Event-driven multi-population optimization: mixing Swarm and Evolutionary strategies

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ABSTRACT

Recently, in the field of nature-inspired optimization, researchers have proposed multi-population asynchronous algorithms that distribute the evolutionary process among heterogeneous seach paradigms.These algorithms execute the seach strategy by taking streams of populations from message queues, and replacing them with evolved populations. Moreover, current studies suggest that having a high number of populations interacting in parallel, the effect of the individual parameters of each population is compensated by those selected in other populations improving the performance of the algorithm. In this work, we propose a simple reactive migration method for the asynchronous execution of multi-population, multi-strategy algorithms that improves over homogeneous configurations. We evaluate this method by comparing between homogeneous and an ensemble of multi-populations, using Genetic Algorithms (GAs) and Particle Swarm Optimization (PSO) in the noisless BBOB testbed for the optimization of continuous functions. Results show, that this method offers better performance, even when compared with other asynchronous population based algorithms.

CCS CONCEPTS

• **Computer systems organization** → **Embedded systems**; *Redundancy*; Robotics; • **Networks** → Network reliability;

KEYWORDS

ACM proceedings, LaTeX, text tagging

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1 INTRODUCTION

The *proceedings* are the records of a conference.[1] ACM seeks to give these conference by-products a uniform, high-quality appearance. To do this, ACM has some rigid requirements for the format of the proceedings documents: there is a specified format (balanced double columns), a specified set of fonts (Arial or Helvetica and Times Roman) in certain specified sizes, a specified live area, centered on the page, specified size of margins, specified column width and gutter size.

*Dr. ANONYMOUS insisted his name be first.
[1] This is a footnote

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2 THE BODY OF THE PAPER

As was the case with tables, you may want a figure that spans two columns. To do this, and still to ensure proper "floating" placement of tables, use the environment **figure*** to enclose the figure and its caption. And don't forget to end the environment with **figure***, not **figure**!

2.1 Experiment

Having a multi-population based algorithm can decrease the execution time because of the parallel execution of the evolution. But, having heterogeneous populations might enhance evolutionary search and needless evaluations than homogeneous systems; heterogeneous settings, if done right, increases the diversity of the whole population [1].

But this is a rule of thumb, and it will depend on the degree of heterogeneity, as well as on the algorithm itself. Some level of heterogeneity can be implemented by just changing the configuration parameters of each population, but in this case, we are interested in a heterogeneous search strategy. Therefore, in this experiment we compare a multi-population with only GA and PSO populations, versus an ensemble of GA and PSO algorithms. We tested on the first five functions of the BBOB testbed. We used ten populations and eight workers for the experiment and the same parameters as before.

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REFERENCES

[1] Lourdes Araujo, Juan J Merelo Guervós, Carlos Cotta, and Francisco Fernández de Vega. 2008. Multikulti algorithm: Migrating the most different genotypes in an island model. *arXiv preprint arXiv:0806.2843* (2008).

Table 1: Some Typical Commands

Command	A Number	Comments
`\author`	100	Author
`\table`	300	For tables
`\table*`	400	For wider tables

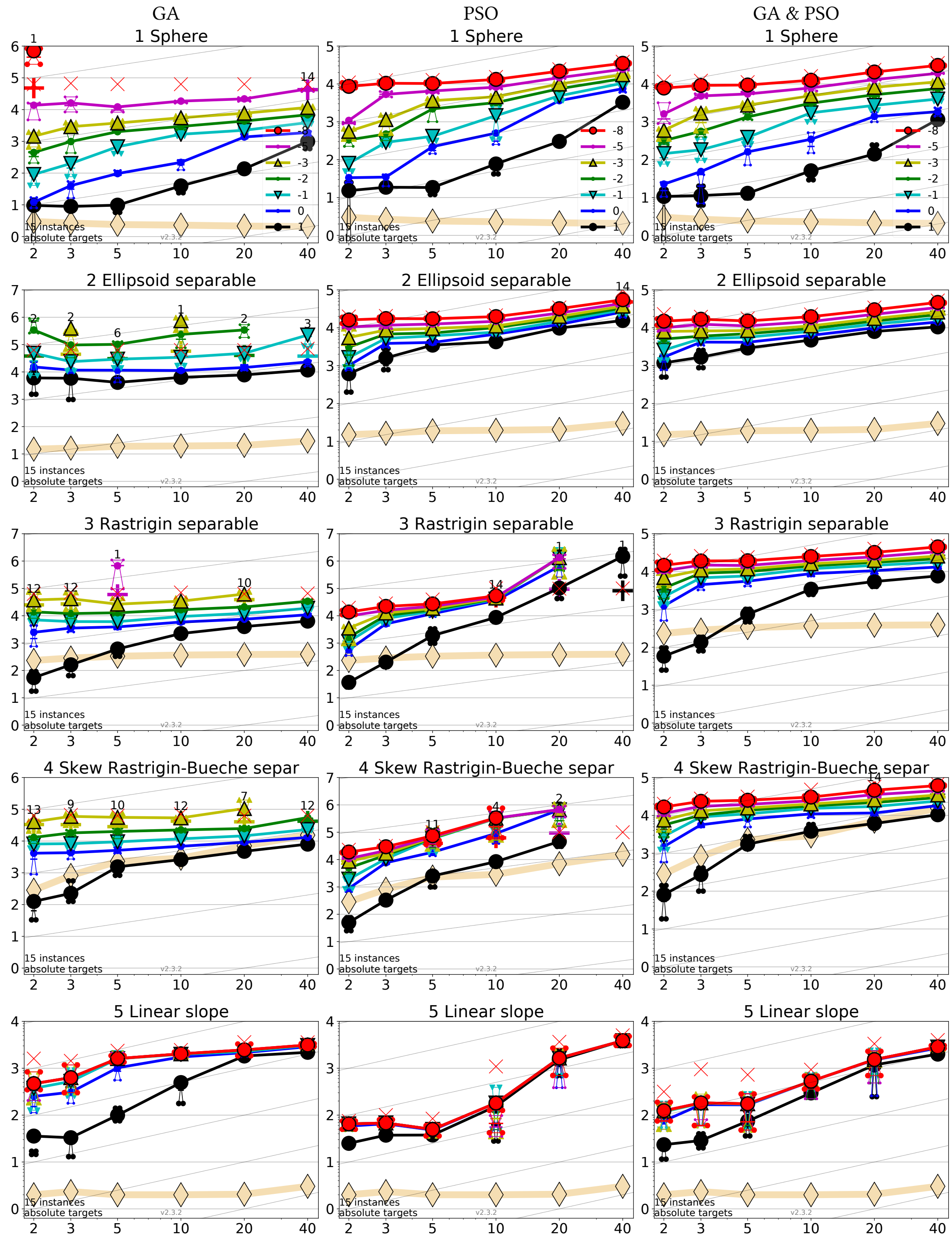

Figure 1: Scaling of runtime with dimension to reach certain target values Δf. Lines: average runtime (aRT); Cross (+): median runtime of successful runs to reach the most difficult target that was reached at least once (but not always); Cross (×): maximum number of f-evaluations in any trial. Notched boxes: interquartile range with median of simulated runs; All values are divided by dimension and plotted as log_{10} values versus dimension. Numbers above aRT-symbols (if appearing) indicate the number of trials reaching the respective target.

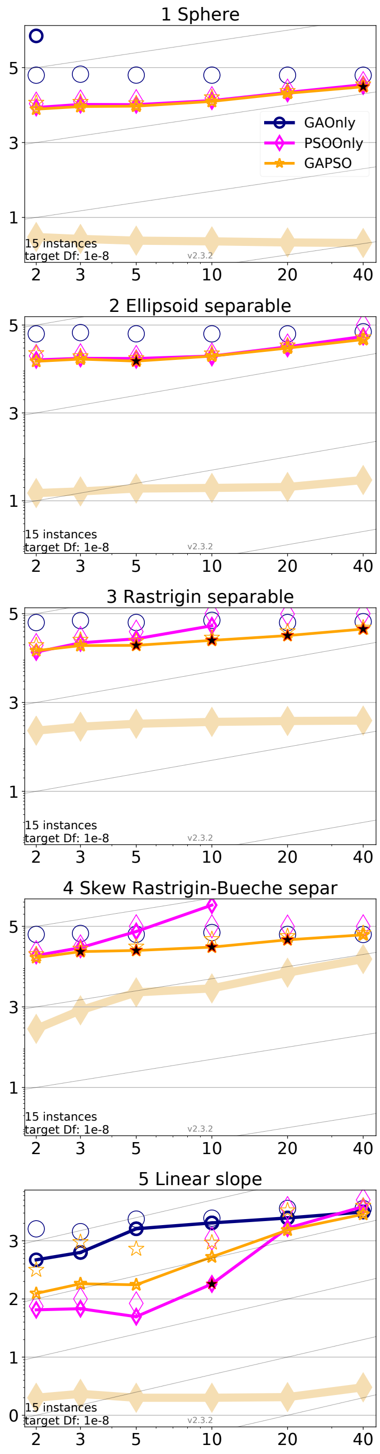

Figure 2: Average running time (in #FEs as log_{10} value), divided by dimension for target function value 10^{-8} vs dimension. Algorithms legends are given in f_1. Light symbols give the maximum number of function evaluations from the longest trial divided by dimension. Black stars indicate a statistically better result compared to all other algorithms ($p < 0.01$) and Bonferroni correction number of dimensions (six).