Weight Vector Grid with New Archive Update Mechanism for Multi-Objective Optimization
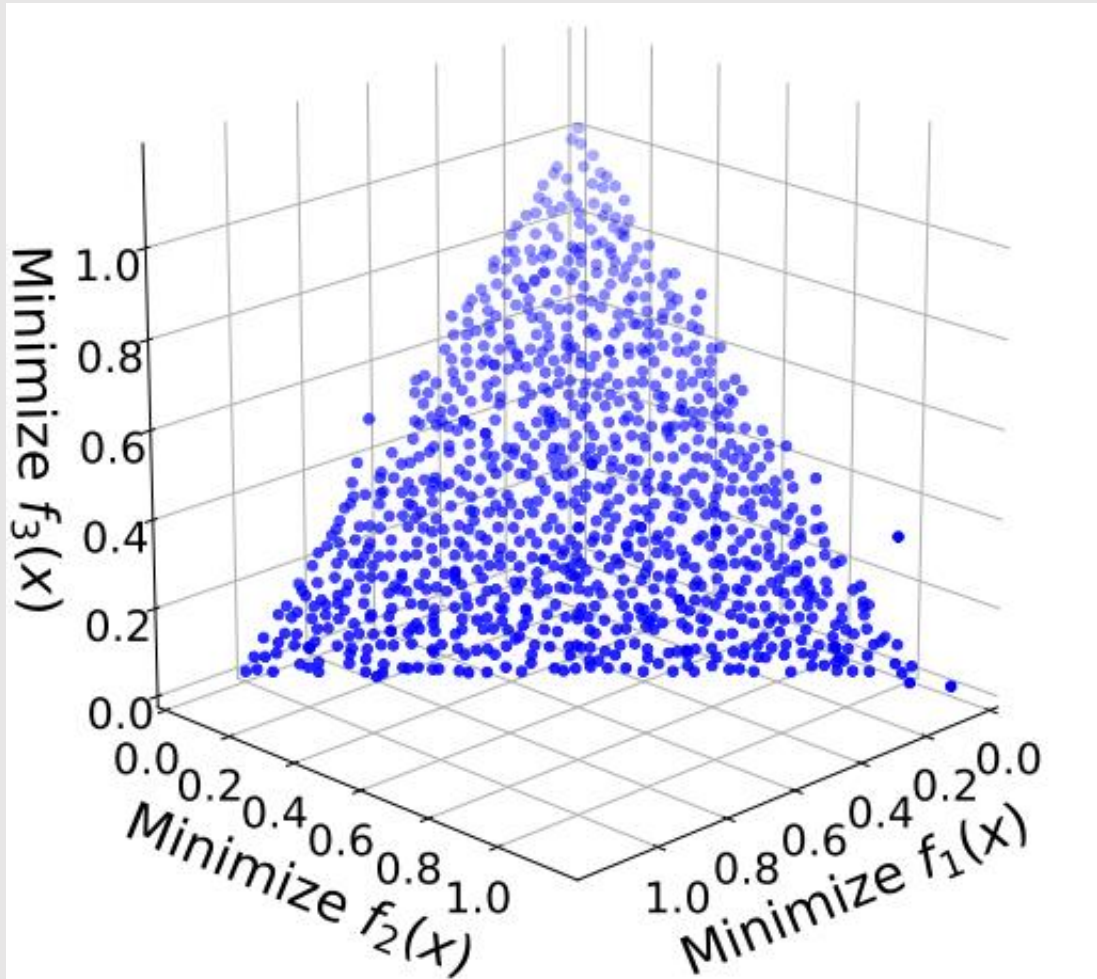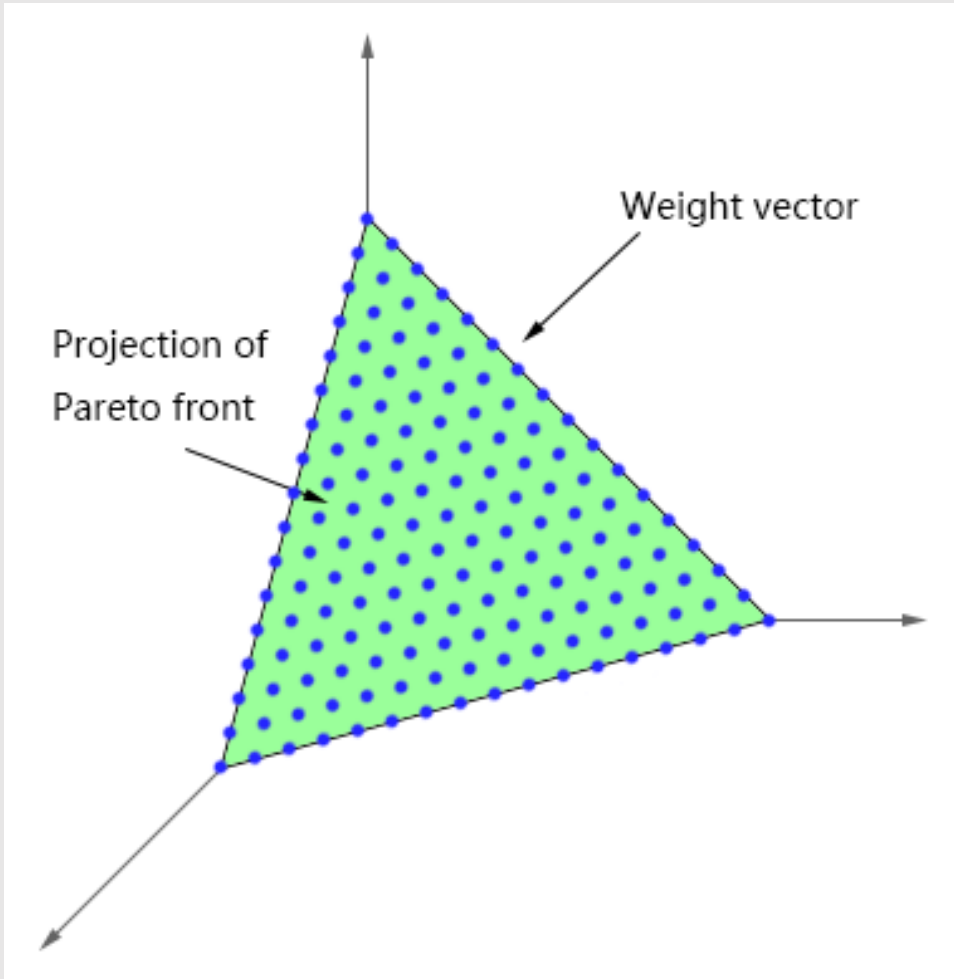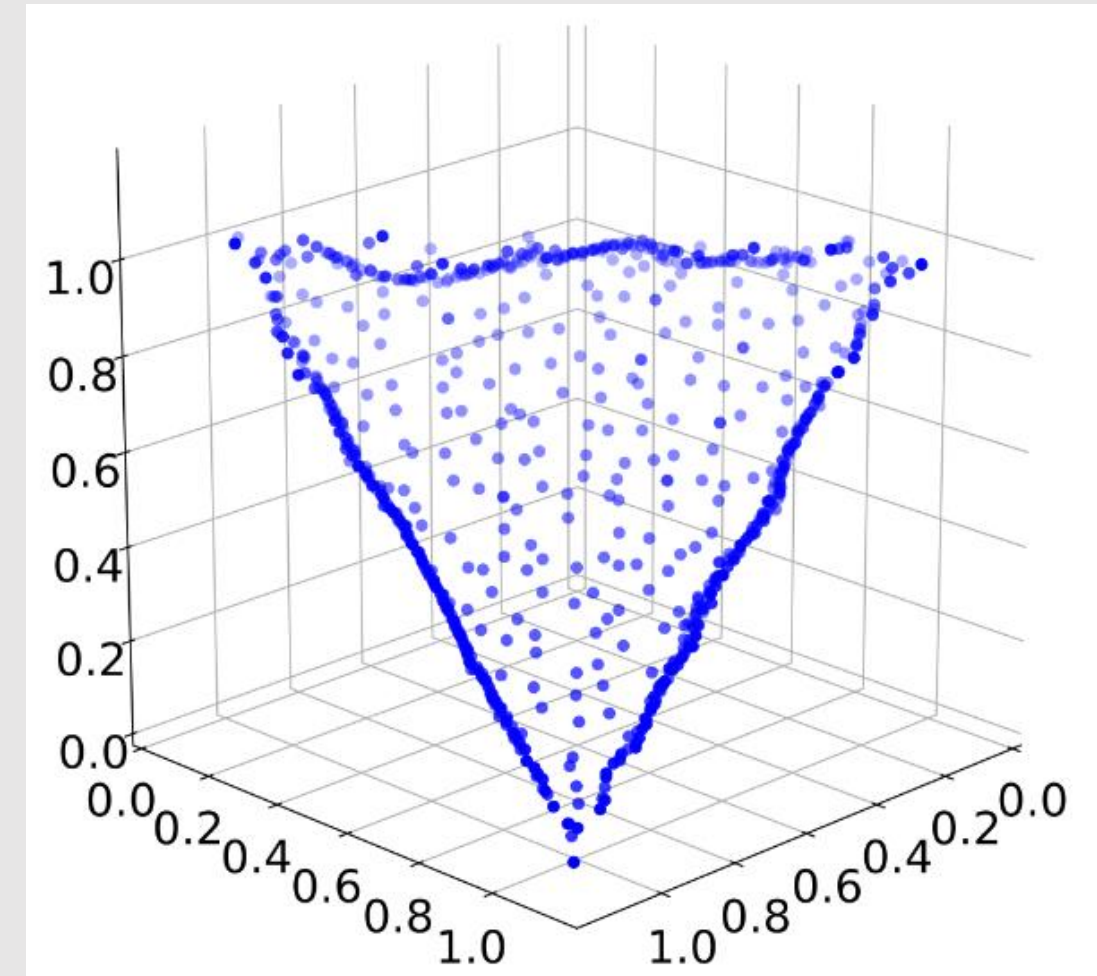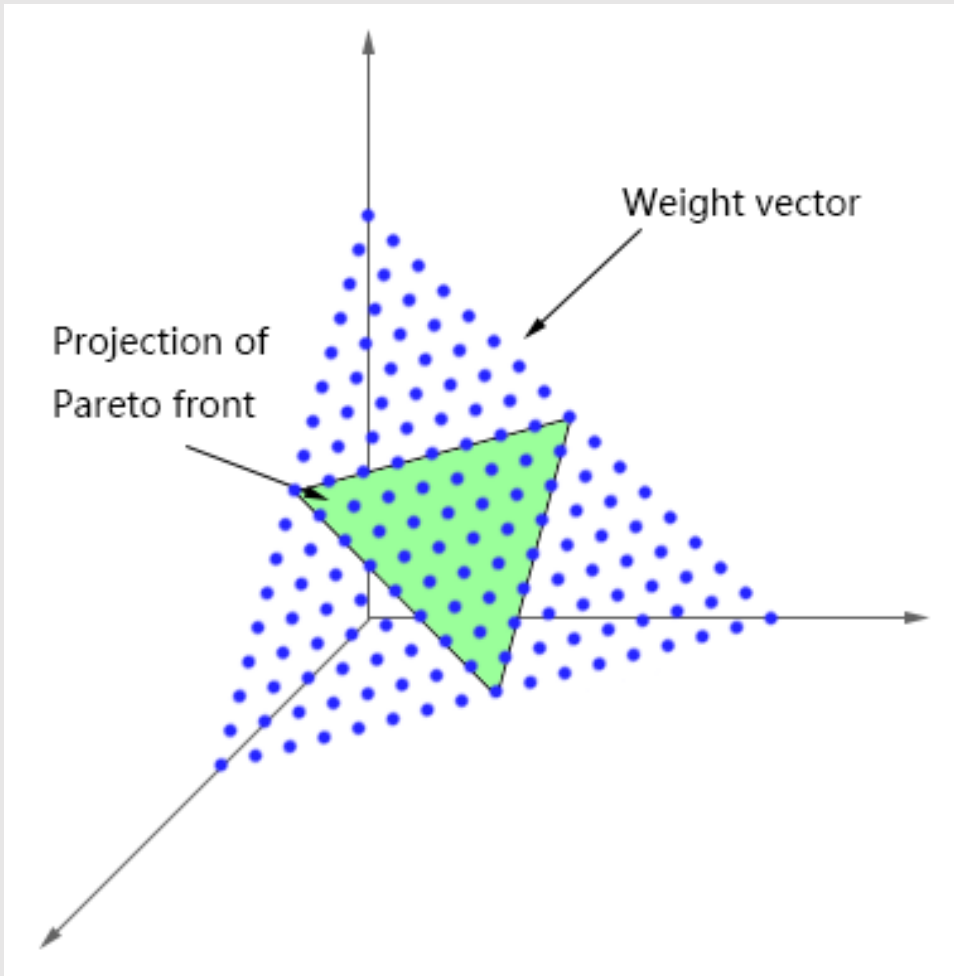
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Current Problem

When the shape of the Pareto front is inconsistent with the shape of the weight vector grid, the obtained solutions are not uniform over the entire Pareto front.


Consistent

Inconsistent

Proposed Idea

Use an uniformly distributed weight vector grid as an external archive. The size of the external archive should be 10 or 100 times larger than the population size. The size of the final solution set should be smaller than the size of the external archive.

Archive Update Procedure

Input: Archive AP, New Solution NS
Output: AP
1: Find the closest weight vector wv
2: If wv has a solution, compare the new solution NS with the current one using a scalarizing function f. Assign the better solution to wv and update AP
3: Else assign NS to wv and update AP
4: Return AP
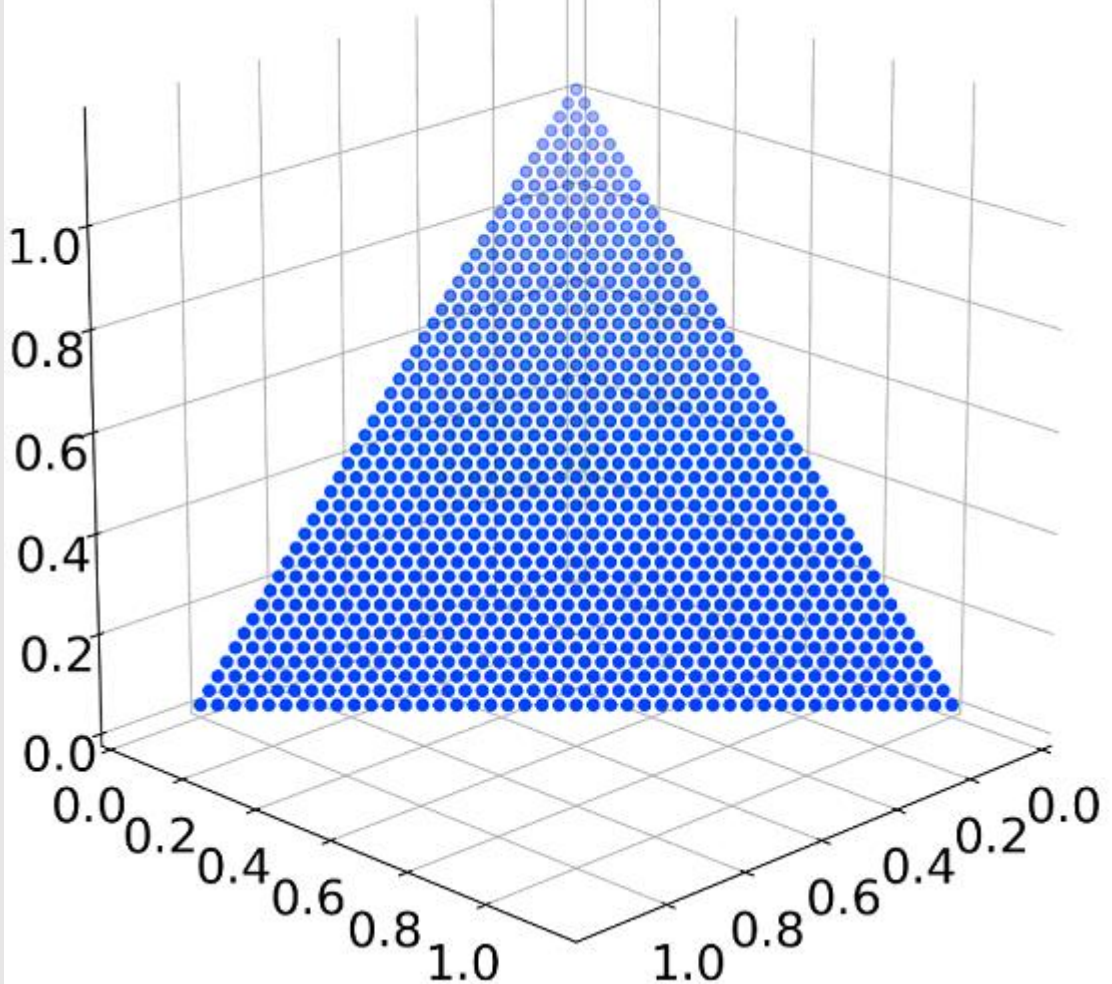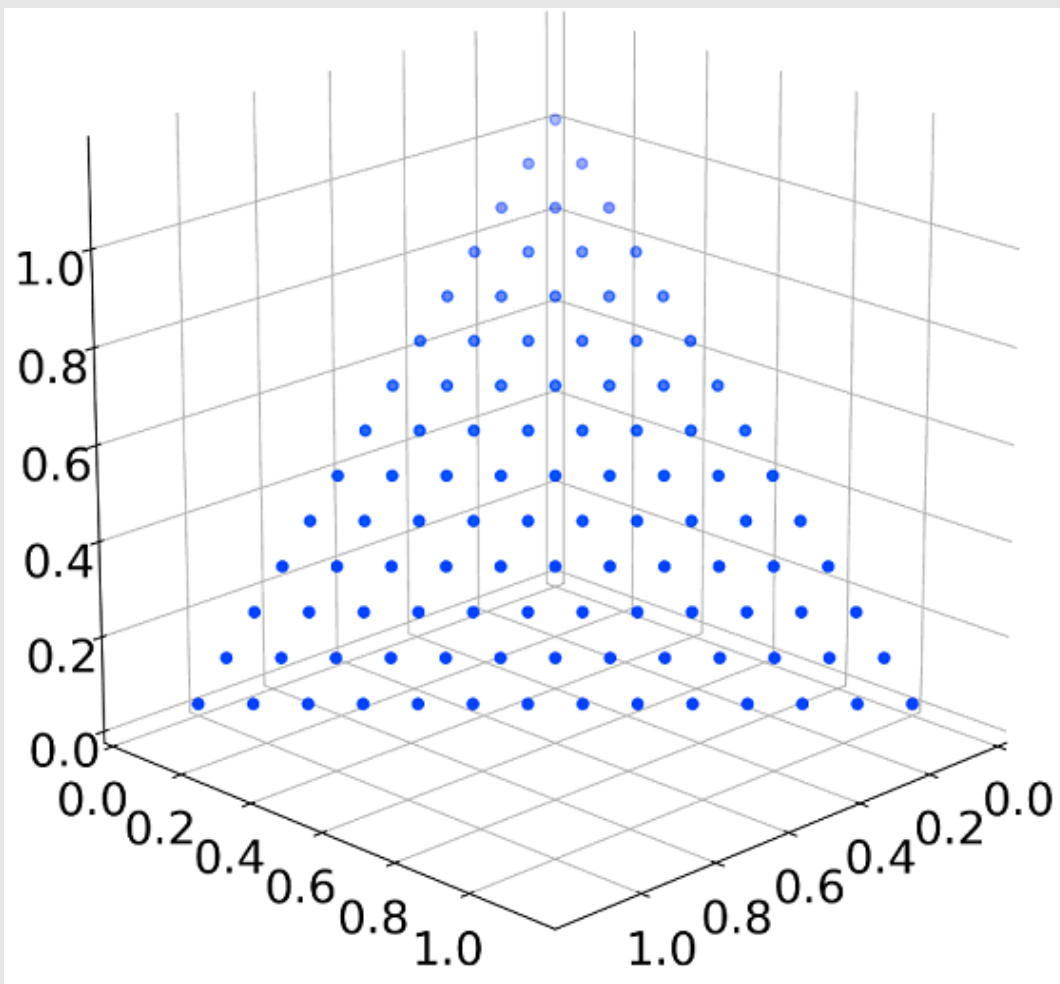
Weight Vector Grid

Experimental Result

Hypervolume				
Algorithm	DTLZ1	I-DTLZ1	DTLZ2BZ	Average
MOEA/D-WV[1]	1.1460	0.3081	0.5773	0.6771
MOEA/D-NA[2]	1.0628	0.2717	0.5660	0.6335
MOEA/D-BA[3]	1.1509	0.3169	0.5827	0.6835
MOEA/D-DB[4]	1.1509	0.3169	0.5827	0.6835

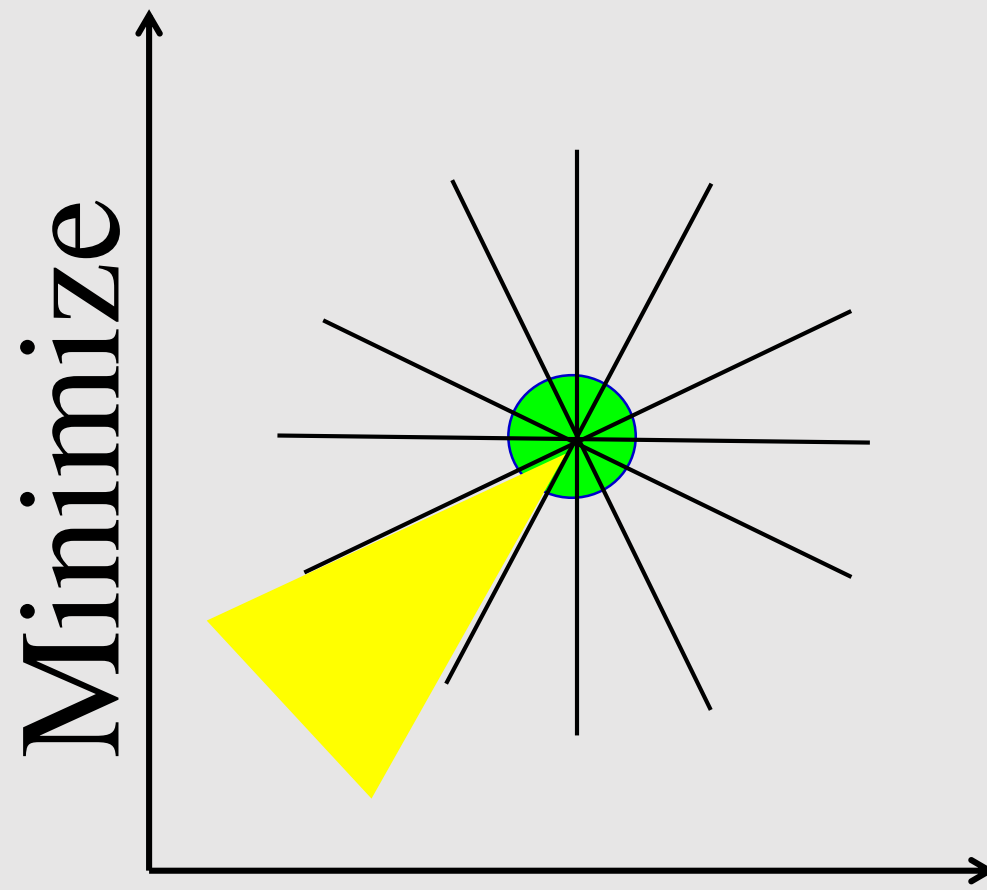| Computational Time (sec)				
Algorithm	3D	4D	5D	Average
MOEA/D-WV[1]	397	1260	2572	1410
MOEA/D-BA[3]	401	19505	92016	37307
MOEA/D-DB[4]	1083	> 2 days	> 2 days	---

1. MOEA/D with Weight Vector Grid based archive
2. MOEA/D without archive
3. MOEA/D with bounded dominance based archive
4. MOEA/D with unbounded dominance based archive

Future Work

1. Speed up the updating
   Purring useless weight vectors
   Update the archive only in the later generation
2. Different scalarizing functions
   Weighted Sum in MOEA/D
   PBI in Weight Vector based Archive

Weighted Sum   PBI