Standardizing Nature-Inspired Optimizers

A Master Thesis proposal

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Context: To solve optimization problems, we can use a wide set of different optimization heuristics. Many of these have been proposed over the years, often based on some kind of nature-inspired metaphor. This has led to a veritable zoo of different optimizers, from which nobody is quite sure which algorithms are useful and which are not.

The project: In order to enable a more systematic comparison between these different optimization methods, we will extract the core algorithmic components and represent them mathematically. In addition, we will implement them in a common structure, such that we can perform large-scale benchmarking. This will allow us to judge the algorithms based not only on their algorithmic ideas, but also on their ability to effectively solve different sets of optimization problems.

Related work: We base the selection of optimization algorithms to include on the bestiary of Evolutionary Computation, and will integrate the algorithms in our benchmarking environment of the IOHprofiler. This has previously been done during the course 'Natural Computing', so a starting point for a large set of algorithms is already available.

Summarized Project Goals:

We will formalize, implement and benchmark a large set of nature-inspired optimization algorithms. In particular, we want to achieve the following:

- A common pseudocode format, which allows us to clearly see the algorithmic ideas introduced in each algorithm.
- An implementation of the algorithm in Python, with an interface to the IOHprofiler for easy benchmarking. This should be done in a modular structure, so we can investigate individual algorithm components.
- A large-scale benchmark comparing these algorithm to the current state-of-the-art in continuous optimization

This project is also an ideal opportunity to publish, as we will aim to work with you to turn the results into a paper which we can submit to a conference.

This project is part of a collaboration with Carola Doerr at Sorbonne Université, Paris.

Contact:

If you are interested to work on this project or want to discuss anything related to this, feel free to contact me at d.l.vermetten@liacs.leidenuniv.nl