Universiteit Leiden
The Netherlands

Practical Assignment Part2

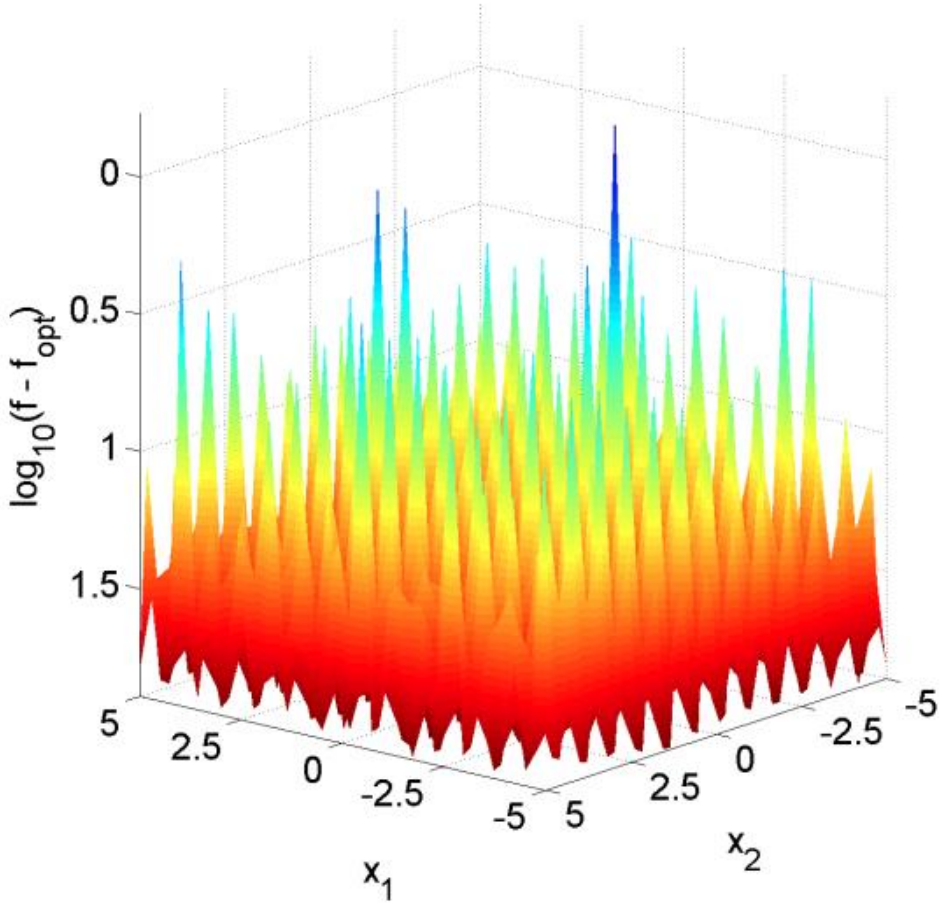
Evolutionary Algorithm Course, LIACS

Solving the F23 problem from the *Black-box Optimization Benchmarking (BBOB)* problem set using Evolution Strategy

F23: Katsuura Problem

$$f_{23}(\mathbf{x}) = \frac{10}{D^2} \prod_{i=1}^{D} \left(1 + i \sum_{j=1}^{32} \frac{|2^j z_i - [2^j z_i]|}{2^j} \right)^{10/D^{1.2}} - \frac{10}{D^2} + f_{\text{pen}}(\mathbf{x}) + f_{\text{opt}}$$

- $\mathbf{z} = \mathbf{Q}\Lambda^{100}\mathbf{R}(\mathbf{x} - \mathbf{x}^{\text{opt}})$



1. Finck, S., Hansen, N., Ros, R., & Auger, A. (2010). *Real-parameter black-box optimization benchmarking 2009: Presentation of the noiseless functions* . Technical Report 2009/20, Research Center PPE, 2009. Updated February.
2. de Nobel, J., Ye, F., Vermetten, D., Wang, H., Doerr, C., & Bäck, T. (2024). Iohexperimenter: Benchmarking platform for iterative optimization heuristics. *Evolutionary Computation* , 1-6.

Requirements and Details

Requirements

- Implement a Evolution Strategy (ES) to solve the F23 problem of Black-box Optimization Benchmarking (BBOB) problem.
  - We set the search dimension to 10 for F23.

- Submit the code of ES, '*studentnumber1_studentnumber2_ES.py*'.

Requirements

- Additional files of other functions are allowed. However, we will only execute the ES code.
- You can choose any ES version taught in the class.
- Submit the report introducing your algorithm and presenting the experimental results (One report includes both part1 and part2 practical assignment).
- Set a fixed random seed in the implementation to obtain the same results as those in the report by running the submitted codes.
- Goal: we want to get good performance upon **5,0000 function evaluations on this problem.**
- ES is random: we will execute it for **20** independent runs and take an aggregated performance value.

General Info

- How to evaluate your PA?
  - Following the guidelines (10%)
    - You will get a full score if you follow all the guidelines
  - Experimental Results (45%)
    - If your code reproduces the results in the report.
  - Report (45%)
    - Based on the presentation of the design of algorithms, experimental settings, and discussion about the results.
- Other:
  - Plagiarism check: if the report copies more than 30%, the PA grade is 0.
  - If the results in your report do not match the results we obtain from using your codes, the PA grade is 0.
  - If the results of your algorithms rank top 2 among all teams, you will get a 0.5 bonus for the **final grade**.
  - Submission ddl: December 20th.

Usage of IOHanalyzer

- GUI: https://iohanalyzer.liacs.nl
- GitHub project: https://github.com/IOHprofiler/IOHanalyzer . You can also install a local version following the tutorial on the git page.
- Paper: https://dl.acm.org/doi/full/10.1145/3510426

What to report

- Description of the Evolution Strategy
  - Introduce the operators and the parameter setting that you suggest.
- Report the average best-found fitness f(x) of **20 independent runs**
- Report the AUC values
- The empirical analysis of your algorithms' performance using ERT and ECDF curves
- Any other details/results you wish to include