

Parameter Control in Evolutionary Algorithms

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<http://cw.felk.cvut.cz/doku.php/courses/a0m33eoa/start>

Algorithm Configuration: Motivation

Often, finding performance-optimizing **parameter configurations of heuristic algorithms requires considerable effort**. In many cases, this task is performed **manually in an ad-hoc way**.

Automating this task is of high practical relevance in several contexts:

- **Development of complex algorithms** - setting the parameters of a heuristic algorithm is a highly labour-intensive task, and indeed can consume a large fraction of overall development time. The use of automated algorithm configuration methods can lead to significant time savings and potentially achieve better results than manual, ad-hoc methods.
- **Empirical studies, evaluations, and comparisons of algorithms** - a central question in comparing heuristic algorithms is whether one algorithm outperforms another because it is fundamentally superior, or because its developers more successfully optimized its parameters. Automatic algorithm configuration methods can mitigate this problem of unfair comparisons and thus facilitate more meaningful comparative studies.
- **Practical use of algorithms** - the ability of complex heuristic algorithms to solve large and hard problem instances often depends critically on the use of suitable parameter settings. End users often have little or no knowledge about the impact of an algorithm's parameter settings on its performance, and thus simply use default settings. Automatic algorithm configuration methods can be used to improve performance in a principled and convenient way.

F-Race: Algorithm

$\Theta^* = \Theta_0, ni = 0$

repeat

randomly choose instance i from set I ; run all configurations on Θ^* on i

$ni = ni + 1$

if ($ni \geq ni_{min}$)

perform rank-based Friedman test on results for configurations in Θ^*
on all instances in I evaluated so far

if (test indicates significant performance differences)

$\theta^* =$ best configuration in Θ^* according to the statistical population parameter
over instances evaluated so far

for all $\theta \in \Theta^* \setminus \{\theta^*\}$ **do**

perform pairwise t-test on θ and θ^*

if (test indicates significant performance differences)

eliminate θ from Θ^*

end if

end for

end if

end if

until (termination condition)

return Θ^*

F-Race: Final Remarks

Good technique, but:

- not suited for applications with large configuration spaces;
- thus, mainly used for configuration problems with few parameters and rather small configuration spaces.