Review of the presentation *“Adaptation Techniques for Scalarizing Functions in Decomposition-Based Multi-Objective Evolutionary Algorithms”*

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Abstract

Review of Miriam Pescador Rojas presentation titled *“Adaptation Techniques for Scalarizing Functions in Decomposition-Based Multi-Objective Evolutionary Algorithms”* as a part of *PhD seminar* class.

1 Review

A multi-objective optimization problem is a minimization or maximization of a set of functions that are in mutual conflict. An alternative to solve such problems is using techniques inspired in biological processes, e.g., evolutionary ones, which are interesting cases of this work.

These algorithms take a set of *input values* and generate a set of *output values* as a result of the execution of this algorithm. Thus, evolutionary algorithms aim to adjust their input values to get their best *performance*, i.e., they find the *optimal solution* with the lowest computational cost.

The *optimal solution* is a known function and it is called *Pareto’s front*. In such n-objectives problems, it is considered as the optimal solution an n-dimensional hyperplane. So, in 2-objetives problems, the optimal solution is frecuently represented with a line or a curve in the plane and that is known as its *Pareto’s front*.

The performance of any evolutionary algorithm requires indicators that measure its convergence, extension and uniformity of its results. Convergence means *how near* does the result cover the optimal solution. Extension means *how much along* does results cover the optimal solution. Finally, uniformity means *how uniform* does results cover the optimal solution.

Any evolutionary algorithm is repeatedly executed a finite number of times. According to its feedback between iterations, they can be classified in *on-line* and *out-of-line*. Those which their inputs depend on outputs of a set of previous iterations are called *on-line*. On the other hand, those whose inputs are independent of any iteration are called *out-of-line*.

Decomposition-based algorithms aim to take a multi-objective problem and transform it in a set of mono-objective problems. They use $\mathbb{R}^n \to \mathbb{R}$ functions, called *scalarization functions*. These functions work in a *collaborative* manner and their collaboration is defined by the algorithm.

This work focuses on decomposition-based algorithms. Among its contributions are an exhaustive review of weighted-scalarization functions reported. There were 32 functions found which were not used in evolutionary computation.

Another contribution is the implementation of these functions into a *programming library* developed in Miriam’s research group and their performance was proven. Also she found that in some specific functions it is required an unexpected input parameter.

This was not previously considered but it is also important. It is relevant on problems were their Pareto’s front is linear or convex kind.

2 Remarks

- Miriam's presentation addresses a specialized topic. I suggest her to prioritize designing her presentation in a scienfitic divulgation level, in order to achieve a general understanding that can reach people with basic computer science knowledge but evolutionary algorithm.

  Our seminar concentrates PhD students specialized who belong to diverse areas. I believe that if a speaker seeks that his/her audience understand his/her exposition, then he/she must use a simplified language, that is a good trade-off technical language, and avoiding specialized details in expectation of a general understanding. Anyway, if some specialized question is asked, then it can be particularly answered.