Report for Differential Evolution and Evolution Strategies on different test functions*

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On using Differential Evolution (DE) and Evolution Strategies on solving different objective functions, it is easily to consider that DE gives out a better solution with a smaller deviation compared to which ES does almost all the times (conclusion jumped into from Table 1a to Table 5b). And even in challenging cases such as Ackley function of 2 dimensions, ES does not converge to the global minimum at all despite the fact that DE could in huge population size case like more than 128.

In addition to results collected above, we could also analyze based on from Figure 1 to Figure 10. Differential Evolution often tends to have a better fitness with a shorter convergent time in comparison with that on Evolution Strategies regardless of increasing difficulties in different objective function or increasing population size within each test function.

Hence, we could conclude that in the case of using 5 different objective functions with 2 and 10 dimensions and population size of 32, 64, 128, 256, 512 and 1024, Different Evolution has a better performance than Evolution Strategies in all aspects.

Link to my gif file is here.

popsize N/λ	DE	ES
32	0 ± 0	0 ± 0
64	0 ± 0	0 ± 0
128	0 ± 0	0 ± 0
256	0 ± 0	0 ± 0
512	0 ± 0	0 ± 0
1024	0 ± 0	0 ± 0

(a)

popsize N/λ	DE	ES
32	0 ± 0	0 ± 0
64	0 ± 0	0 ± 0
128	0 ± 0	0 ± 0
256	0 ± 0	0 ± 0
512	0 ± 0	0 ± 0
1024	0 ± 0	0 ± 0

(b)

Table 1: Statistics on solution given by Differential Evolution and Evolution Strategies on Sphere function with 2 dimensions (a) and 10 dimensions (b)

popsize N/λ	DE	ES
32	0 ± 0	3.38 ± 3.6
64	0 ± 0	0.9 ± 0.8
128	0 ± 0	0.3 ± 0.5
256	0 ± 0	0 ± 0
512	0 ± 0	0 ± 0
1024	0 ± 0	0 ± 0

(a)

popsize N/λ	DE	ES
32	0 ± 0	62.58 ± 21.9
64	0 ± 0	55.12 ± 18.9
128	0 ± 0	44.18 ± 21.7
256	0 ± 0	38.4 ± 20.2
512	7.41 ± 0.8	32.93 ± 11.1
1024	11.53 ± 1.5	25.97 ± 9.0

(b)

Table 2: Statistics on solution given by Differential Evolution and Evolution Strategies 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

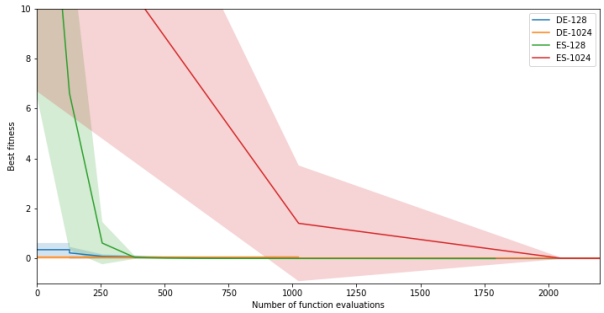

Figure 1: Sphere function with 2 dimensions

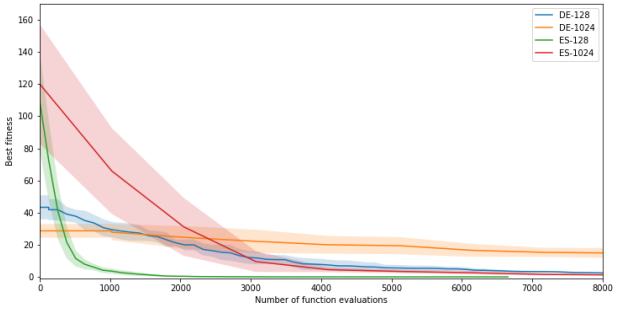

Figure 2: Sphere function with 10 dimensions

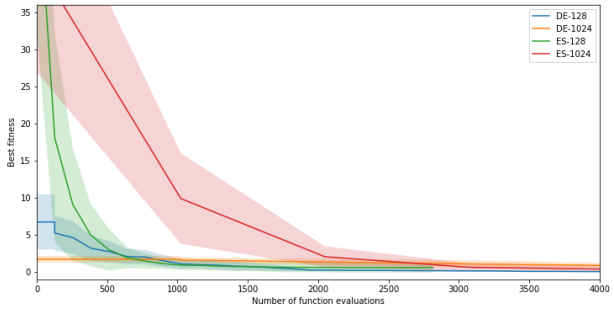

Figure 3: Rastrigin function with 2 dimensions

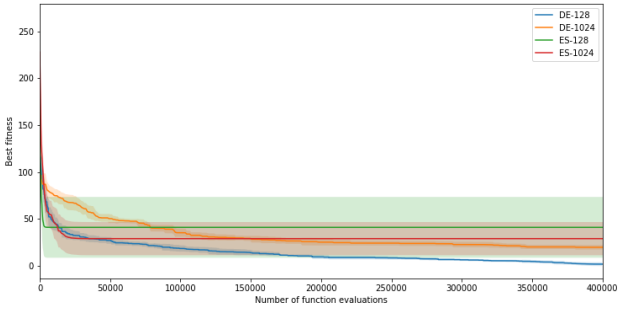

Figure 4: Rastrigin function with 10 dimensions

popsize N/λ	DE	ES
32	0 ± 0	0 ± 0
64	0 ± 0	0 ± 0
128	0 ± 0	0 ± 0
256	0 ± 0	0 ± 0
512	0 ± 0	0 ± 0
1024	0 ± 0	0 ± 0

(a)

popsize N/λ	DE	ES
32	0 ± 0	1.2 ± 1.8
64	0 ± 0	0.4 ± 1.2
128	0 ± 0	0.4 ± 1.2
256	0 ± 0	0.8 ± 1.6
512	0 ± 0	2.0 ± 2.0
1024	0.23 ± 0.03	0.8 ± 1.6

(b)

Table 3: Statistics on solution given by Differential Evolution and Evolution Strategies on Rosenbrock function with 2 dimensions (a) and 10 dimensions (b)

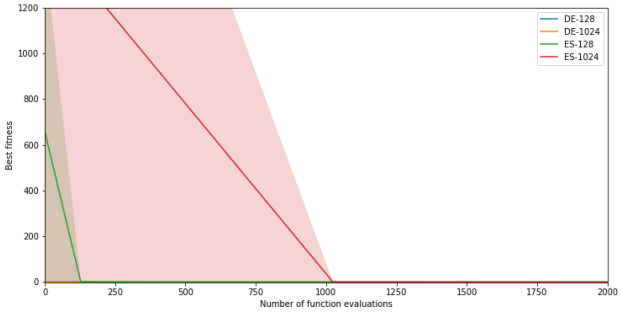

Figure 5: Rosenbrock function with 2 dimensions

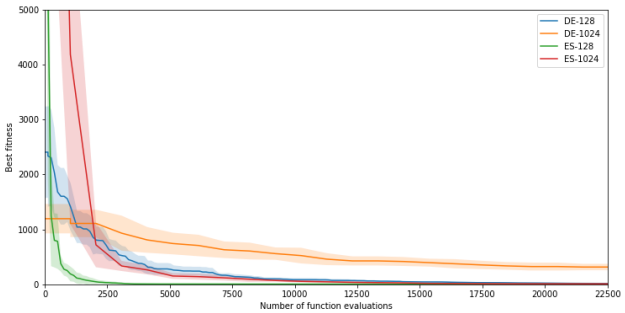

Figure 6: Rosenbrock function with 10 dimensions

popsize N/λ	DE	ES
32	0.002 ± 0.0	40.45 ± 34.3
64	0 ± 0	22.25 ± 30.1
128	0 ± 0	24.03 ± 27.5
256	0 ± 0	31.91 ± 31.91
512	0 ± 0	4.02 ± 8.3
1024	0.0 ± 0.0	4.59 ± 13.8

(a)

popsize N/λ	DE	ES
32	0.0 ± 0.0	0.19 ± 0.1
64	0.0 ± 0.0	0.19 ± 0.1
128	0.07 ± 0.04	0.17 ± 0.1
256	0.15 ± 0.02	0.28 ± 0.1
512	0.2 ± 0.03	0.23 ± 0.1
1024	0.2 ± 0.02	0.27 ± 0.1

(b)

Table 4: Statistics on solution given by Differential Evolution and Evolution Strategies on Griewank function with 2 dimensions (a) and 10 dimensions (b)

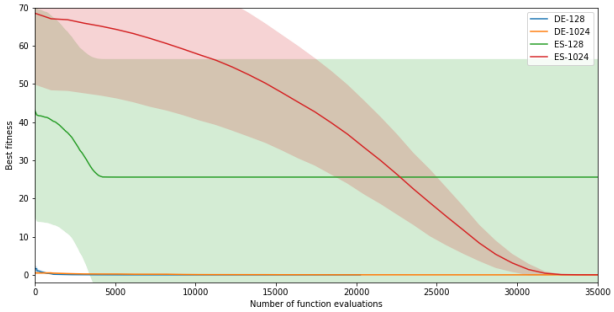

Figure 7: Griewank function with 2 dimensions

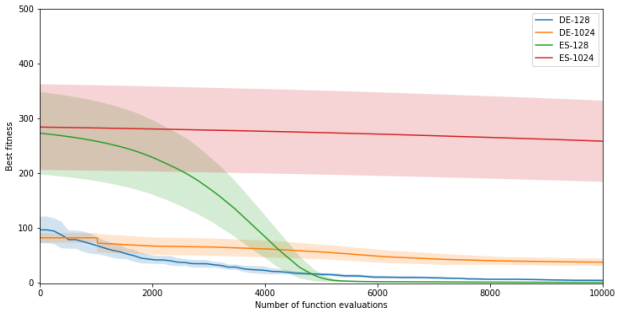

Figure 8: Griewank function with 10 dimensions

popsize N/λ	DE	ES
32	11.95 ± 9.8	20 ± 0.0
64	3.99 ± 8.0	20 ± 0.0
128	0.0 ± 0.0	20 ± 0.0
256	0.0 ± 0.0	20 ± 0.0
512	0.0 ± 0.0	20 ± 0.0
1024	0.0 ± 0.0	20 ± 0.0

(a)

popsize N/λ	DE	ES
32	19.98 ± 0.01	20.0 ± 0.0
64	19.98 ± 0.01	20.0 ± 0.0
128	19.97 ± 0.0	20.0 ± 0.0
256	19.97 ± 0.001	20.0 ± 0.0
512	19.97 ± 0.002	20.0 ± 0.0
1024	19.97 ± 0.003	20.0 ± 0.0

(b)

Table 5: Statistics on solution given by Differential Evolution and Evolution Strategies on Ackley function with 2 dimensions (a) and 10 dimensions (b)

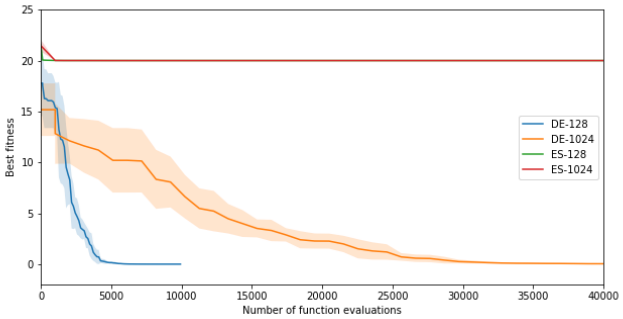

Figure 9: Ackley function with 2 dimensions

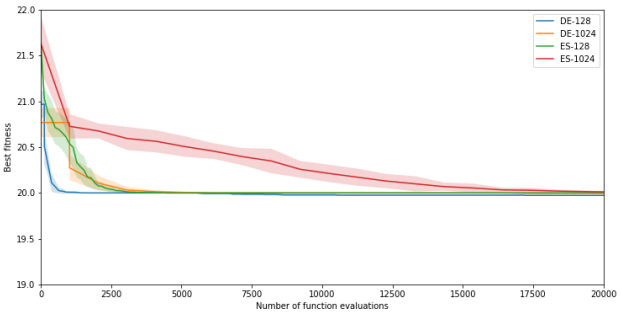

Figure 10: Ackley function with 10 dimensions