Table 1: Comparison of Algorithms on DTLZ1

	DTLZ1(4)	DTLZ1(5)	DTLZ1(6)
PHN-EPO	11.8155	21.7964	42.6230
PHN-LS	11.9910	23.3634	47.8617
PHN-Tche	9.7352	18.6714	47.2200
COSMOS	11.9769	23.6661	45.4436
PHN-HVI	12.0378	24.4189	49.1362
PHN-HVVS	**12.1652**	**24.5912**	**49.2156**

Table 2: Results of MS Metric under different datasets

Algorithm	MM.	MF.	FM.	Drug	Jura	SAR
PHN-EPO	0.1968	0.2983	0.6766	0.5226	0.2123	0.1420
PHN-LS	0.0752	0.0863	0.1940	0.1570	0.1983	0.1005
PHN-Tche	0.2667	0.4644	0.8286	**0.9722**	0.3632	0.1226
COSMOS	0.2883	0.3010	0.2989	NA	0.1121	0.1500
PHN-HVI	0.4588	0.5350	0.4346	0.3149	0.5760	0.2000
PHN-HVVS	**1**	**1**	**0.9854**	0.6259	**0.8885**	**0.3324**

Table 3: Comparison of Algorithms on Different Problems

Algorithm	Pro.1	Pro.2	Pro.3	Pro.4	Pro.5	Pro.6	Pro.7
PHN-EPO	0.7297	0.9806	0.9982	0.8129	0.9802	0.8316	0.9506
PHN-LS	0.9617	0.9777	0.7071	0.9869	0.9938	0.9854	0.9898
PHN-Tche	0.7859	0.9261	0.9982	0.8204	0.9875	0.8544	0.9887
COSMOS	0.6947	0.9439	0.9948	0.7276	0.9498	0.7136	0.9769
PHN-HVI	0.7344	0.9833	0.9857	0.7159	0.9856	0.7562	0.9894
PHN-HVVS	**1**	**0.9919**	**1**	**0.9988**	**0.9988**	**1**	**0.9937**

Table 4: Comparison of Different Sampling Methods on Jura and SARCOS

	Random	Latin	Polar	Dir	K-means	Voronoi
Jura	0.928	0.922	0.928	0.923	0.925	**0.935**
SARCOS	0.884	0.883	0.881	0.888	0.877	**0.949**

Table 5: Previous FL works

	Peoblem Description
Stable Coalition (KDD'22)	Clients are divided into multiple groups or coalitions. Let $\pi(i)$ denote the unique coalition to which client i belongs. Cui et al. (2022) studied how to form a core-stable coalition structure π such that there is no other coalition $\mathcal{C}$ where every client $i \in \mathcal{C}$ prefers $\mathcal{C}$ over $\pi(i)$. Only clients within the same coalition contribute to each other in the FL network, forming a subgraph of $\mathcal{G}_b$.
Conflict of Interest (AAAI'24)	In cross-silo FL, clients are typically organizations. Clients in the same market area may compete while those in different areas are independent. Tan et al. (2024) extended the principle "the friend of my enemy is my enemy" to prevent clients from benefiting their enemies in collaborative FL, forming a subgraph of $\mathcal{G}_b$.
Free-riders (NeurIPS'24)	Addressing self-interested clients in cross-silo FL, Chen et al. (2024) proposed a framework to simultaneously eliminate free riders (who benefit without contributing) and avoid conflict of interest between clients, forming a subgraph of $\mathcal{G}_b$.

Table 6: Results comparison on different problems.

	PHN-EPO	PHN-LS	PHN-TCHE	COSMOS	PHN-HVI	PHN-HVVS
Pro.1	3.790±0.007230	3.832±0.000526	3.813±0.005223	3.210±0.736292	3.791±0.002538	**3.833±0.000026**
Pro.2	3.304±0.063656	3.362±0.016258	3.321±0.086994	3.344±0.043419	3.374±0.011347	**3.387±0.007168**
Pro.3(DTLZ4)	7.380±0.010358	6.020±1.096984	7.267±0.010933	7.236±0.010072	7.383±0.005471	**7.386±0.003612**
Pro.4(ZDT1)	3.651±0.075391	3.654±0.085641	NA	3.631±0.036321	3.520±0.012252	**3.735±0.001754**
Pro.5(ZDT2)	2.047±1.094539	2.0±0	2.800±0.652913	3.057±0.528525	3.321±0.022386	**3.323±0.004026**
Pro.6(VLMOP1)	3.810±0.003677	3.825±0.010152	3.816±0.006643	3.747±0.012842	3.782±0.000523	**3.829±0.000629**
Pro.7(VLMOP2)	3.308±0.020874	3.313±0.021368	3.329±0.012204	3.299±0.014255	3.335±0.001013	**3.339±0.000001**
	PHN-EPO	PHN-LS	PHN-TCHE	COSMOS	PHN-HVI	PHN-HVVS
MM.	2.974±0.004188	2.976±0.007291	2.969±0.010703	2.977±0.014792	2.993±0.017194	**3.008±0.016559**
MF.	2.272±0.044656	2.283±0.030211	2.275±0.023285	2.274±0.039690	2.303±0.016967	**2.328±0.035270**
FM.	2.887±0.023533	2.881±0.027041	2.905±0.014980	2.857±0.019973	2.908±0.027066	**2.947±0.020804**
Jura	0.876±0.041178	0.897±0.045139	0.883±0.044926	0.892±0.041809	0.922±0.044198	**0.935±0.012841**
SAR.	0.852±0.071599	0.858±0.070854	0.726±0.063612	0.865±0.068888	0.929±0.031036	**0.939±0.026444**

Table 7: The results of the four objectives

	DTLZ2	DTLZ3	DTLZ4	DTLZ5	DTLZ6	DTLZ7
PHN-EPO	15.999	8.351	15.566	6.645	6.344	16.009
PHN-LS	7.998	10.833	7.465	6.435	6.193	15.999
PHN-TCHE	7.977	10.641	7.434	6.345	6.226	16.053
COSMOS	7.212	13.539	7.397	6.641	6.543	5.011
PHN-HVI	15.992	13.833	15.235	6.649	6.087	16.912
PHN-HVVS	**16.576**	**13.853**	**16.499**	**6.754**	**6.978**	**16.925**

Table 8: The results of the five objectives

	DTLZ2	DTLZ3	DTLZ4	DTLZ5	DTLZ6	DTLZ7
PHN-EPO	31.922	26.620	31.041	13.232	13.294	31.772
PHN-LS	15.944	12.175	15.871	13.201	13.769	31.943
PHN-TCHE	15.950	13.672	15.507	13.166	13.349	31.985
COSMOS	15.941	21.947	15.671	13.217	13.581	5.174
PHN-HVI	31.999	29.487	31.611	13.498	13.677	31.969
PHN-HVVS	**32.828**	**30.843**	**32.916**	**13.561**	**13.853**	**31.998**

Table 9: The results of the six objectives

	DTLZ2	DTLZ3	DTLZ4	DTLZ5	DTLZ6	DTLZ7
PHN-EPO	29.718	22.718	29.168	26.454	26.772	63.038
PHN-LS	31.929	25.063	31.570	26.315	26.048	63.909
PHN-TCHE	31.935	25.057	31.891	26.447	26.279	63.566
COSMOS	18.787	24.924	18.003	26.390	26.583	63.888
PHN-HVI	31.981	29.364	31.739	26.393	26.875	63.969
PHN-HVVS	**31.998**	**29.395**	**31.939**	**26.839**	**26.947**	**63.999**

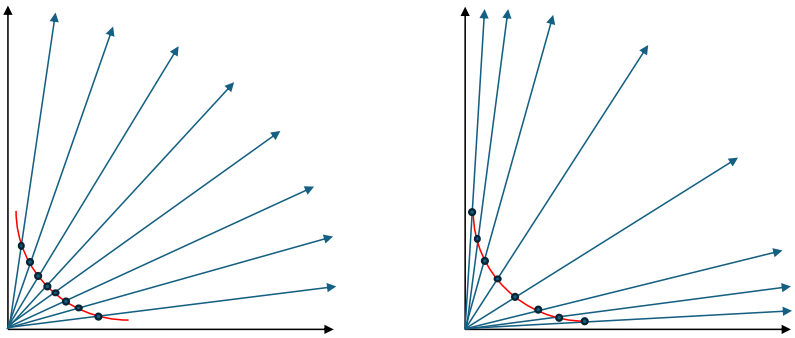

Figure 1: The solutions obtained by uniformly sampling will cluster in certain local areas.

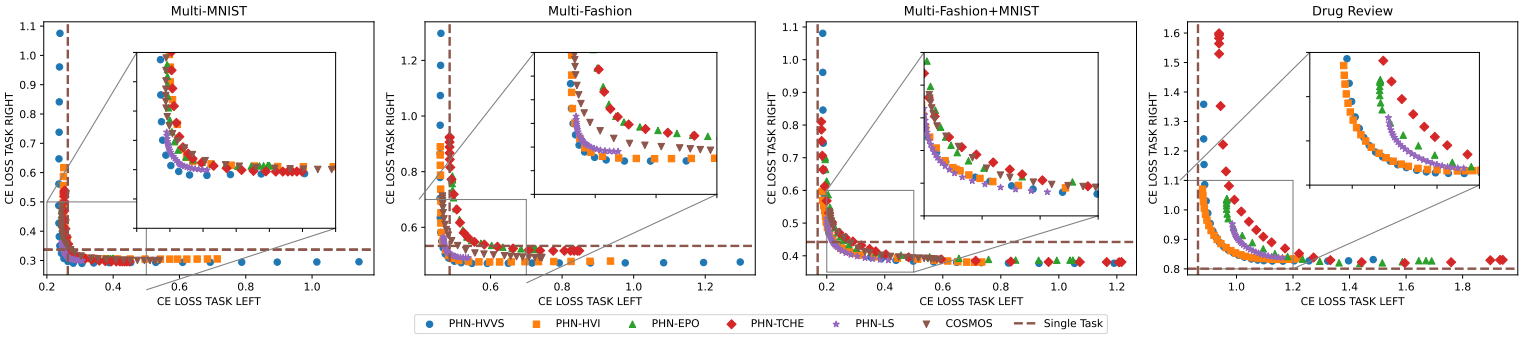

Figure 2: Results comparison on different Multi-Task Dataset.

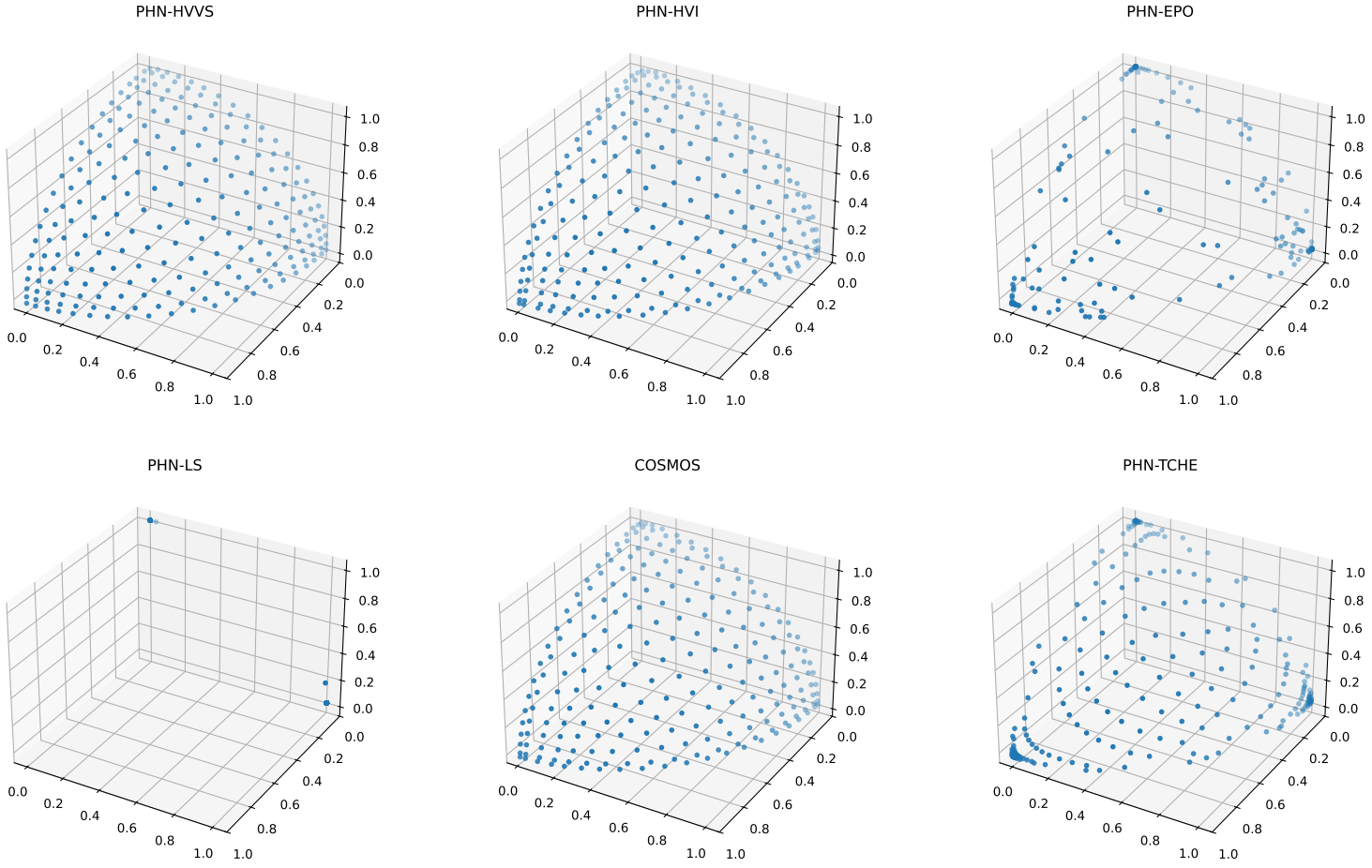

Figure 3: Results comparison on DTLZ2.