Commentary on:
"Developer Tools for Evaluating Multi-Objective Algorithms"
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Multi-objective algorithms are recognized to offer many features to the users of optimization algorithms. This is true also for solving problems in planning & scheduling.
A traditional way to implement multi-objective criteria is to define a min/max function as linear combination of weighted parameters. One significant limitation to this approach is the missing capability to explore the space of solutions with the tuning of the weights in one go. Pareto-surface do offer this opportunity and we have now algorithms for solving multi-objectives planning problems which are effective in building uniformly sampled approximation of the Pareto-surface.

The problem now being phased by the authors is to identify efficient techniques able to support user-friendly interpretation and comparison of Pareto-surfaces and to develop associated tools for the process. The proposed tools belong to the Multi-User Scheduling Environment (MUSE).

Techniques for Evaluating Pareto-surfaces

The use of the suggested binary evaluation functions that compare the quality of two Pareto-surfaces works if strict dominance of one surface respect the other exists. In real world most of the situations will be without strict dominance and therefore there is a necessity to explore formulations that help evaluating the Pareto-surfaces. Binary evaluation functions, E-indicator and F-indicator are being explored. They are being confronted with the visual information made available in X-Y plots. It is shown that the suggested metrics have difficulties to capture what intuition picks up from the graphs. Particularly difficult is to pick-up the best fitting between algorithms and individual objective criteria.

Tools for Evaluating Pareto-surface

Parallel coordinated plot have been demonstrated to be simpler to read and to interpret with respect to the traditional X-Y trade-off plots. However coordinated plot can become unreadable for an increased number of samples. More research is required to develop a technique that can easily interpret Pareto-surfaces with the minimal amount of information required, for instance by pre-selecting the most relevant portion of results.

Recommendations and Conclusions

The research presented in the paper is motivated by a strong need in providing mechanisms to easily explore, compare and evaluate multi-objective algorithm solutions in full, exploiting the Pareto-surface representation.

Users would need easy and intuitive tools to support the comparison of Pareto-surfaces and also to explore and select a solution out of a Pareto optimal frontier. The research needs further work to be done.

By searching in internet it seems the tackled problem is not limited to the planning & scheduling community for space missions.
Representing and visualizing Pareto-surfaces is, for instance, also addressed in other domains, such as multi-objective intensity modulated radiotherapy (IMRT) treatment planning. For this case a MATLAB-derived visual tool has been made available to the scientific community.
It is recommended to continue the research and possibly to use synergically the effort and the results made available by different research communities active on the subject.