CEC 2017 Competition on Constrained Real-Parameter Optimization

Optimization for Computer Science

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Introduction

In real-world applications, most optimization problems contain constraints (ranging from physical, time, geometric, design etc.) which need to be satisfied while finding an optimal solution. However, the presence of constraints alters the shape of the search space making it difficult to solve. In the last few decades, stochastic search algorithms such as evolutionary algorithms have gained popularity due to their effectiveness in solving optimization problems. However, since evolutionary algorithms or most meta-heuristics naturally designed for unconstrained optimization problems require additional mechanisms to solve constrained optimization problems.

To evaluate and compare the performance of these different algorithms, different benchmarks have been proposed in the context of competitions in international conferences.

This year, in the IEEE Congress on Evolutionary Computation (CEC), a competition with some novel benchmark functions will take place [1].

Co-evolutionary constraint decomposition algorithm (CCDA)

In some previous work, we proposed a novel approach to tackle such constrained optimization problems, referred to as the co-evolutionary constraint decomposition algorithm (CCDA) [2]. CCDA divides the original problem $\mathcal{P}$ into several sub-problems $\mathcal{P}_\rangle$ with $i \in \{1, ..., m\}$, m being the number of constraints. Each sub-problem is therefore a relaxation of $\mathcal{P}$. Figure 1 illustrates the decomposition mechanism which assigns each constraint to one and only one sub-population. The exchange of information is not performed at evaluation but during mating. Crossovers are realized between sub-populations while mutation operates only locally inside sub-populations.

The good performance of CCDA was demonstrated against state-of-the-art algorithms on 8 benchmarks from the literature.

Objective

- The main objective is to apply/adapt the CCDA to run on the CEC 2017 benchmarks;

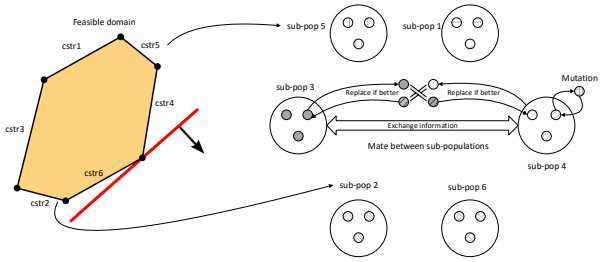

Figure 1: Constraint decomposition

- If results/time allows : submit results to to official competition in the IEEE CEC 2017 conference;

References

[1] Guohua Wu, R. Mallipeddi, P. N. Suganthan. *Problem Definitions and Evaluation Criteria for the CEC 2017 Competition on Constrained Real- Parameter Optimization*. Technical Report. 2017. `http://web.mysites.ntu.edu.sg/epnsugan/PublicSite/Shared%20Documents/CEC-2017/Constrained/Technical%20Report%20-%20CEC2017-%20Final.pdf`.

[2] Emmanuel Kieffer, Gregoire Danoy, Anass Nagih, Pascal Bouvry. *A new co-evolutionary algorithm based on constraint decomposition.*