Approximating the Pareto Front for Decision Making with a Sub-Complex of the Delaunay Simplicial Complex

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Abstract

Shape reconstruction problem can be defined as the problem of finding a set in $\mathbb{R}^d$ that best approximates an unknown set $S \subset \mathbb{R}^d$. One approach to this is to construct a sub-complex of a Delaunay simplicial complex of a given finite set of points in S.

Approximating the Pareto front of a multiobjective optimization problem is a both theoretically and practically interesting problem. Previously we proposed a property called inherent nondominance for a Pareto front approximation. We argued that an inherently nondominated Pareto front approximation has certain desirable properties that make it a good tool for decision making.

Inherently nondominated Pareto front approximations can be constructed as a sub-complex of the Delaunay complex of a given set of Pareto optimal outcomes. Unfortunately, the existing approaches for constructing sub-complexes (e.g., the restricted Delaunay complex) do not apply because of the inherent nondominance property. For this reason we develop new approaches for constructing inherently nondominated sub-complexes.