TABLE I: On 2-dimensional BBOB functions, we evaluate the SMAPE metric across three modeling approaches: the original model, the transferred model, and the model trained from scratch using the transfer dataset. The results. reported as the mean and standard deviation over ten repetitions, are provided for two dataset sizes, $|\mathcal{T}| \in \{50, 50d\}$. Statistical comparisons are performed using the Kruskal-Wallis test, followed by Dunn's post-hoc analysis with a significance threshold of 5%. To emphasize significant differences, we adopt the following conventions: an underlined transferred model indicates it significantly outperforms the original model, while bold font highlights the superior model between the transferred model and the one trained from scratch.

2D	Original RFR	Train from scratch	Transferred	Train from scratch	Transferred
		50 samples		100 samples	
F1	0.2960 ± 0.0772	0.1219 ± 0.0239	**0.0212 ± 0.0015**	0.0779 ± 0.0085	**0.0215 ± 0.0025**
F2	0.1191 ± 0.0311	0.0516 ± 0.0167	**0.0050 ± 0.0035**	0.0423 ± 0.0144	**0.0048 ± 0.0033**
F3	0.2495 ± 0.0796	0.0654 ± 0.0117	**0.0295 ± 0.0058**	0.0516 ± 0.0102	**0.0269 ± 0.0040**
F4	0.2290 ± 0.0774	0.0597 ± 0.0123	**0.0262 ± 0.0071**	0.0457 ± 0.0083	0.0278 ± 0.0106
F5	0.2450 ± 0.0782	0.0409 ± 0.0152	**0.0052 ± 0.0024**	0.0267 ± 0.0101	**0.0049 ± 0.0021**
F6	0.3753 ± 0.0966	0.0923 ± 0.0202	**0.0221 ± 0.0036**	0.0650 ± 0.0109	**0.0229 ± 0.0049**
F7	0.3564 ± 0.1164	0.1830 ± 0.0304	**0.0633 ± 0.0074**	0.1343 ± 0.0197	**0.0626 ± 0.0086**
F8	0.3098 ± 0.0702	0.1489 ± 0.0103	**0.0422 ± 0.0083**	0.1163 ± 0.0087	**0.0459 ± 0.0175**
F9	0.2769 ± 0.0706	0.1401 ± 0.0136	0.0678 ± 0.0415	0.1109 ± 0.0112	0.0730 ± 0.0531
F10	0.1667 ± 0.0423	0.0575 ± 0.0182	**0.0153 ± 0.0020**	0.0434 ± 0.0096	**0.0149 ± 0.0016**
F11	0.1816 ± 0.0569	0.0451 ± 0.0089	**0.0153 ± 0.0038**	0.0369 ± 0.0065	**0.0151 ± 0.0036**
F12	0.3175 ± 0.1044	0.0551 ± 0.0112	**0.0049 ± 0.0023**	0.0425 ± 0.0113	**0.0048 ± 0.0021**
F13	0.1744 ± 0.0407	0.0581 ± 0.0171	**0.0154 ± 0.0022**	0.0435 ± 0.0127	**0.0144 ± 0.0021**
F14	0.5312 ± 0.1455	0.1643 ± 0.0392	**0.0365 ± 0.0125**	0.1100 ± 0.0263	**0.0305 ± 0.0087**
F15	0.3250 ± 0.0981	0.0762 ± 0.0102	**0.0339 ± 0.0049**	0.0564 ± 0.0073	**0.0332 ± 0.0062**
F16	0.2314 ± 0.0250	0.1706 ± 0.0144	**0.1026 ± 0.0127**	0.1578 ± 0.0096	**0.0969 ± 0.0057**
F17	0.5371 ± 0.1604	0.1460 ± 0.0164	0.1267 ± 0.0069	0.1341 ± 0.0082	0.1185 ± 0.0080
F18	0.4140 ± 0.1237	0.1072 ± 0.0086	**0.0864 ± 0.0046**	0.0982 ± 0.0052	0.0849 ± 0.0032
F19	0.3579 ± 0.0794	0.2229 ± 0.0128	0.2057 ± 0.0196	0.2016 ± 0.0069	0.2025 ± 0.0142
F20	0.4282 ± 0.1314	0.1533 ± 0.0266	**0.0345 ± 0.0031**	0.1168 ± 0.0238	**0.0342 ± 0.0047**
F21	0.2996 ± 0.0296	0.2402 ± 0.0177	0.1857 ± 0.0783	0.2213 ± 0.0143	0.1818 ± 0.0743
F22	0.3196 ± 0.0355	0.2069 ± 0.0246	**0.0961 ± 0.0125**	0.1807 ± 0.0143	**0.0925 ± 0.0123**
F23	0.1638 ± 0.0039	0.1717 ± 0.0095	0.1660 ± 0.0079	0.1692 ± 0.0076	0.1655 ± 0.0043
F24	0.1922 ± 0.0404	0.1383 ± 0.0242	0.1568 ± 0.0336	0.1257 ± 0.0219	0.1583 ± 0.0371

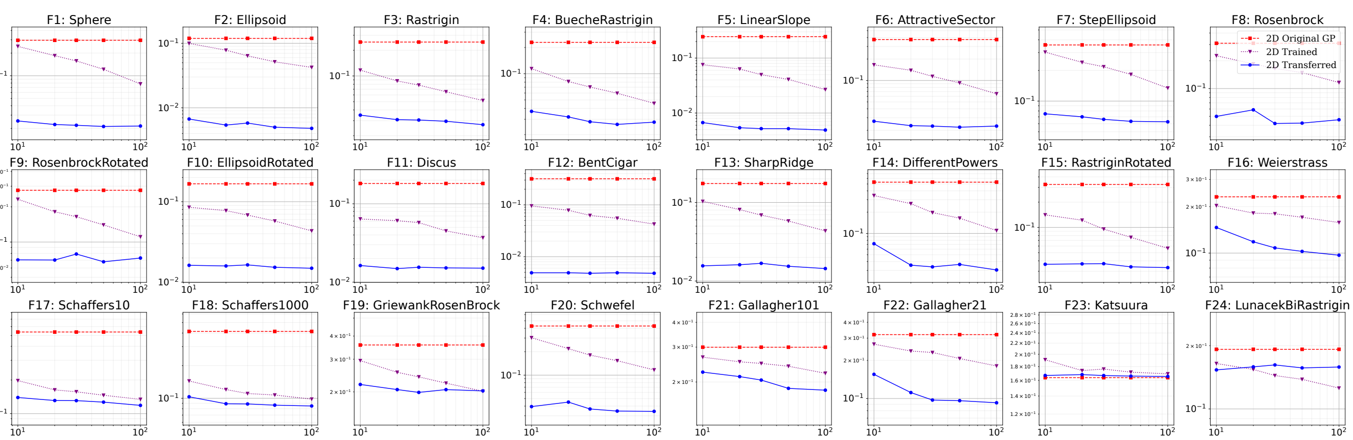

Fig. 6: The SMAPE values (y-axis) for three model variants — original RFR, transferred RFR, and the model trained exclusively on the transfer dataset — are plotted against the size of the transfer dataset on 2-dimensional BBOB functions. The dataset sizes (x-axis) considered are 10, 20, 30, 50, and 100 samples.

TABLE II: On 5-dimensional BBOB functions, we evaluate the SMAPE metric across three modeling approaches: the original model, the transferred model, and the model trained from scratch using the transfer dataset. The results. reported as the mean and standard deviation over ten repetitions, are provided for two dataset sizes, $|\mathcal{T}| \in \{50, 50d\}$. Statistical comparisons are performed using the Kruskal-Wallis test, followed by Dunn's post-hoc analysis with a significance threshold of 5%. To emphasize significant differences, we adopt the following conventions: an underlined transferred model indicates it significantly outperforms the original model, while bold font highlights the superior model between the transferred model and the one trained from scratch.

5D	Original RFR	Train from scratch	Transferred	Train from scratch	Transferred
		50 samples		250 samples	
F1	0.1141 ± 0.0346	0.0748 ± 0.0050	**0.0350 ± 0.0056**	0.0491 ± 0.0020	**0.0293 ± 0.0030**
F2	0.1047 ± 0.0132	0.0611 ± 0.0094	**0.0093 ± 0.0053**	0.0437 ± 0.0068	**0.0050 ± 0.0007**
F3	0.0905 ± 0.0180	0.0554 ± 0.0048	0.0403 ± 0.0077	0.0376 ± 0.0026	**0.0305 ± 0.0029**
F4	0.1404 ± 0.0126	0.0960 ± 0.0082	0.0716 ± 0.0144	0.0706 ± 0.0079	**0.0464 ± 0.0115**
F5	0.0774 ± 0.0169	0.0261 ± 0.0043	**0.0088 ± 0.0008**	0.0146 ± 0.0030	**0.0069 ± 0.0008**
F6	0.1334 ± 0.0320	0.0844 ± 0.0115	**0.0552 ± 0.0100**	0.0577 ± 0.0052	0.0470 ± 0.0075
F7	0.1638 ± 0.0128	0.1179 ± 0.0130	**0.0691 ± 0.0067**	0.0808 ± 0.0102	0.0572 ± 0.0034
F8	0.1042 ± 0.0102	0.0726 ± 0.0041	0.0557 ± 0.0099	0.0519 ± 0.0051	0.0397 ± 0.0039
F9	0.0787 ± 0.0115	0.0748 ± 0.0048	**0.0524 ± 0.0053**	0.0549 ± 0.0039	**0.0435 ± 0.0044**
F10	0.1139 ± 0.0168	0.0576 ± 0.0067	**0.0315 ± 0.0033**	0.0410 ± 0.0062	**0.0293 ± 0.0027**
F11	0.1496 ± 0.0279	0.0926 ± 0.0104	**0.0421 ± 0.0053**	0.0725 ± 0.0070	**0.0389 ± 0.0036**
F12	0.0692 ± 0.0161	0.0336 ± 0.0026	**0.0256 ± 0.0029**	0.0219 ± 0.0019	0.0208 ± 0.0024
F13	0.0576 ± 0.0094	0.0257 ± 0.0047	**0.0169 ± 0.0018**	0.0170 ± 0.0024	0.0124 ± 0.0021
F14	0.3330 ± 0.0926	0.1371 ± 0.0118	**0.0915 ± 0.0110**	0.0900 ± 0.0106	0.0740 ± 0.0059
F15	0.1421 ± 0.0300	0.0572 ± 0.0047	**0.0338 ± 0.0038**	0.0358 ± 0.0039	**0.0277 ± 0.0030**
F16	0.1066 ± 0.0012	0.1139 ± 0.0043	**0.1087 ± 0.0026**	0.1096 ± 0.0025	0.1080 ± 0.0021
F17	0.3131 ± 0.0405	0.1322 ± 0.0176	0.1024 ± 0.0093	0.0993 ± 0.0078	0.0960 ± 0.0087
F18	0.2122 ± 0.0265	0.0926 ± 0.0157	0.0715 ± 0.0050	0.0699 ± 0.0044	0.0649 ± 0.0030
F19	0.1468 ± 0.0139	0.1350 ± 0.0069	**0.1027 ± 0.0108**	0.0986 ± 0.0034	**0.0846 ± 0.0048**
F20	0.1125 ± 0.0193	0.0710 ± 0.0122	**0.0484 ± 0.0056**	0.0462 ± 0.0039	**0.0356 ± 0.0018**
F21	0.0707 ± 0.0036	0.0650 ± 0.0054	0.0702 ± 0.0027	**0.0575 ± 0.0025**	0.0664 ± 0.0026
F22	0.0403 ± 0.0020	0.0386 ± 0.0070	0.0382 ± 0.0047	0.0314 ± 0.0023	0.0337 ± 0.0019
F23	0.1420 ± 0.0020	0.1501 ± 0.0075	0.1468 ± 0.0038	0.1444 ± 0.0026	0.1438 ± 0.0031
F24	0.2046 ± 0.0217	0.1987 ± 0.0183	0.2035 ± 0.0197	**0.1698 ± 0.0145**	0.1980 ± 0.0198

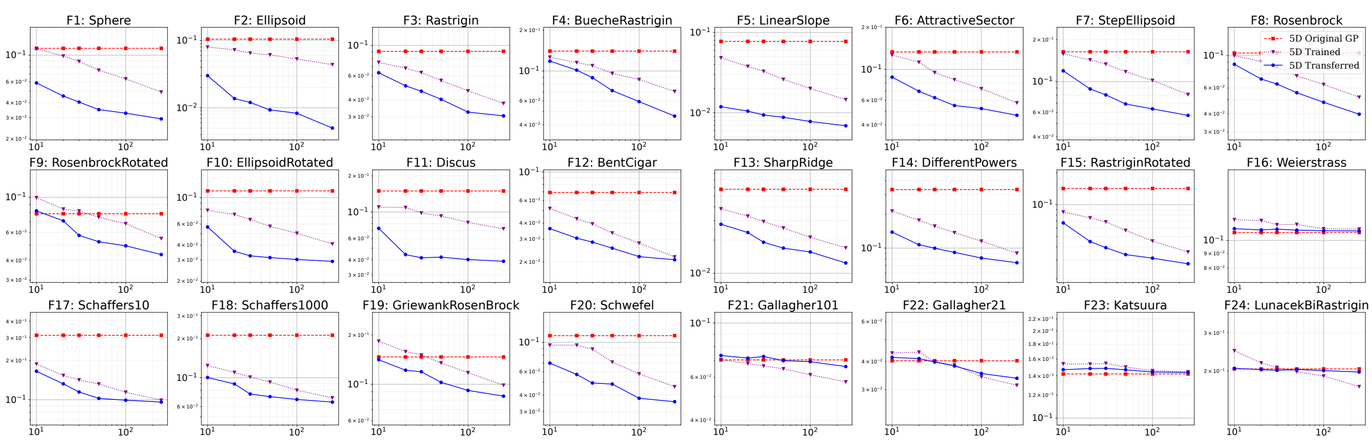

Fig. 7: The SMAPE values (y-axis) for three model variants — original RFR, transferred RFR, and the model trained exclusively on the transfer dataset — are plotted against the size of the transfer dataset on 5-dimensional BBOB functions. The dataset sizes (x-axis) considered are 10, 20, 30, 50, 100, and 250 samples.

TABLE III: On 10-dimensional BBOB functions, we evaluate the SMAPE metric across three modeling approaches: the original model, the transferred model, and the model trained from scratch using the transfer dataset. The results. reported as the mean and standard deviation over ten repetitions, are provided for two dataset sizes, $|\mathcal{T}| \in \{50, 50d\}$. Statistical comparisons are performed using the Kruskal-Wallis test, followed by Dunn's post-hoc analysis with a significance threshold of 5%. To emphasize significant differences, we adopt the following conventions: an underlined transferred model indicates it significantly outperforms the original model, while bold font highlights the superior model between the transferred model and the one trained from scratch.

10D	Original RFR	Train from scratch	Transferred	Train from scratch	Transferred
		50 samples		500 samples	
F1	0.0713 ± 0.0107	0.0509 ± 0.0037	$\underline{\mathbf{0.0381} \pm \mathbf{0.0020}}$	0.0348 ± 0.0011	$\underline{0.0325 \pm 0.0011}$
F2	0.0811 ± 0.0132	0.0465 ± 0.0041	$\underline{\mathbf{0.0220} \pm \mathbf{0.0064}}$	0.0332 ± 0.0025	$\underline{\mathbf{0.0097} \pm \mathbf{0.0017}}$
F3	0.0647 ± 0.0023	0.0475 ± 0.0036	$\underline{0.0403 \pm 0.0039}$	0.0343 ± 0.0019	$\underline{\mathbf{0.0283} \pm \mathbf{0.0020}}$
F4	0.1220 ± 0.0049	0.0861 ± 0.0035	$\underline{0.0925 \pm 0.0065}$	0.0669 ± 0.0021	$\underline{\mathbf{0.0546} \pm \mathbf{0.0048}}$
F5	0.0462 ± 0.0079	0.0204 ± 0.0027	$\underline{\mathbf{0.0094} \pm \mathbf{0.0003}}$	0.0122 ± 0.0019	$\underline{\mathbf{0.0079} \pm \mathbf{0.0003}}$
F6	0.0606 ± 0.0058	0.0334 ± 0.0033	$\underline{\mathbf{0.0230} \pm \mathbf{0.0009}}$	0.0232 ± 0.0023	$\underline{0.0194 \pm 0.0011}$
F7	0.1001 ± 0.0108	0.0575 ± 0.0021	$\underline{\mathbf{0.0459} \pm \mathbf{0.0028}}$	0.0418 ± 0.0021	$\underline{\mathbf{0.0345} \pm \mathbf{0.0015}}$
F8	0.0659 ± 0.0072	0.0468 ± 0.0028	$\underline{0.0423 \pm 0.0023}$	0.0342 ± 0.0007	$\underline{0.0330 \pm 0.0015}$
F9	0.0409 ± 0.0009	0.0481 ± 0.0021	$\underline{0.0454 \pm 0.0023}$	0.0381 ± 0.0006	$\underline{0.0381 \pm 0.0017}$
F10	0.0708 ± 0.0141	0.0387 ± 0.0030	$\underline{\mathbf{0.0250} \pm \mathbf{0.0025}}$	0.0273 ± 0.0022	$\underline{\mathbf{0.0201} \pm \mathbf{0.0015}}$
F11	0.1375 ± 0.0110	0.1273 ± 0.0121	$\underline{\mathbf{0.0763} \pm \mathbf{0.0037}}$	0.0994 ± 0.0086	$\underline{\mathbf{0.0695} \pm \mathbf{0.0021}}$
F12	0.0617 ± 0.0054	0.0370 ± 0.0011	$\underline{\mathbf{0.0304} \pm \mathbf{0.0013}}$	0.0272 ± 0.0009	$\underline{0.0254 \pm 0.0012}$
F13	0.0342 ± 0.0049	0.0179 ± 0.0016	$\underline{\mathbf{0.0143} \pm \mathbf{0.0009}}$	0.0123 ± 0.0004	$\underline{\mathbf{0.0107} \pm \mathbf{0.0006}}$
F14	0.1816 ± 0.0248	0.1052 ± 0.0073	$\underline{\mathbf{0.0832} \pm \mathbf{0.0052}}$	0.0748 ± 0.0055	$\underline{\mathbf{0.0584} \pm \mathbf{0.0031}}$
F15	0.0796 ± 0.0082	0.0496 ± 0.0037	$\underline{0.0446 \pm 0.0030}$	0.0350 ± 0.0008	$\underline{0.0338 \pm 0.0013}$
F16	$\underline{0.0715 \pm 0.0006}$	0.0772 ± 0.0037	0.0745 ± 0.0026	0.0726 ± 0.0006	0.0728 ± 0.0009
F17	0.2179 ± 0.0257	0.1238 ± 0.0082	$\underline{0.1072 \pm 0.0107}$	0.0930 ± 0.0037	$\underline{0.0839 \pm 0.0053}$
F18	0.1760 ± 0.0223	0.0949 ± 0.0060	$\underline{0.0779 \pm 0.0073}$	0.0700 ± 0.0030	$\underline{\mathbf{0.0580} \pm \mathbf{0.0032}}$
F19	0.0911 ± 0.0040	0.1026 ± 0.0033	$\underline{0.0980 \pm 0.0056}$	0.0847 ± 0.0021	$\underline{0.0826 \pm 0.0025}$
F20	0.0722 ± 0.0085	0.0429 ± 0.0015	$\underline{0.0389 \pm 0.0037}$	0.0304 ± 0.0014	$\underline{0.0270 \pm 0.0023}$
F21	0.0156 ± 0.0003	**0.0147** ± **0.0010**	0.0161 ± 0.0005	**0.0132** ± **0.0006**	0.0155 ± 0.0004
F22	0.0118 ± 0.0005	0.0098 ± 0.0007	$\underline{0.0107 \pm 0.0004}$	**0.0082** ± **0.0004**	$\underline{0.0101 \pm 0.0004}$
F23	$\underline{0.1253 \pm 0.0012}$	0.1290 ± 0.0052	0.1296 ± 0.0025	**0.1214** ± **0.0013**	0.1277 ± 0.0017
F24	0.2761 ± 0.0058	**0.2199** ± **0.0051**	0.2732 ± 0.0056	**0.1951** ± **0.0014**	0.2713 ± 0.0051

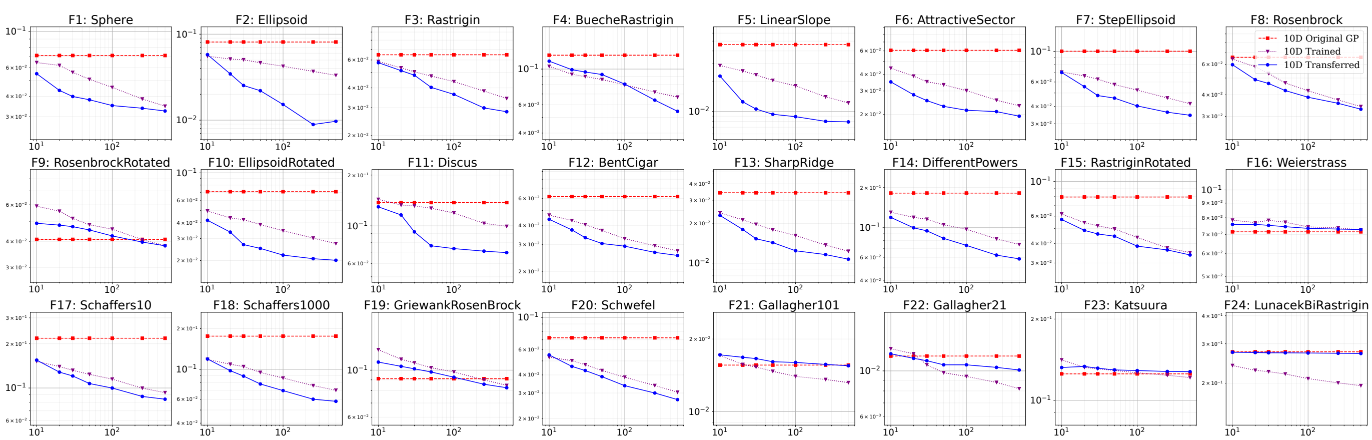

Fig. 8: The SMAPE values (y-axis) for three model variants — original RFR, transferred RFR, and the model trained exclusively on the transfer dataset — are plotted against the size of the transfer dataset on 10-dimensional BBOB functions. The dataset sizes (x-axis) considered are 10, 20, 30, 50, 100, 250, and 500 samples.

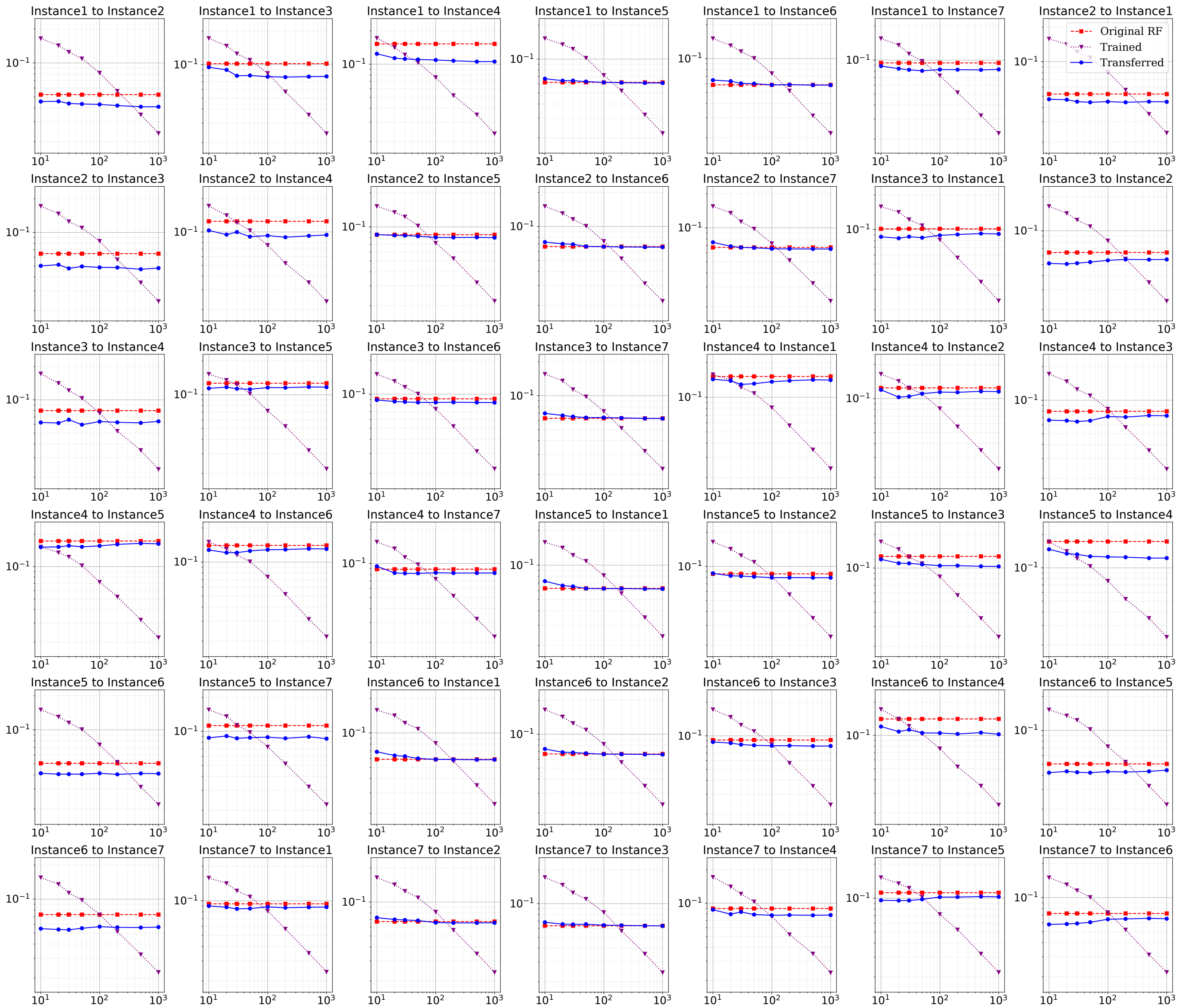

Fig. 9: The SMAPE values (displayed on the y-axis) for three model variants—original RFR, transferred RFR, and a model trained exclusively on the transfer dataset—are analyzed for the Earth-to-Mars mission using Porkchop Plot Benchmarks in Interplanetary Trajectory Optimization. These values are plotted against transfer dataset sizes (shown on the x-axis), which include 10, 20, 30, 50, 100, 200, 500, and 1 000 samples.

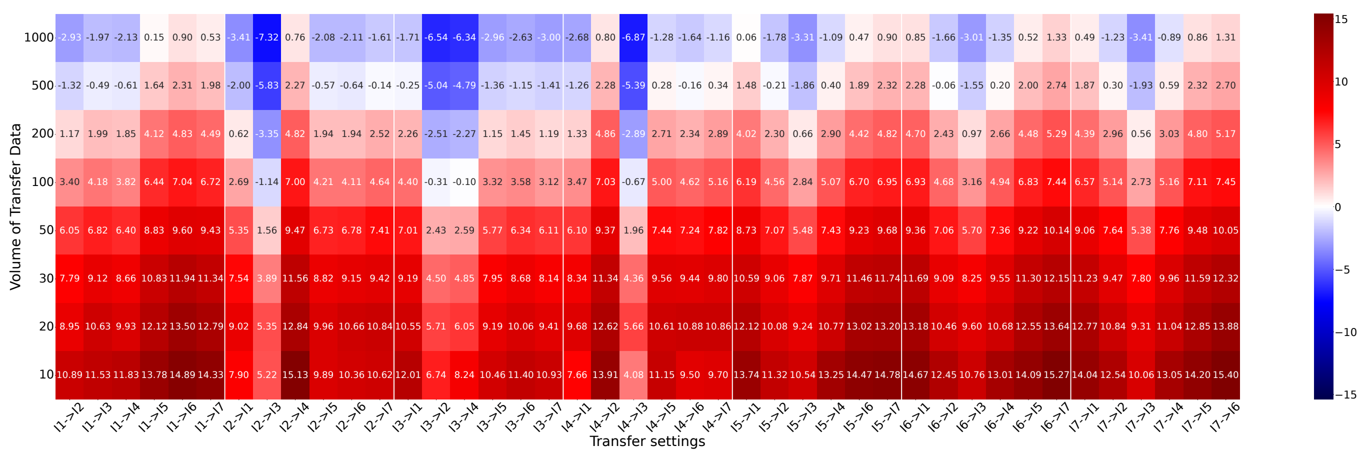

Fig. 10: The comparison evaluates the performance of Random forest regression (RFR) models obtained through transfer learning against those trained from scratch on the Porkchop Plot Benchmarks in Interplanetary Trajectory Optimization, focusing on the Earth-to-Venus mission. This analysis examines various transfer data sample sizes. Each cell in the figure shows the percentage difference in average SMAPE (%) between the two approaches for specific transfer settings and sample sizes. Positive values indicate that the transferred model achieves superior accuracy by yielding a lower SMAPE compared to the model trained from scratch.

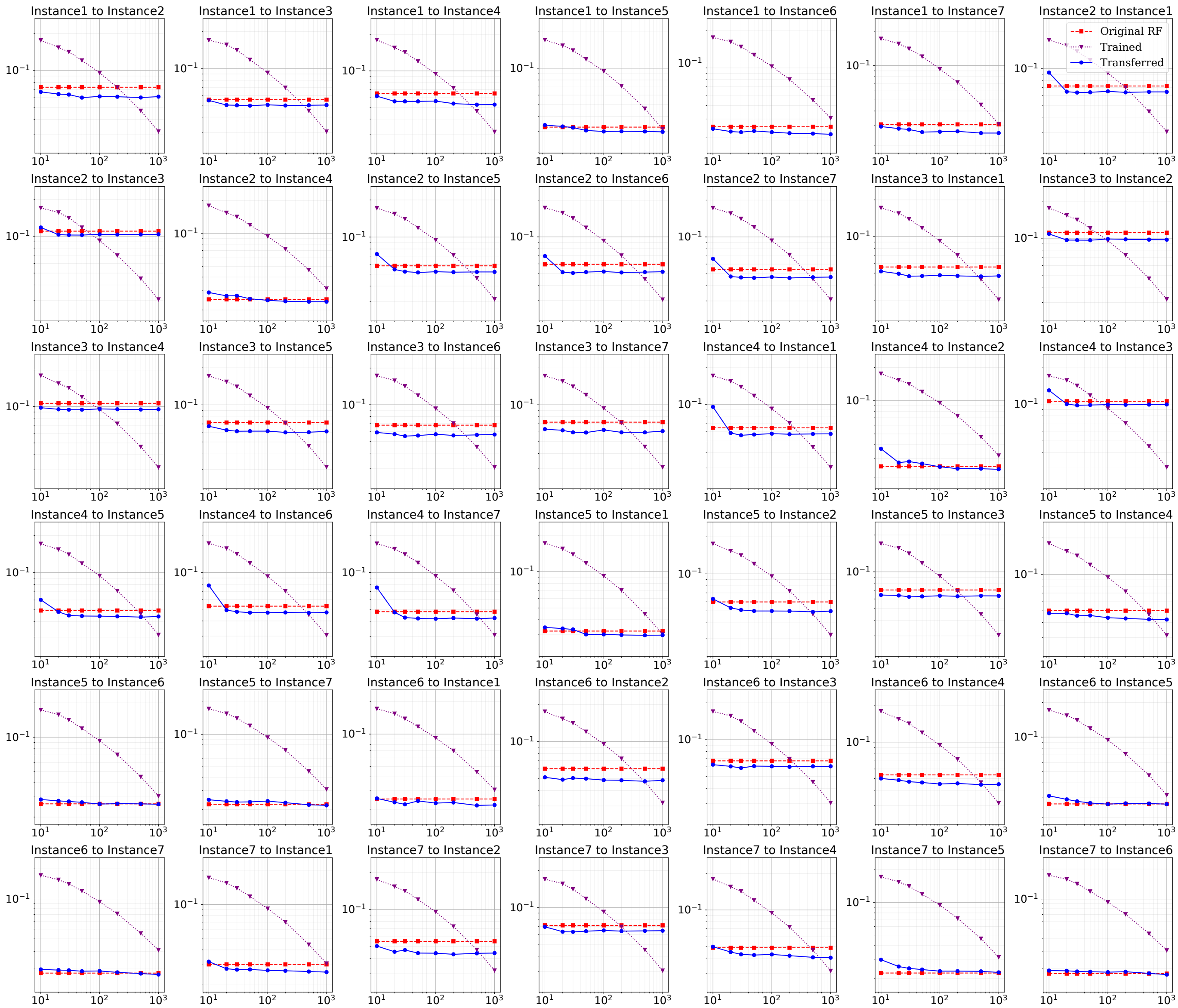

Fig. 11: The SMAPE values (displayed on the y-axis) for three model variants—original RFR, transferred RFR, and a model trained exclusively on the transfer dataset—are analyzed for the Earth-to-Venus mission using Porkchop Plot Benchmarks in Interplanetary Trajectory Optimization. These values are plotted against transfer dataset sizes (shown on the x-axis), which include 10, 20, 30, 50, 100, 200, 500, and 1 000 samples.

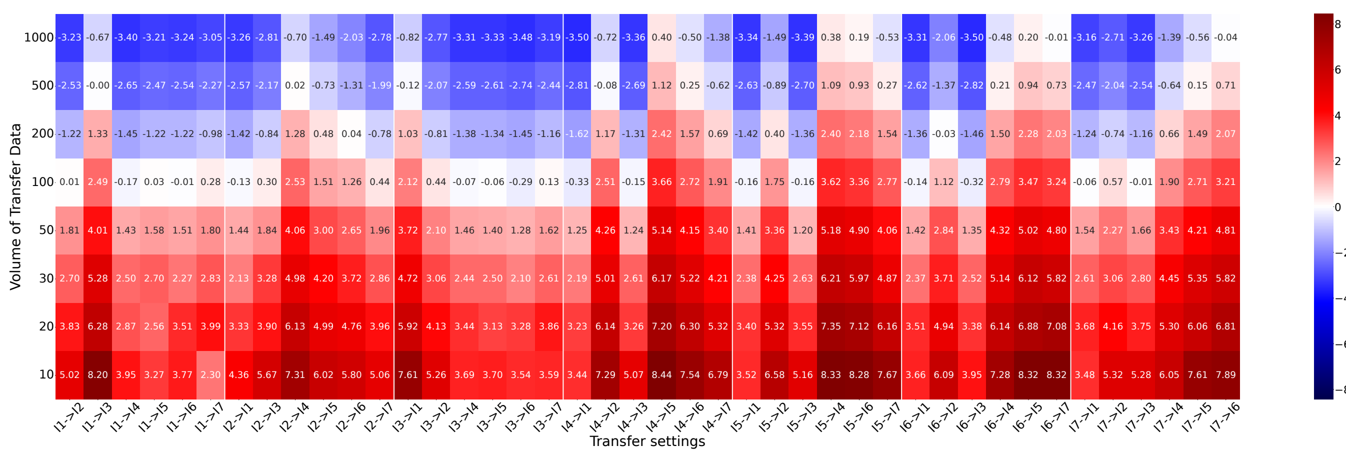

Fig. 12: The comparison evaluates the performance of Random forest regression (RFR) models obtained through transfer learning against those trained from scratch on the Porkchop Plot Benchmarks in Interplanetary Trajectory Optimization, focusing on the Mercury-to-Earth mission. This analysis examines various transfer data sample sizes. Each cell in the figure shows the percentage difference in average SMAPE (%) between the two approaches for specific transfer settings and sample sizes. Positive values indicate that the transferred model achieves superior accuracy by yielding a lower SMAPE compared to the model trained from scratch.

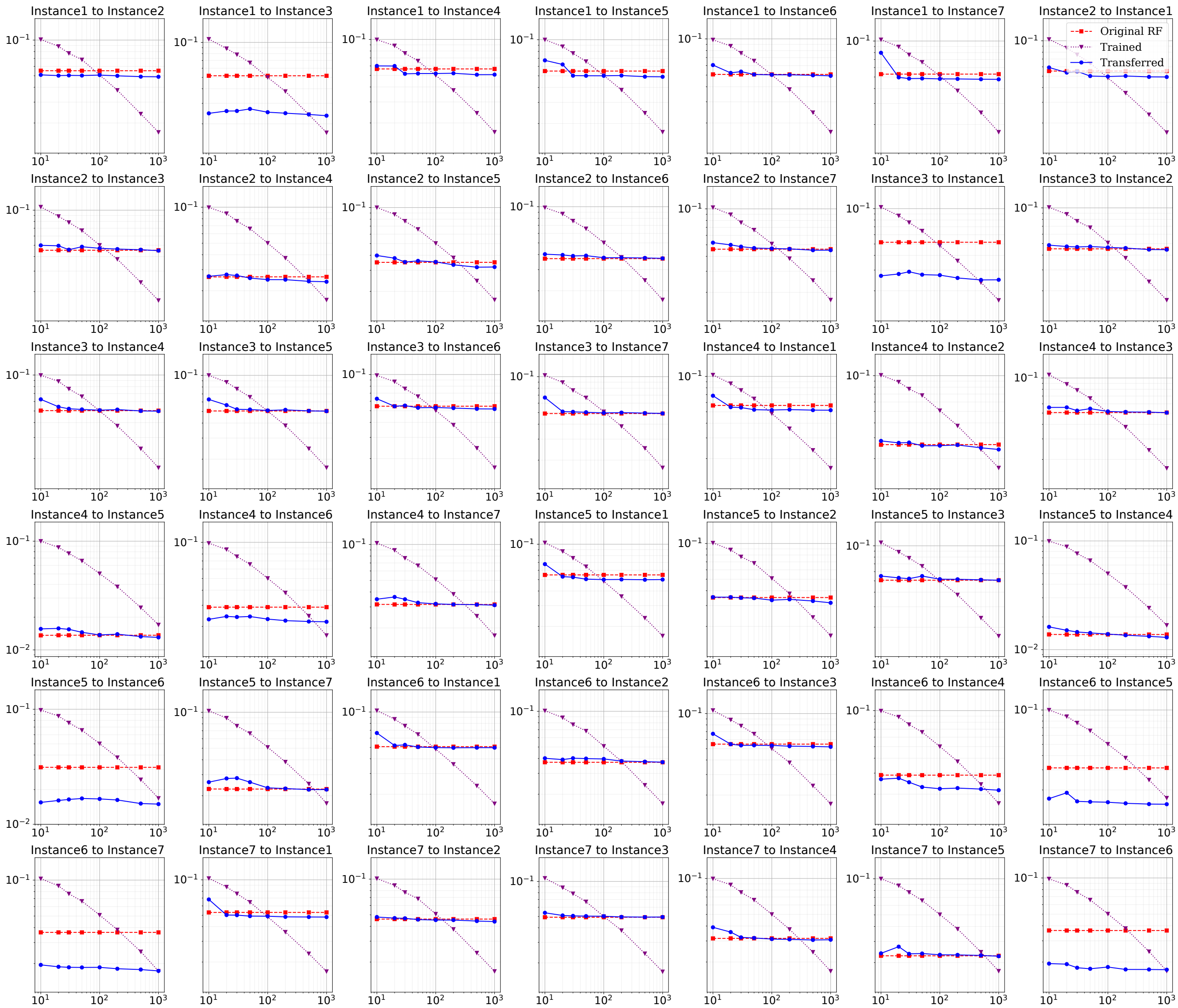

Fig. 13: The SMAPE values (displayed on the y-axis) for three model variants—original RFR, transferred RFR, and a model trained exclusively on the transfer dataset—are analyzed for the Mercury-to-Earth mission using Porkchop Plot Benchmarks in Interplanetary Trajectory Optimization. These values are plotted against transfer dataset sizes (shown on the x-axis), which include 10, 20, 30, 50, 100, 200, 500, and $1\,000$ samples.

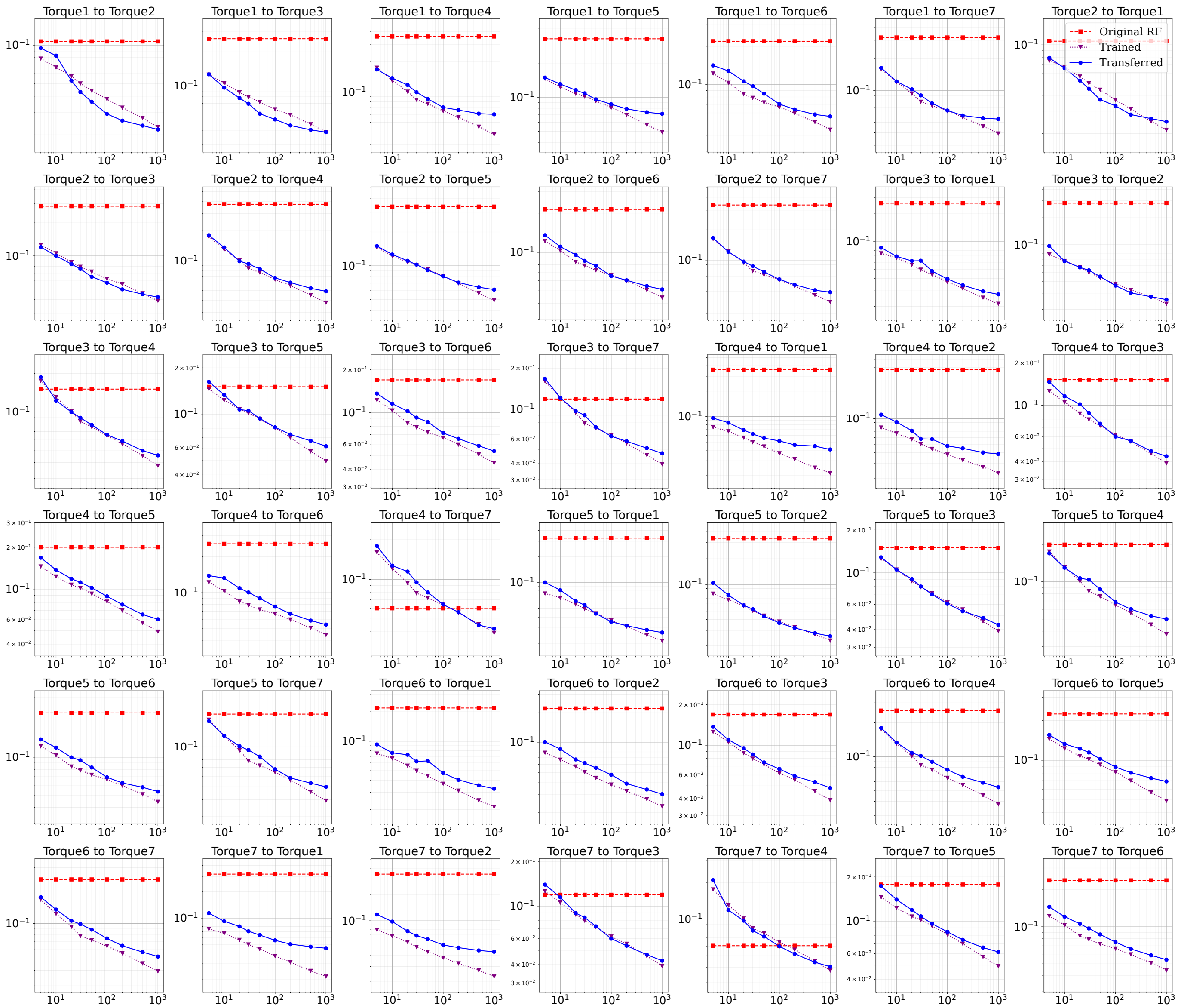

Fig. 14: The SMAPE values (displayed on the y-axis) for three model variants—original RFR, transferred RFR, and a model trained exclusively on the transfer dataset—are analyzed on the Kinematics of the Robot Arm real-world application. These values are plotted against transfer dataset sizes (shown on the x-axis), which include 5, 10, 20, 30, 50, 100, 200, 500, and 1 000 samples.

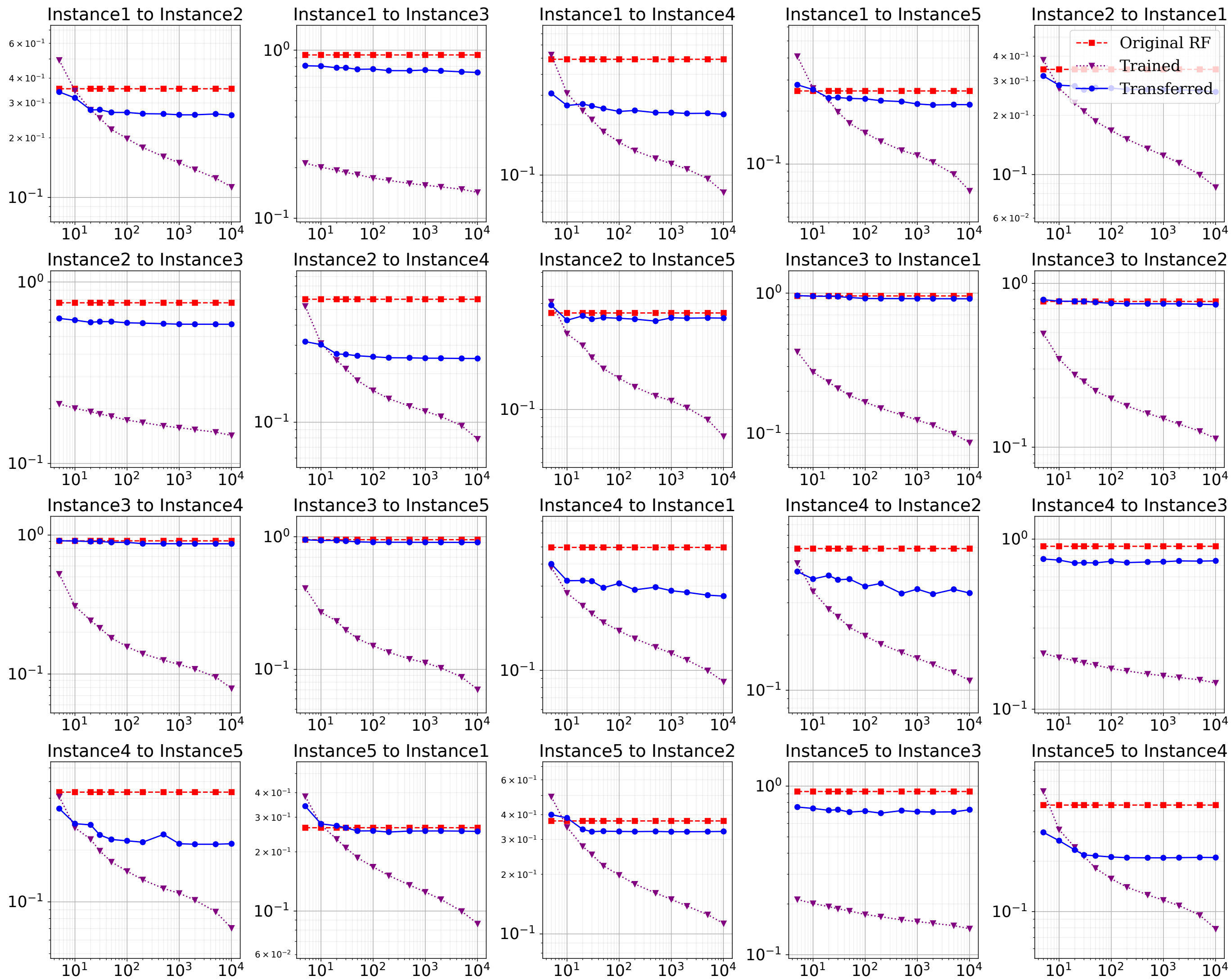

Fig. 15: The SMAPE values (displayed on the y-axis) for three model variants—original RFR, transferred RFR, and a model trained exclusively on the transfer dataset—are analyzed on the real-world optimization benchmark from vehicle dynamics. These values are plotted against transfer dataset sizes (shown on the x-axis), which include 5, 10, 20, 30, 50, 100, 200, 500, 1 000, 2 000, 5 000, and 10 101 samples.

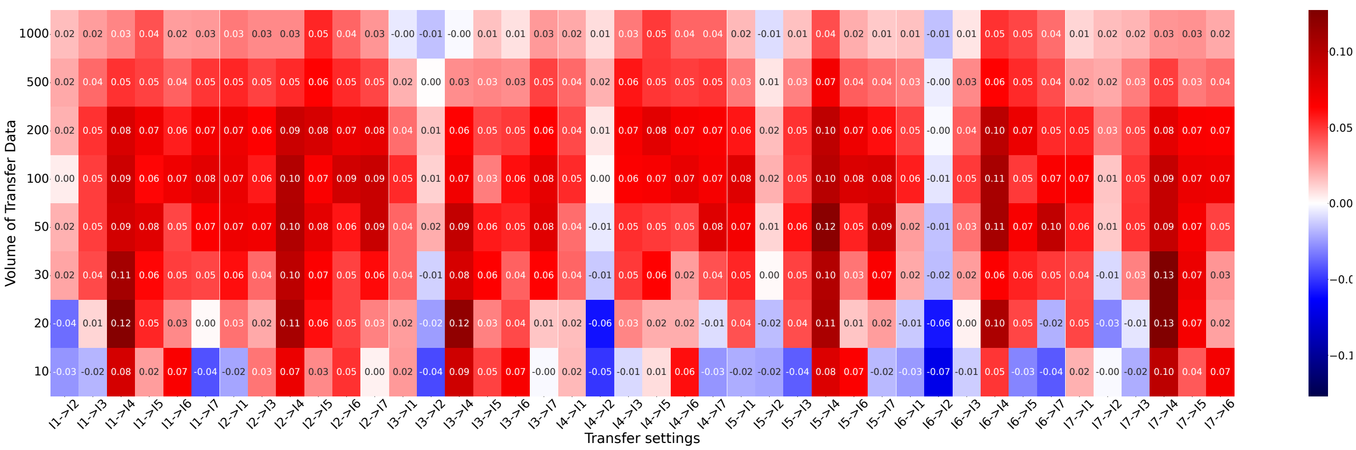

Fig. 16: The comparison evaluates the performance of Random forest regression (RFR) models obtained through transfer learning against those trained from scratch on F5 of the MarioGAN Suite. This analysis examines various transfer data sample sizes. Each cell in the figure shows the percentage difference in average SMAPE (%) between the two approaches for specific transfer settings and sample sizes. Positive values indicate that the transferred model achieves superior accuracy by yielding a lower SMAPE compared to the model trained from scratch.

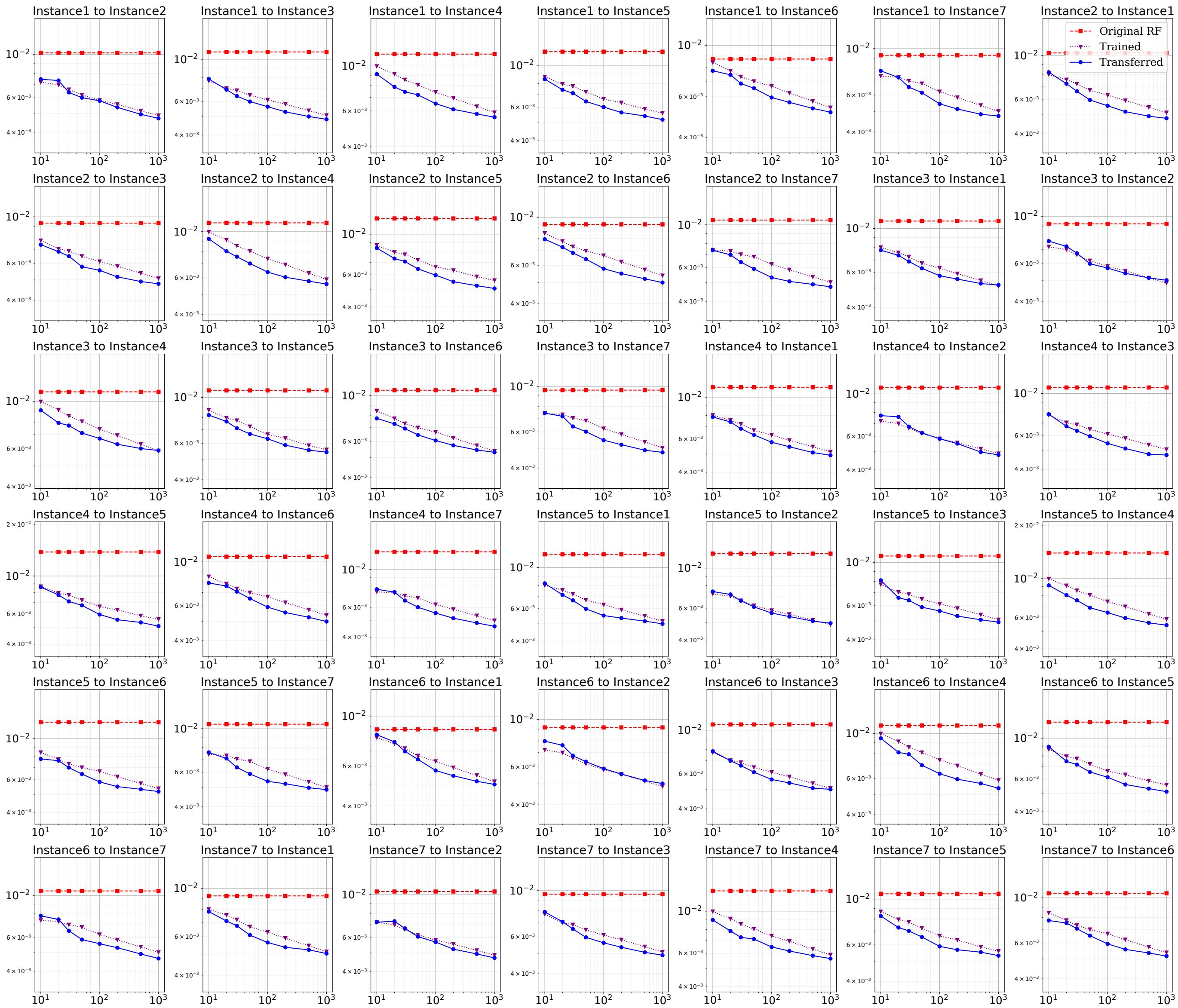

Fig. 17: The SMAPE values (displayed on the y-axis) for three model variants—original RFR, transferred RFR, and a model trained exclusively on the transfer dataset—are analyzed on F5 of Single-Objective Game-Benchmark MarioGAN Suite. These values are plotted against transfer dataset sizes (shown on the x-axis), which include 10, 20, 30, 50, 100, 200, 500, and $1\,000$ samples.

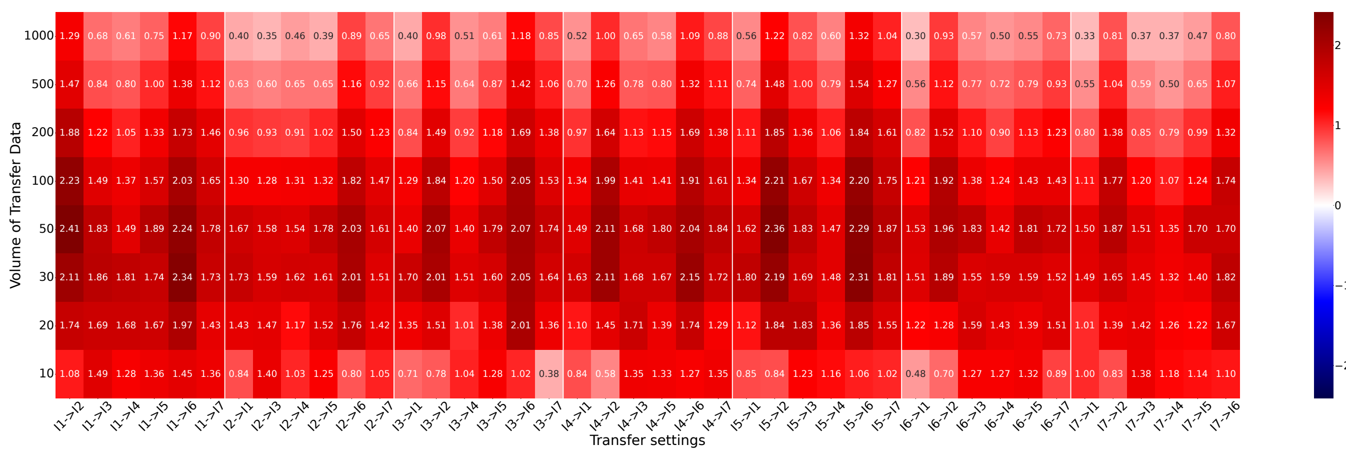

Fig. 18: The comparison evaluates the performance of Random forest regression (RFR) models obtained through transfer learning against those trained from scratch on F6 of the MarioGAN Suite. This analysis examines various transfer data sample sizes. Each cell in the figure shows the percentage difference in average SMAPE (%) between the two approaches for specific transfer settings and sample sizes. Positive values indicate that the transferred model achieves superior accuracy by yielding a lower SMAPE compared to the model trained from scratch.

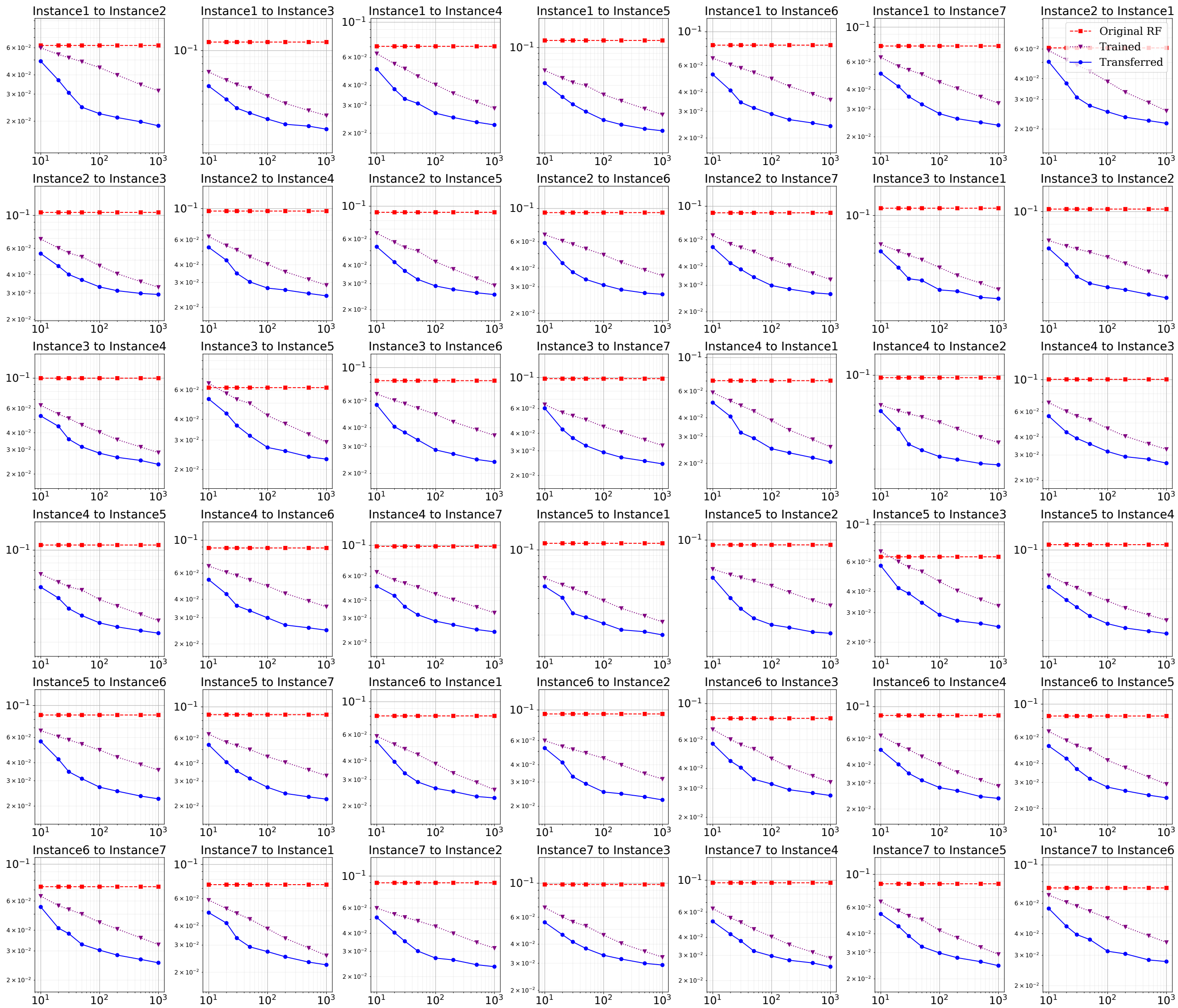

Fig. 19: The SMAPE values (displayed on the y-axis) for three model variants—original RFR, transferred RFR, and a model trained exclusively on the transfer dataset—are analyzed on F6 of Single-Objective Game-Benchmark MarioGAN Suite. These values are plotted against transfer dataset sizes (shown on the x-axis), which include 10, 20, 30, 50, 100, 200, 500, and $1\,000$ samples.

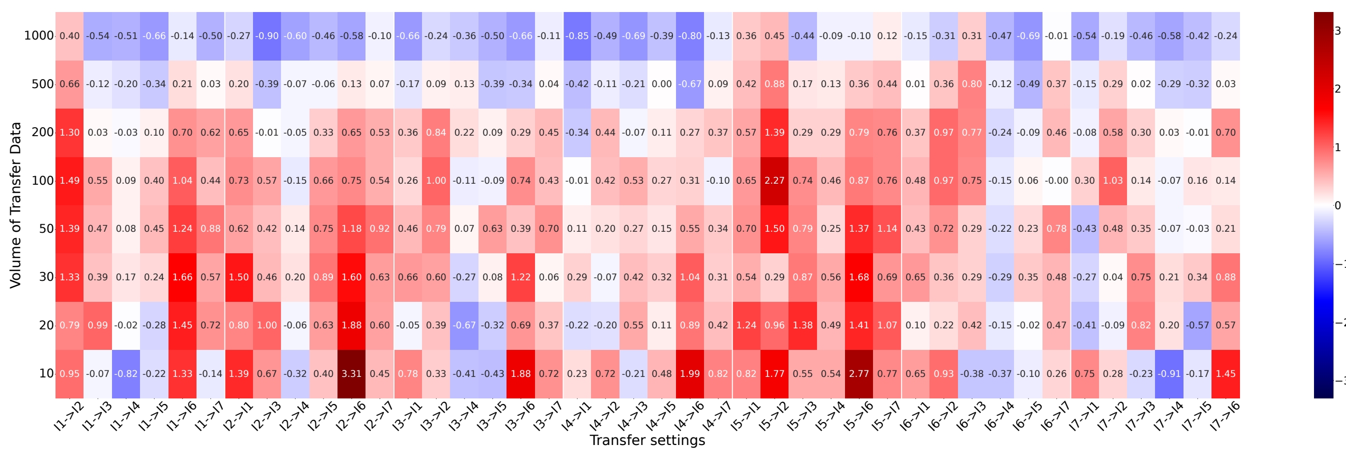

Fig. 20: The comparison evaluates the performance of Random forest regression (RFR) models obtained through transfer learning against those trained from scratch on F1 of the MarioGAN Suite. This analysis examines various transfer data sample sizes. Each cell in the figure shows the percentage difference in average SMAPE (%) between the two approaches for specific transfer settings and sample sizes. Positive values indicate that the transferred model achieves superior accuracy by yielding a lower SMAPE compared to the model trained from scratch.

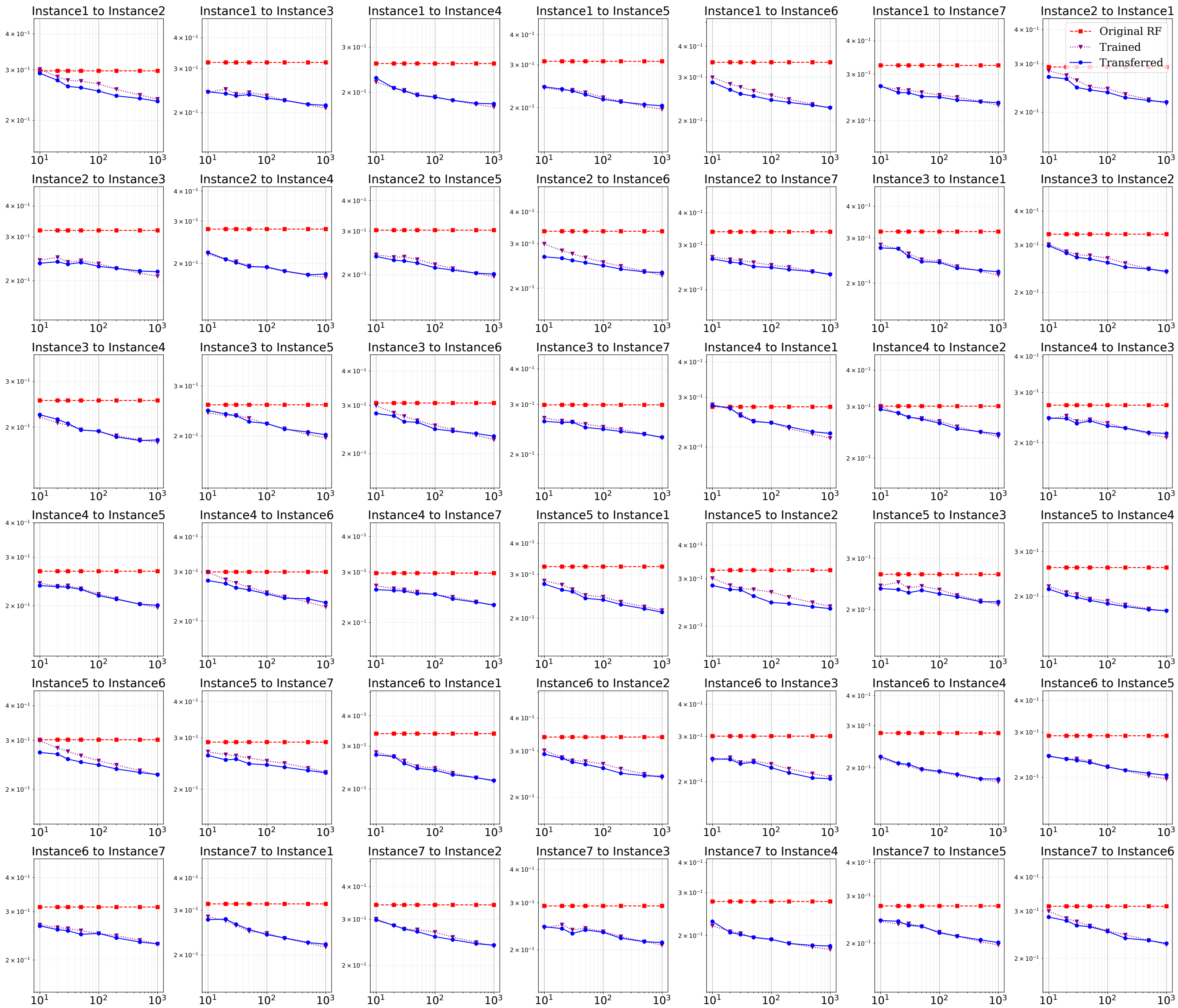

Fig. 21: The SMAPE values (displayed on the y-axis) for three model variants—original RFR, transferred RFR, and a model trained exclusively on the transfer dataset—are analyzed on F1 of Single-Objective Game-Benchmark MarioGAN Suite. These values are plotted against transfer dataset sizes (shown on the x-axis), which include 10, 20, 30, 50, 100, 200, 500, and 1 000 samples.