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Artificial Intelligence-13(II)

Contemporary Intelligent Information Technology (CIIT)

Function Minimization

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Task 1.

Minimize the function with 20 parameters ($x_1, x_2, \dots, x_{20}$) using two approaches:

$$y = (x_1)^2 + (x_2)^2 + (x_3)^2 + (x_4)^2 + \dots + (x_{20})^2 \quad [-1.1]$$

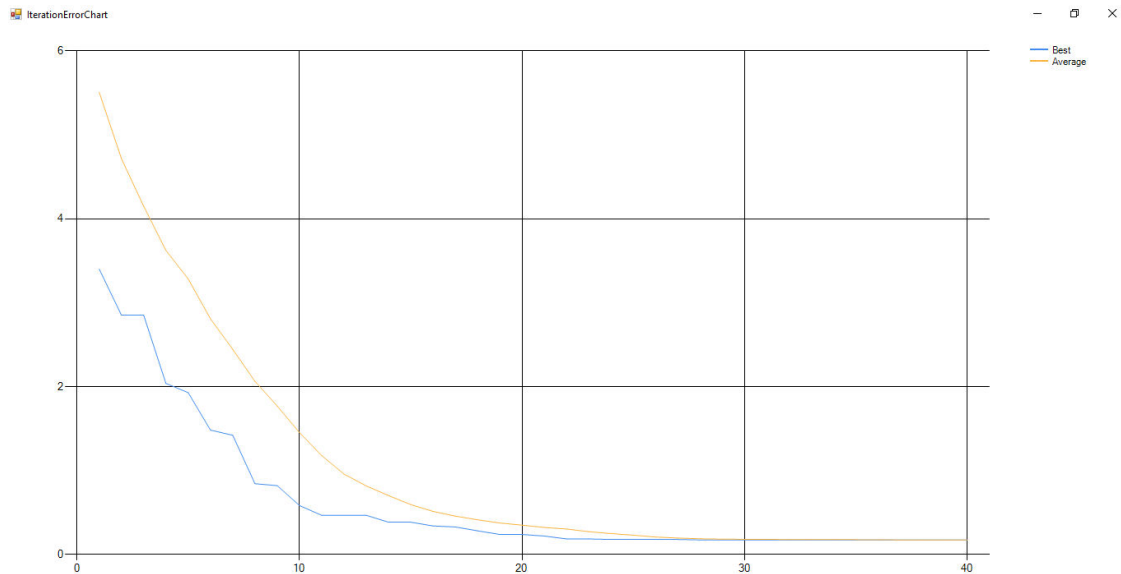
The 1st approach (GA with uniform crossover and without mutation):

population size - 100

gene size - 20

uniform crossover

Iteration number	Average fitness	The best fitness in generation
1	5.50791	3.40234
2	4.71611	2.85155
3	4.14939	2.85155
4	3.62301	2.03879
5	3.28295	1.92871
6	2.80878	1.4823
7	2.44397	1.42096
8	2.06275	0.843885
9	1.76964	0.820569
10	1.45259	0.58324
...	...	...
40	0.173165	0.173165



The **X** axis describes generation number, the **Y** axis describes fitness.

Blue line – the best fitness in generation

Orange line – average fitness

The 2nd approach (GA with uniform crossover and mutation):

population size - 100

gene size - 20

uniform crossover

mutation percentage - 1 %

Iteration number	The best fitness in generation	Average fitness
1	5.56108	3.09799
2	4.86921	3.09799
3	4.34332	2.51794
4	3.93627	2.51794
5	3.44404	1.92027
...	...	...
10	1.70577	0.901974
...	...	...
100	0.0619583	0.0378703
...	...	...
200	0.0288121	0.0120703
...	...	...
400	0.00892557	0.00589819
...	...	...
600	0.0264576	0.00292214
...	...	...
795	0.00920156	0.00107421
796	0.0107889	0.00103774

The **X** axis describes generation number, the **Y** axis describes fitness.

Blue line – the best fitness in generation

Orange line – average fitness

The method with mutation gave more accurate result but for more iterations.

Task 2.

Minimize the 2D function using two approaches:

$$y = 3 + x^2 + 3 \cdot \cos(2 \cdot \pi \cdot x) \quad [-1, 1]$$

The 1st approach (GA without mutation):

population size - 25

chromosome size - 11

uniform crossover

The **X** axis describes generation number, the **Y** axis describes fitness.

Blue line – the best fitness in generation

Orange line – average fitness

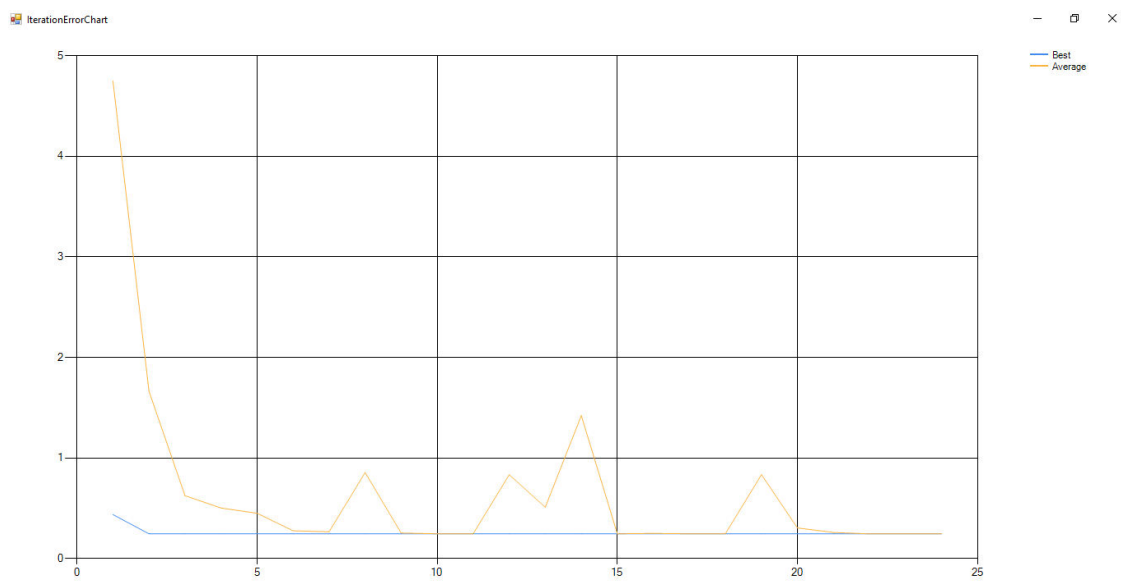
The 2nd approach (GA with mutation):

population size - 25

chromosome size - 11

uniform crossover

mutation chance - $1/25 = 0.04(4\%)$



The **X** axis describes generation number, the **Y** axis describes fitness.

Blue line – the best fitness in generation

Orange line – average fitness