Improvements to a decision-making algorithm

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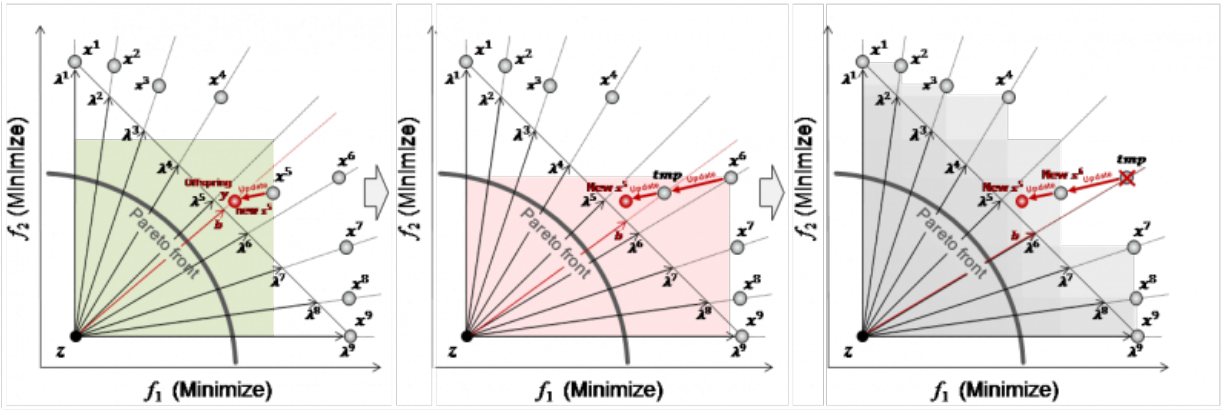

The chain-reaction update to effectively replace existing solutions for the search of the Pareto frontier. Hiroyuki Sato at the University of Electro-Communications in Tokyo, Japan, has made improvements to ability of the MOEA/D algorithm to search for the best solutions in multi- and many-objective decision-making problems. Credit: University of Electro-Communications

In fields such as engineering, economics or finance, highly complex decisions must be made, often incorporating multiple, at times contradictory, objectives. Highly specialised computer algorithms can help find the best possible solutions to these multi-objective problems (MOPs).

One such algorithm is MOEA/D (multi-objective evolutionary algorithm

based on decomposition), which works by decomposing MOPs into single 'sub-problems', before selecting and presenting an optimal set of possible solutions known as the 'Pareto frontier'. The Pareto frontier is useful to designers and engineers, for example, because it helps them make trade-offs that allow for the best solution to a MOP.

Now, Hiroyuki Sato at the University of Electro-Communications in Tokyo has made improvements to the way in which MOEA/D searches for this optimal set of solutions. The method, which is based upon a chain-reaction solution update, deliberately ignores duplicated solutions within a search, thus enhancing the diversity of the solution population during a search. It also determines the order of existing search solutions to be presented in any one objective space; it does not automatically delete a solution if another neighbouring solution is deemed better but rather allows the user to specify target areas of the Pareto frontier that need to be met.

Further, the chain-reaction solution update allows for existing solutions to be replaced, and it will automatically back-track to check for alternative search directions. Initial trials using the updated MOEA/D with 2-8 objectives showed improvements in its searching ability by enhancing solution diversity, although further investigations are needed into the computational costs of the proposed update.

More information: Hiroyuki Sato. Chain-reaction solution update in MOEA/D and its effects on multi- and many-objective optimization, *Soft Computing* (2016). DOI: 10.1007/s00500-016-2092-3

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