

EARIN Lab 3 Report

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1 Exercise Variant 2 - "Rastrigin function"

Our task was to write a program that optimizes Rastrigin function:

$$f(x, y) = 20 + (x^2 - 10 \cos(2x)) + (y^2 - 10 \cos(2y))$$

Using Evolutionary Strategy (μ, λ) (later referred as $ES(\mu, \lambda)$)

2 Implementation

Program can be ran by installing python, moving to project directory and issuing command:

```
python main.py
```

There are 7 parameters we can (but do not have to) change:

1. Number of parents (default equal to 5)
2. Size of population (default equal to 20)
3. Mutation Strength (default equal to 0.1)
4. Number of generations (default equal to 100)
5. Minimal Value (default equal to -5.12)
6. Maximal Value (default equal to 5.12)
7. Number of outputs (default equal to 10)

Number of outputs are strictly for displaying results and does not influence the result itself

To set parameters values user can add those flags to program run:

```

-nop --number_of_parents [number]
-sop --size_of_population [number]
-ms --mutation_strength [number]
-nog --number_of_generations [number]
-min --min_value [number]
-max --max_value [number]
-noo --number_of_outputs [number]

```

Order of those parameters does not matter, user can provide none, one, or any number of arguments

Exemplary use (settings all values to default values):

```

python main.py -nop 5 -sop 20 -s 0.1
-i 100 -min -5.12 -max 5.12 -noo 10

```

There are additional flags for quality of life with the program

```

-nd --no_display (If used will NOT print out the plots)
-s --save (If used WILL save plot files to code folder)

```

To print help info about program user can issue help flag:

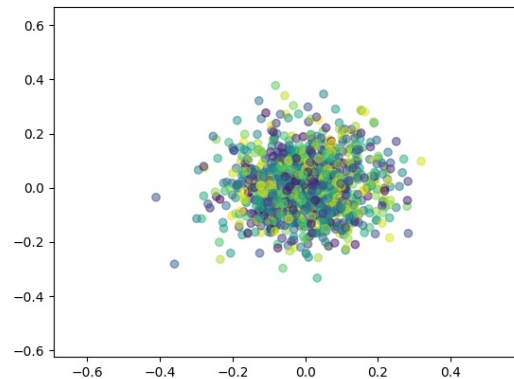
```

python main.py -h

```

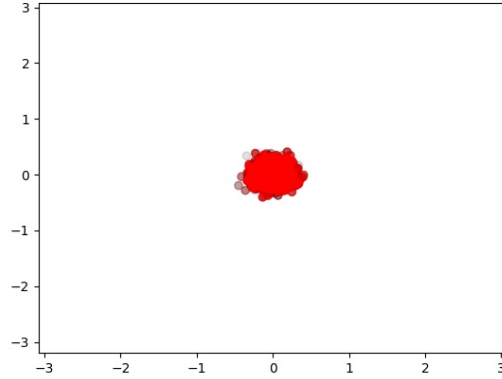
Results will be displayed on 2D scatter plot. There will be as many outputs as user wanted with incrementation of generation so that the final plot will be on final generation

Figure 1: Exemplary plot halfway through generation with parameters nop 250 sop 1000 ms 0.1 nog 500 min max (-5.12, 5.12) noo 10



At the end summary of results on plot will display with red gradient showing results from the earliest (white) to latest (bright red)

Figure 2: Exemplary summary plot with parameters
nop 250 sop 1000 ms 0.1 nog 500 min max (-5.12, 5.12) noo 10



Results will be displayed and if user requested saved in the same folder as code directory for further inspection, with file name containing information about input parameters

3 Results

We have successfully implemented $ES(\mu, \lambda)$ to optimize Rastrigin function
Rastrigin function is used to test optimization algorithms as it contains a lot of local minima