)

*This is my report for CS410 - Neural network and Genetic Algorithms (Fall 2021) at University of Information Technology - Vietnam National University HCMC

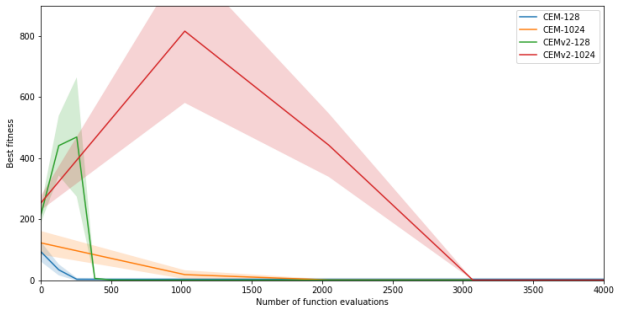

Figure 1: Sphere function with 2 dimensions

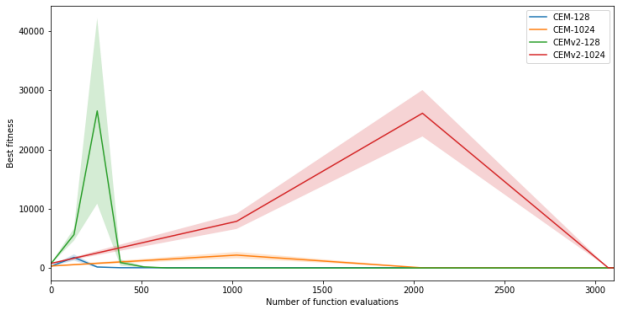

Figure 2: Sphere function with 10 dimensions

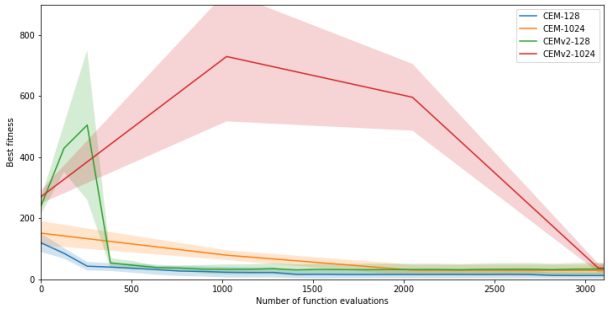

Figure 3: Rastrigin function with 2 dimensions

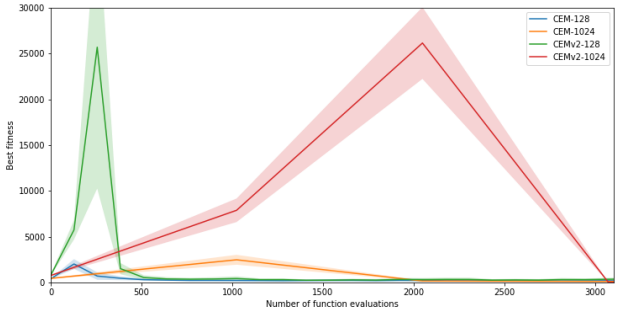

Figure 4: Rastrigin function with 10 dimensions

popsize N/λ	CEM	CEMv2
32	126.12 ± 127.6	7.5 ± 4.4
64	150.7 ± 150.2	7.89 ± 3.7
128	108.51 ± 95.2	7.99 ± 2.7
256	24.73 ± 32.6	8.36 ± 5.1
512	8.09 ± 21.7	6.87 ± 2.3
1024	1.86 ± 5.2	6.81 ± 1.3

(a)

popsize N/λ	CEM	CEMv2
32	446.1 ± 254.5	325.6 ± 175.7
64	873.4 ± 592.7	108.5 ± 41.7
128	565.6 ± 275.6	106.1 ± 57.0
256	503.36 ± 381.3	85.7 ± 29.7
512	428.43 ± 144.7	97.8 ± 43.2
1024	425.95 ± 203.8	98.9 ± 38.3

(b)

Table 3: Statistics on solution given by 2 different Cross Entropy Methods on Rosenbrock function with 2 dimensions (a) and 10 dimensions (b)

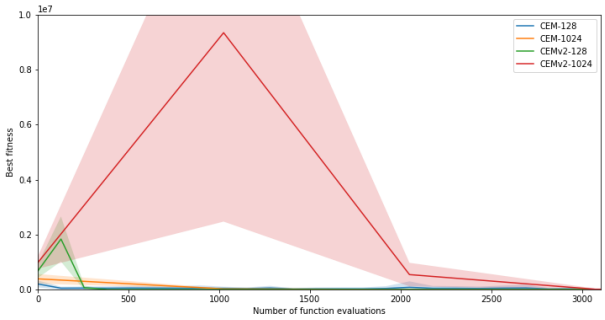

Figure 5: Rosenbrock function with 2 dimensions

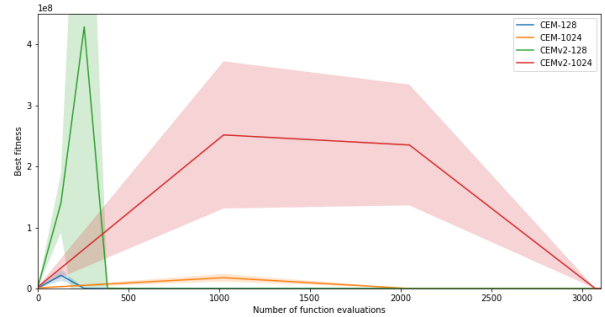

Figure 6: Rosenbrock function with 10 dimensions

popsize N/λ	CEM	CEMv2
32	174.94 ± 3.6	0.01 ± 0.0
64	176.26 ± 1.9	0.01 ± 0.0
128	176.14 ± 1.8	0.01 ± 0.0
256	174.19 ± 2.8	0.01 ± 0.0
512	173.02 ± 2.6	0.01 ± 0.0
1024	172.87 ± 2.3	0.02 ± 0.0

(a)

popsize N/λ	CEM	CEMv2
32	0.52 ± 0.2	0.23 ± 0.1
64	0.45 ± 0.2	0.12 ± 0.1
128	0.57 ± 0.2	0.10 ± 0.1
256	131.55 ± 169.2	0.10 ± 0.0
512	425.94 ± 149.0	0.09 ± 0.0
1024	599.25 ± 125.5	0.08 ± 0.0

(b)

Table 4: Statistics on solution given by 2 different Cross Entropy Methods on Griewank function with 2 dimensions (a) and 10 dimensions (b)

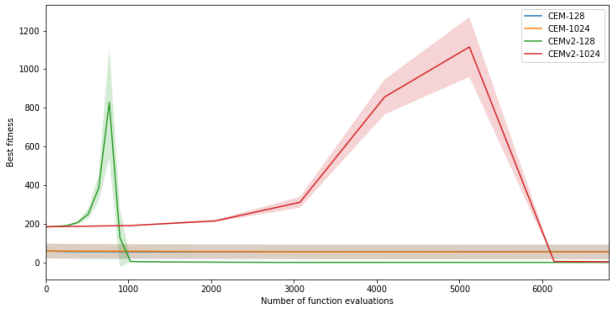

Figure 7: Griewank function with 2 dimensions

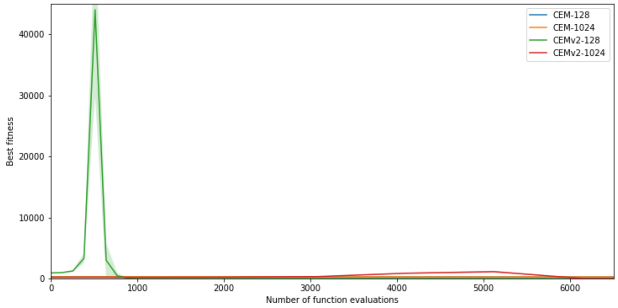

Figure 8: Griewank function with 10 dimensions

popsize N/λ	CEM	CEMv2
32	2.57 $\pm$ 1.6	3.84 $\pm$ 6.3
64	7.39 $\pm$ 6.3	2.71 $\pm$ 1.1
128	7.30 $\pm$ 6.4	2.22 $\pm$ 1.6
256	14.51 $\pm$ 7.3	1.91 $\pm$ 1.8
512	16.99 $\pm$ 5.3	2.11 $\pm$ 1.2
1024	20.35 $\pm$ 0.8	1.39 $\pm$ 1.0

(a)

popsize N/λ	CEM	CEMv2
32	22.05 $\pm$ 0.4	22.31 $\pm$ 0.0
64	21.93 $\pm$ 0.4	6.06 $\pm$ 5.4
128	21.43 $\pm$ 0.8	4.28 $\pm$ 0.7
256	20.82 $\pm$ 0.8	4.02 $\pm$ 1.0
512	20.54 $\pm$ 0.5	4.27 $\pm$ 0.4
1024	20.55 $\pm$ 0.4	4.18 $\pm$ 0.5

(b)

Table 5: Statistics on solution given by 2 different Cross Entropy Methods on Ackley function with 2 dimensions (a) and 10 dimensions (b)

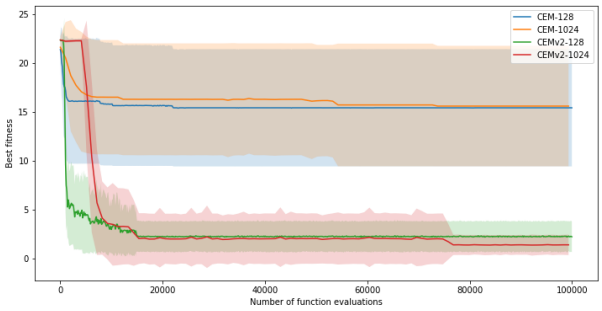

Figure 9: Ackley function with 2 dimensions

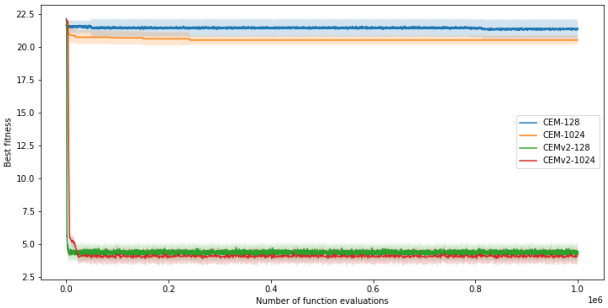

Figure 10: Ackley function with 10 dimensions