A Supplementary File for “Towards Exploratory Landscape Analysis for Large-scale Optimization: A Dimensionality Reduction Framework”

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ABSTRACT

This paper is a supplementary file for “Towards Exploratory Landscape Analysis for Large-scale Optimization: A Dimensionality Reduction Framework”.

Figure S.1: Average computation time (sec) of three sampling methods over 31 runs. For each run, the three sampling methods generate a sample $\mathcal{X}$ with the size $50 \times n$ in $[0, 1]^n$, where n is the dimension. IHS is the improved Latin hypercube sampling method (lhs in the flacco package). LHS is the Latin hypercube sampling method (lhs in the pyDOE package). RND is the random number generator in the Python Numpy library. We stopped the run of IHS for $n = 320$ because the single-run computation of IHS did not finish within one day.

Figure S.2: Average feature computation time (sec) on the first instance of f_1 with $n \in \{2, 3, 5, 10, 20, 40, 80, 160, 320, 640\}$. The sample size $|\mathcal{X}|$ was set to 100 for all dimensions. In contrast to Figure 1 in the main paper, this figure shows how the feature computation time scale with respect to the dimension n .

Figure S.3: Average feature computation time (sec) on the first instance of f_1 with $n = 2$. The sample size $|\mathcal{X}|$ was set to 100, 150, 250, 500, 1000, 2000, 8000, 16000, 32000, where they correspond to 50×2 , 50×3 , 50×5 , 50×10 , 50×20 , 50×40 , 50×80 , 50×160 , 50×320 , 50×640 , respectively. In contrast to Figure 1 in the main paper, this figure shows how the feature computation time scale with respect to the sample size $|\mathcal{X}|$.

Figure S.4: Average feature computation time (sec) on the first instance of f_1 with $n \in \{2, 3, 5, 10, 20, 40, 80, 160, 320, 640\}$. This figure is an extended version of Figure 1 in the main paper by including the results of the dimensionality reduction versions of the four cell mapping features (d_gcm, d_cm_angle, d_cm_conv, d_cm_grad).

Table S.1: Average accuracy of C7, C7-E2, and C7-D2 on the 24 BBOB functions with $n \in \{2, 3, 5, 10, 20, 40, 80, 160, 320, 640\}$. The numbers in parentheses show the standard deviation.

(a) Multimodality				(b) Global structure			
	C7	C7-E2	C7-D2		C7	C7-E2	C7-D2
2	0.642 (0.404)	0.703 (0.357)	Na	2	0.758 (0.402)	0.786 (0.374)	Na
3	0.569 (0.432)	0.597 (0.419)	0.578 (0.437)	3	0.792 (0.381)	0.797 (0.373)	0.778 (0.389)
5	0.536 (0.443)	0.625 (0.411)	0.622 (0.415)	5	0.769 (0.395)	0.772 (0.407)	0.761 (0.412)
10	0.522 (0.451)	0.631 (0.405)	0.647 (0.434)	10	0.708 (0.424)	0.750 (0.425)	0.692 (0.435)
20	0.531 (0.427)	0.725 (0.397)	0.639 (0.413)	20	0.714 (0.426)	0.742 (0.419)	0.697 (0.440)
40	0.556 (0.465)	0.689 (0.394)	0.617 (0.441)	40	0.711 (0.460)	0.711 (0.443)	0.711 (0.460)
80	0.600 (0.450)	0.783 (0.371)	0.622 (0.454)	80	0.697 (0.444)	0.697 (0.449)	0.697 (0.453)
160	0.522 (0.457)	0.650 (0.438)	0.561 (0.475)	160	0.647 (0.447)	0.650 (0.457)	0.631 (0.463)
320	0.544 (0.472)	Na	0.578 (0.472)	320	0.664 (0.474)	Na	0.667 (0.482)
640	0.514 (0.485)	Na	0.583 (0.489)	640	0.667 (0.461)	Na	0.678 (0.468)

(c) Separability				(d) Variable scaling			
	C7	C7-E2	C7-D2		C7	C7-E2	C7-D2
2	0.756 (0.381)	0.803 (0.344)	Na	2	0.581 (0.496)	0.586 (0.495)	Na
3	0.789 (0.363)	0.856 (0.336)	0.786 (0.387)	3	0.611 (0.445)	0.583 (0.468)	0.611 (0.456)
5	0.758 (0.395)	0.864 (0.322)	0.761 (0.421)	5	0.628 (0.454)	0.600 (0.465)	0.594 (0.480)
10	0.758 (0.401)	0.828 (0.344)	0.753 (0.411)	10	0.508 (0.489)	0.556 (0.494)	0.572 (0.496)
20	0.708 (0.427)	0.808 (0.377)	0.744 (0.401)	20	0.539 (0.507)	0.578 (0.499)	0.583 (0.504)
40	0.767 (0.389)	0.836 (0.349)	0.758 (0.401)	40	0.539 (0.507)	0.581 (0.496)	0.556 (0.492)
80	0.703 (0.440)	0.775 (0.405)	0.686 (0.447)	80	0.542 (0.509)	0.583 (0.504)	0.581 (0.501)
160	0.697 (0.456)	0.753 (0.421)	0.667 (0.476)	160	0.558 (0.497)	0.583 (0.504)	0.583 (0.504)
320	0.722 (0.441)	Na	0.669 (0.467)	320	0.547 (0.499)	Na	0.583 (0.504)
640	0.725 (0.400)	Na	0.669 (0.453)	640	0.542 (0.509)	Na	0.542 (0.509)

(e) Homogeneity				(f) Basin size			
	C7	C7-E2	C7-D2		C7	C7-E2	C7-D2
2	0.633 (0.397)	0.636 (0.395)	Na	2	0.450 (0.421)	0.492 (0.409)	Na
3	0.664 (0.378)	0.608 (0.379)	0.608 (0.389)	3	0.544 (0.430)	0.547 (0.400)	0.522 (0.428)
5	0.647 (0.399)	0.578 (0.431)	0.647 (0.408)	5	0.508 (0.404)	0.628 (0.343)	0.522 (0.373)
10	0.722 (0.380)	0.658 (0.399)	0.769 (0.338)	10	0.494 (0.419)	0.608 (0.387)	0.636 (0.384)
20	0.772 (0.369)	0.731 (0.400)	0.731 (0.403)	20	0.467 (0.429)	0.647 (0.398)	0.558 (0.409)
40	0.761 (0.385)	0.700 (0.432)	0.744 (0.407)	40	0.531 (0.447)	0.617 (0.412)	0.614 (0.423)
80	0.703 (0.450)	0.639 (0.448)	0.742 (0.412)	80	0.464 (0.474)	0.650 (0.415)	0.597 (0.460)
160	0.656 (0.477)	0.625 (0.466)	0.683 (0.439)	160	0.472 (0.457)	0.578 (0.460)	0.614 (0.447)
320	0.719 (0.438)	Na	0.761 (0.417)	320	0.408 (0.474)	Na	0.508 (0.446)
640	0.772 (0.413)	Na	0.781 (0.411)	640	0.456 (0.477)	Na	0.528 (0.471)

(g) GL contrast				(h) Overall average			
	C7	C7-E2	C7-D2		C7	C7-E2	C7-D2
2	0.572 (0.411)	0.642 (0.335)	Na	2	0.627 (0.422)	0.664 (0.396)	Na
3	0.586 (0.429)	0.600 (0.393)	0.572 (0.422)	3	0.651 (0.413)	0.656 (0.406)	0.637 (0.420)
5	0.497 (0.411)	0.669 (0.358)	0.536 (0.411)	5	0.621 (0.421)	0.677 (0.399)	0.635 (0.420)
10	0.542 (0.403)	0.656 (0.368)	0.619 (0.410)	10	0.608 (0.431)	0.669 (0.407)	0.670 (0.415)
20	0.544 (0.424)	0.728 (0.377)	0.617 (0.384)	20	0.611 (0.437)	0.708 (0.410)	0.653 (0.421)
40	0.533 (0.422)	0.708 (0.368)	0.597 (0.428)	40	0.628 (0.445)	0.692 (0.415)	0.657 (0.436)
80	0.558 (0.458)	0.703 (0.423)	0.619 (0.458)	80	0.610 (0.461)	0.690 (0.430)	0.649 (0.451)
160	0.553 (0.441)	0.636 (0.453)	0.622 (0.445)	160	0.587 (0.460)	0.639 (0.453)	0.623 (0.458)
320	0.550 (0.478)	Na	0.647 (0.436)	320	0.594 (0.472)	Na	0.631 (0.459)
640	0.572 (0.481)	Na	0.614 (0.473)	640	0.607 (0.467)	Na	0.628 (0.467)

Table S.2: Average accuracy of C7, C7-C4, and C7-D4 on the 24 BBOB functions with $n \in \{2, 3, 5, 10, 20, 40, 80, 160, 320, 640\}$. The numbers in parentheses show the standard deviation.

(a) Multimodality				(b) Global structure			
	C7	C7-C4	C7-D4		C7	C7-C4	C7-D4
2	0.642 (0.404)	0.725 (0.368)	Na	2	0.758 (0.402)	0.789 (0.359)	Na
3	0.569 (0.432)	0.622 (0.413)	0.547 (0.424)	3	0.792 (0.381)	0.797 (0.368)	0.792 (0.392)
5	0.536 (0.443)	0.633 (0.417)	0.522 (0.423)	5	0.769 (0.395)	0.783 (0.396)	0.778 (0.400)
10	0.522 (0.451)	Na	0.561 (0.414)	10	0.708 (0.424)	Na	0.719 (0.426)
20	0.531 (0.427)	Na	0.550 (0.436)	20	0.714 (0.426)	Na	0.733 (0.416)
40	0.556 (0.465)	Na	0.564 (0.449)	40	0.711 (0.460)	Na	0.714 (0.456)
80	0.600 (0.450)	Na	0.544 (0.436)	80	0.697 (0.444)	Na	0.706 (0.440)
160	0.522 (0.457)	Na	0.528 (0.445)	160	0.647 (0.447)	Na	0.656 (0.453)
320	0.544 (0.472)	Na	0.542 (0.472)	320	0.664 (0.474)	Na	0.664 (0.474)
640	0.514 (0.485)	Na	0.536 (0.466)	640	0.667 (0.461)	Na	0.683 (0.461)

(c) Separability				(d) Variable scaling			
	C7	C7-C4	C7-D4		C7	C7-C4	C7-D4
2	0.756 (0.381)	0.811 (0.345)	Na	2	0.581 (0.496)	0.586 (0.490)	Na
3	0.789 (0.363)	0.856 (0.337)	0.800 (0.390)	3	0.611 (0.445)	0.592 (0.472)	0.650 (0.457)
5	0.758 (0.395)	0.825 (0.352)	0.761 (0.409)	5	0.628 (0.454)	0.597 (0.462)	0.636 (0.469)
10	0.758 (0.401)	Na	0.758 (0.414)	10	0.508 (0.489)	Na	0.528 (0.486)
20	0.708 (0.427)	Na	0.731 (0.410)	20	0.539 (0.507)	Na	0.536 (0.504)
40	0.767 (0.389)	Na	0.775 (0.402)	40	0.539 (0.507)	Na	0.533 (0.490)
80	0.703 (0.440)	Na	0.719 (0.425)	80	0.542 (0.509)	Na	0.581 (0.501)
160	0.697 (0.456)	Na	0.708 (0.440)	160	0.558 (0.497)	Na	0.583 (0.504)
320	0.722 (0.441)	Na	0.731 (0.433)	320	0.547 (0.499)	Na	0.544 (0.506)
640	0.725 (0.400)	Na	0.744 (0.413)	640	0.542 (0.509)	Na	0.542 (0.509)

(e) Homogeneity				(f) Basin size			
	C7	C7-C4	C7-D4		C7	C7-C4	C7-D4
2	0.633 (0.397)	0.650 (0.392)	Na	2	0.450 (0.421)	0.492 (0.403)	Na
3	0.664 (0.378)	0.617 (0.364)	0.617 (0.397)	3	0.544 (0.430)	0.539 (0.389)	0.550 (0.434)
5	0.647 (0.399)	0.564 (0.435)	0.636 (0.412)	5	0.508 (0.404)	0.658 (0.324)	0.478 (0.403)
10	0.722 (0.380)	Na	0.706 (0.395)	10	0.494 (0.419)	Na	0.531 (0.388)
20	0.772 (0.369)	Na	0.769 (0.367)	20	0.467 (0.429)	Na	0.483 (0.425)
40	0.761 (0.385)	Na	0.781 (0.368)	40	0.531 (0.447)	Na	0.533 (0.440)
80	0.703 (0.450)	Na	0.706 (0.434)	80	0.464 (0.474)	Na	0.519 (0.448)
160	0.656 (0.477)	Na	0.656 (0.465)	160	0.472 (0.457)	Na	0.472 (0.459)
320	0.719 (0.438)	Na	0.772 (0.408)	320	0.408 (0.474)	Na	0.400 (0.478)
640	0.772 (0.413)	Na	0.758 (0.424)	640	0.456 (0.477)	Na	0.492 (0.475)

(g) GL contrast				(h) Overall average			
	C7	C7-C4	C7-D4		C7	C7-C4	C7-D4
2	0.572 (0.411)	0.647 (0.362)	Na	2	0.627 (0.422)	0.671 (0.398)	Na
3	0.586 (0.429)	0.608 (0.392)	0.578 (0.423)	3	0.651 (0.413)	0.662 (0.401)	0.648 (0.422)
5	0.497 (0.411)	0.689 (0.363)	0.503 (0.407)	5	0.621 (0.421)	0.679 (0.398)	0.616 (0.426)
10	0.542 (0.403)	Na	0.592 (0.419)	10	0.608 (0.431)	Na	0.628 (0.423)
20	0.544 (0.424)	Na	0.558 (0.410)	20	0.611 (0.437)	Na	0.623 (0.432)
40	0.533 (0.422)	Na	0.522 (0.417)	40	0.628 (0.445)	Na	0.632 (0.440)
80	0.558 (0.458)	Na	0.553 (0.446)	80	0.610 (0.461)	Na	0.618 (0.447)
160	0.553 (0.441)	Na	0.547 (0.440)	160	0.587 (0.460)	Na	0.593 (0.457)
320	0.550 (0.478)	Na	0.550 (0.473)	320	0.594 (0.472)	Na	0.600 (0.471)
640	0.572 (0.481)	Na	0.544 (0.486)	640	0.607 (0.467)	Na	0.614 (0.466)

Table S.3: Average rankings of the d_{ela_meta} (dem) and d_{ela_level} (del) features in C7-D2 for $n \in \{3, 5, 10, 20, 40, 80, 160, 320, 640\}$.

(a) $n = 3$		(b) $n = 5$		(c) $n = 10$		(d) $n = 20$	
Feature	Rank	Feature	Rank	Feature	Rank	Feature	Rank
dem.lin_simple.coef.max	10.9	dem.lin_simple.coef.max	8.9	dem.lin_simple.coef.max	9.1	dem.lin_simple.coef.max	8.0
dem.lin_simple.intercept	14.2	dem.lin_simple.intercept	9.6	dem.lin_simple.intercept	11.5	dem.lin_simple.intercept	11.1
dem.lin_simple.coef.min	17.0	dem.quad_simple.adj_r2	17.9	dem.quad_w_interact.adj_r2	16.8	dem.quad_w_interact.adj_r2	13.8
dem.quad_simple.adj_r2	18.3	dem.lin_simple.coef.min	18.8	dem.lin_simple.adj_r2	17.0	dem.lin_w_interact.adj_r2	16.3
dem.quad_w_interact.adj_r2	18.6	dem.quad_w_interact.adj_r2	20.4	dem.lin_w_interact.adj_r2	17.1	dem.lin_simple.adj_r2	16.7
dem.lin_simple.adj_r2	25.2	dem.lin_w_interact.adj_r2	20.4	dem.quad_simple.adj_r2	17.4	dem.quad_simple.adj_r2	16.7
dem.lin_w_interact.adj_r2	27.2	dem.lin_simple.adj_r2	21.0	dem.lin_simple.coef.min	19.8	dem.lin_simple.coef.min	16.9
del.costs_runtime	36.7	del.mmce_lda_25	40.8	del.mmce_lda_25	43.2	del.mmce_mda_50	33.4
del.mmce_mda_25	43.6	del.mmce_lda_10	42.5	del.mmce_lda_10	45.0	del.mmce_lda_25	34.4
dem.quad_simple.cond	44.0	del.mmce_mda_50	46.1	del.mmce_mda_25	45.4	del.mmce_mda_25	35.6
del.mmce_mda_10	48.0	del.mmce_mda_10	46.8	del.mmce_lda_10	45.7	del.mmce_lda_10	38.2
del.mmce_lda_25	48.4	del.mmce_lda_50	47.4	del.costs_runtime	46.6	del.mmce_mda_10	38.2
del.qda_mda_25	49.5	del.costs_runtime	48.8	del.mmce_mda_50	46.9	del.mmce_lda_50	44.4
del.mmce_qda_25	50.5	del.mmce_mda_25	50.4	del.mmce_lda_50	49.0	del.qda_mda_10	50.9
dem.lin_simple.coef.max_by_min	51.9	del.llda_qda_10	51.5	dem.costs_runtime	50.4	del.llda_qda_25	51.0
del.mmce_lda_50	51.9	del.llda_mda_50	52.6	del.llda_qda_50	52.2	del.llda_mda_50	51.1
del.qda_mda_10	52.3	dem.quad_simple.cond	55.2	del.qda_mda_10	52.4	del.llda_qda_10	51.3
del.llda_qda_50	53.8	del.mmce_qda_25	57.6	del.llda_mda_50	52.8	del.mmce_qda_25	52.0
del.mmce_lda_10	54.7	del.qda_mda_25	57.8	del.llda_qda_10	56.3	del.llda_qda_50	53.3
del.llda_qda_10	55.4	del.llda_qda_50	58.1	del.qda_mda_50	56.3	del.qda_mda_50	54.3
del.llda_mda_50	56.3	del.llda_qda_25	58.7	del.mmce_qda_50	61.4	del.qda_mda_25	56.2
del.llda_qda_25	58.9	dem.costs_runtime	60.3	del.llda_mda_25	61.6	del.mmce_qda_50	59.6
del.qda_mda_50	59.2	del.qda_mda_10	60.4	del.mmce_qda_25	63.1	del.costs_runtime	60.2
del.mmce_mda_50	59.9	del.qda_mda_50	61.6	dem.quad_simple.cond	63.6	dem.lin_simple.coef.max_by_min	61.3
del.llda_mda_10	64.7	dem.lin_simple.coef.max_by_min	63.1	del.llda_qda_25	63.8	del.lin_simple.adj_r2	61.5
del.llda_mda_25	64.8	del.mmce_qda_10	63.7	dem.lin_simple.coef.max_by_min	64.2	dem.quad_simple.cond	64.1
del.mmce_qda_50	67.5	del.llda_mda_25	65.8	del.mmce_qda_10	66.1	del.mmce_qda_10	65.2
del.mmce_qda_10	68.4	del.mmce_qda_50	67.8	del.qda_mda_25	67.3	del.costs_runtime	72.0
dem.costs_runtime	70.2	del.llda_mda_10	70.5	del.llda_mda_10	72.7	del.llda_mda_10	74.6

(e) $n = 40$		(f) $n = 80$		(g) $n = 160$		(h) $n = 320$	
Feature	Rank	Feature	Rank	Feature	Rank	Feature	Rank
dem.lin_simple.coef.max	9.3	dem.lin_simple.coef.max	8.1	dem.lin_simple.coef.max	7.6	dem.lin_simple.coef.max	6.2
dem.lin_simple.intercept	10.3	dem.lin_simple.intercept	10.1	dem.lin_simple.intercept	11.3	dem.lin_simple.intercept	13.6
dem.quad_w_interact.adj_r2	14.1	dem.quad_w_interact.adj_r2	17.4	dem.quad_w_interact.adj_r2	18.7	dem.lin_w_interact.adj_r2	21.0
dem.lin_w_interact.adj_r2	16.9	dem.quad_simple.adj_r2	18.5	dem.lin_w_interact.adj_r2	19.5	dem.lin_simple.coef.min	21.4
dem.lin_simple.adj_r2	17.4	dem.lin_simple.adj_r2	18.7	dem.lin_simple.adj_r2	20.5	dem.quad_w_interact.adj_r2	23.1
dem.quad_simple.adj_r2	19.8	dem.lin_w_interact.adj_r2	19.0	dem.quad_simple.adj_r2	21.1	dem.lin_simple.adj_r2	23.6
dem.lin_simple.coef.min	20.4	dem.lin_simple.coef.min	24.2	dem.lin_simple.coef.min	22.6	dem.quad_simple.adj_r2	24.4
del.mmce_mda_50	35.6	del.mmce_mda_50	34.8	del.mmce_mda_50	28.6	del.mmce_lda_25	36.6
del.mmce_mda_10	39.4	del.mmce_lda_25	36.6	del.mmce_lda_25	35.6	del.mmce_lda_10	36.7
del.mmce_lda_10	39.6	del.mmce_lda_10	38.9	del.mmce_lda_50	38.4	del.mmce_mda_50	37.0
del.mmce_lda_50	40.8	del.mmce_mda_10	39.9	del.mmce_mda_25	39.4	del.mmce_qda_25	37.2
del.mmce_mda_25	42.7	del.mmce_mda_25	42.1	del.mmce_lda_10	40.9	del.mmce_mda_10	38.1
del.mmce_lda_25	43.2	del.mmce_lda_50	44.1	del.mmce_mda_10	41.4	del.mmce_lda_50	38.6
del.llda_qda_50	45.7	del.qda_mda_50	44.9	del.mmce_qda_25	47.2	del.mmce_mda_25	42.0
del.qda_mda_50	46.9	del.llda_qda_50	45.0	del.mmce_qda_50	49.7	del.qda_mda_50	46.9
del.llda_mda_50	48.7	del.mmce_qda_10	50.1	del.qda_mda_50	49.7	del.costs_runtime	48.8
del.llda_qda_25	50.9	del.llda_mda_50	50.8	del.mmce_qda_10	51.8	del.mmce_qda_10	49.4
del.qda_mda_10	54.8	del.mmce_qda_25	52.5	del.llda_mda_50	52.8	del.llda_qda_50	51.0
del.mmce_qda_10	56.3	del.costs_runtime	54.9	del.llda_qda_25	53.2	del.mmce_qda_50	54.9
del.llda_qda_10	56.6	del.llda_qda_25	55.8	del.llda_qda_50	54.8	del.llda_qda_25	55.0
del.mmce_qda_25	56.8	del.qda_mda_25	57.3	del.qda_mda_10	55.6	del.llda_mda_50	55.4
del.qda_mda_25	57.8	del.llda_qda_10	58.8	del.qda_mda_25	56.1	del.llda_qda_10	56.7
del.llda_mda_25	60.7	del.qda_mda_10	60.0	del.llda_qda_10	56.3	del.qda_mda_25	57.5
del.mmce_qda_50	60.8	del.mmce_qda_50	61.1	del.llda_mda_25	61.3	del.qda_mda_10	58.0
del.costs_runtime	66.2	del.llda_mda_25	62.1	del.costs_runtime	66.1	del.llda_mda_25	59.7
dem.lin_simple.coef.max_by_min	67.3	dem.lin_simple.coef.max_by_min	70.1	dem.quad_simple.cond	67.2	dem.costs_runtime	68.7
dem.quad_simple.cond	67.3	dem.quad_simple.cond	72.3	dem.lin_simple.coef.max_by_min	67.3	dem.lin_simple.coef.max_by_min	69.9
dem.costs_runtime	72.3	dem.costs_runtime	73.9	dem.costs_runtime	71.8	dem.quad_simple.cond	70.1
del.llda_mda_10	75.8	del.llda_mda_10	75.7	del.llda_mda_10	75.8	del.llda_mda_10	74.7

(i) $n = 640$ (part 1)		(j) $n = 640$ (part 2)	
Feature	Rank	Feature	Rank
dem.lin_simple.coef.max	10.4	del.qda_mda_50	46.2
dem.lin_simple.intercept	14.0	del.mmce_qda_50	46.8
dem.lin_simple.coef.min	22.7	del.llda_qda_50	51.1
dem.quad_simple.adj_r2	22.8	del.llda_qda_25	51.3
dem.quad_w_interact.adj_r2	23.2	del.qda_mda_10	53.1
dem.lin_simple.adj_r2	23.9	del.llda_mda_50	53.8
dem.lin_w_interact.adj_r2	25.5	del.llda_qda_10	55.2
del.mmce_qda_25	29.7	del.qda_mda_25	56.3
del.mmce_lda_50	29.7	del.llda_mda_25	64.1
del.mmce_mda_50	30.1	dem.costs_runtime	68.9
del.mmce_lda_25	34.7	dem.lin_simple.coef.max_by_min	69.5
del.mmce_lda_10	36.7	dem.quad_simple.cond	69.6
del.mmce_mda_10	37.3	del.costs_runtime	71.7
del.mmce_qda_10	43.3	del.llda_mda_10	75.1
del.mmce_mda_25	43.4		

Table S.4: Average rankings of the d_{cm_angle} (dca), d_{cm_conv} (dcc), d_{cm_grad} (dgc), and d_{gcm} (dg) features in C7-D4 for $n \in \{3, 5, 10, 20, 40, 80, 160, 320, 640\}$.

(a) $n = 3$		(b) $n = 5$		(c) $n = 10$		(d) $n = 20$	
Feature	Rank	Feature	Rank	Feature	Rank	Feature	Rank
dca.costs_runtime	25.4	dca.y_ratio_best2worst.mean	20.4	dca.y_ratio_best2worst.mean	25.4	dca.y_ratio_best2worst.mean	26.1
dca.y_ratio_best2worst.mean	29.6	dca.y_ratio_best2worst.sd	30.8	dca.y_ratio_best2worst.sd	28.9	dca.y_ratio_best2worst.sd	31.6
dca.y_ratio_best2worst.sd	39.0	dca.angle.sd	44.2	dgc.mean	46.3	dca.costs_runtime	46.3
dg.min.costs_runtime	39.0	dca.angle.mean	47.6	dg.near.basin_prob.min	47.1	dca.dist_ctr2worst.mean	47.3
dgc.costs_runtime	39.3	dca.dist_ctr2worst.mean	48.0	dca.angle.sd	48.7	dca.dist_ctr2best.mean	47.4
dg.near.costs_runtime	43.9	dca.dist_ctr2worst.sd	48.5	dca.angle.mean	51.2	dca.dist_ctr2worst.sd	51.0
dca.dist_ctr2best.mean	44.5	dgc.sd	49.8	dca.dist_ctr2worst.mean	51.8	dgc.sd	52.0
dca.dist_ctr2worst.sd	48.5	dca.dist_ctr2best.sd	50.4	dg.mean.basin_prob.min	52.5	dgc.costs_runtime	52.8
dgc.mean	48.8	dca.dist_ctr2best.mean	51.9	dgc.sd	53.1	dca.dist_ctr2best.sd	53.4
dg.mean.costs_runtime	48.8	dgc.mean	53.0	dca.dist_ctr2best.sd	53.2	dca.angle.mean	53.4
dca.dist_ctr2best.sd	50.4	dg.mean.basin_prob.min	53.0	dca.dist_ctr2worst.sd	53.8	dca.angle.sd	54.6
dca.angle.mean	50.7	dg.near.basin_prob.min	54.8	dca.dist_ctr2best.mean	54.1	dgc.mean	55.2
dca.dist_ctr2worst.mean	50.8	dgc.costs_runtime	56.9	dg.near.best_attr_prob	56.0	dg.near.basin_prob.min	55.8
dca.angle.sd	52.4	dg.near.best_attr_prob	59.4	dgc.costs_runtime	60.3	dg.mean.basin_prob.min	56.4
dgc.sd	52.8	dg.min.basin_prob.min	60.3	dg.min.basin_prob.min	62.2	dg.near.costs_runtime	58.2
dg.mean.basin_prob.min	61.5	dcc.costs_runtime	61.1	dg.mean.best_attr_prob	65.8	dg.mean.costs_runtime	59.4
dg.near.best_attr_prob	61.8	dcc.concave.soft	61.4	dg.mean.basin_prob.max	66.2	dcc.costs_runtime	61.7
dg.near.basin_prob.min	63.1	dcc.convex.soft	61.9	dg.mean.basin_prob.median	66.8	dg.mean.basin_prob.max	65.0
dg.mean.best_attr_prob	63.9	dg.near.basin_prob.max	64.5	dg.near.costs_runtime	66.9	dg.mean.best_attr_prob	66.1
dg.min.best_attr_prob	64.6	dg.min.basin_prob.max	65.0	dg.min.basin_prob.max	67.9	dg.min.costs_runtime	67.2
dg.near.basin_prob.max	65.2	dg.min.best_attr_prob	67.6	dg.min.best_attr_prob	67.9	dg.min.basin_prob.min	69.0
dg.min.basin_prob.min	65.7	dg.near.costs_runtime	68.6	dcc.concave.hard	68.7	dg.min.basin_prob.max	69.6
dg.mean.basin_prob.max	66.2	dca.costs_runtime	69.0	dg.mean.costs_runtime	69.7	dg.min.best_attr_prob	69.7
dcc.concave.soft	67.8	dg.mean.basin_prob.max	70.0	dcc.convex.soft	70.1	dg.near.basin_certain.mean	70.2
dcc.convex.soft	68.8	dg.mean.best_attr_prob	70.5	dcc.concave.soft	70.1	dg.near.basin_prob.max	71.9
dg.min.basin_prob.max	69.4	dg.mean.basin_prob.median	72.9	dg.near.basin_prob.max	70.1	dg.mean.basin_prob.median	72.0
dg.mean.basin_prob.median	70.1	dg.near.basin_uncertain.max	75.0	dcc.costs_runtime	72.0	dg.near.basin_certain.sum	72.6
dcc.costs_runtime	71.3	dcc.concave.hard	75.3	dg.near.basin_uncertain.min	72.5	dg.near_uncertain	73.5
dcc.concave.hard	77.0	dg.min.basin_prob.median	76.7	dg.min.costs_runtime	73.8	dg.near.best_attr_prob	75.1
dg.near.basin_prob.median	77.6	dg.mean.costs_runtime	77.5	dca.costs_runtime	73.9	dg.mean.basin_uncertain.min	82.0
dg.min.basin_prob.median	78.2	dg.min.costs_runtime	80.7	dg.mean.basin_uncertain.median	76.3	dcc.concave.soft	82.0
dg.mean.basin_uncertain.mean	81.0	dg.near.basin_prob.median	81.1	dg.mean.basin_uncertain.mean	77.4	dg.mean.basin_uncertain.median	82.0
dg.mean.basin_prob.mean	81.2	dg.min.basin_prob.mean	81.5	dg.mean.basin_prob.mean	78.1	dg.mean.basin_certain.sum	82.6
dg.mean.basin_uncertain.median	83.8	dg.min.basin_uncertain.mean	81.5	dg.mean.basin_certain.sum	81.2	dcc.convex.soft	82.6
dg.near.basin_certain.mean	84.2	dg.mean.basin_uncertain.mean	81.6	dg.near.basin_certain.sum	83.5	dg.mean.basin_uncertain.mean	83.0
dg.min.basin_uncertain.median	85.3	dg.mean.basin_prob.mean	83.1	dg.near_uncertain	84.2	dg.near.basin_certain.mean	84.1
dg.min.basin_uncertain.mean	85.8	dg.near_uncertain	83.4	dg.mean.basin_uncertain.min	85.4	dg.mean.basin_prob.mean	84.8
dg.min.basin_prob.mean	86.9	dg.near.basin_certain.mean	83.7	dg.near.basin_uncertain.max	86.9	dcc.concave.hard	85.9
dg.min_uncertain	87.3	dg.near.basin_certain.sum	84.1	dg.min.basin_prob.median	86.9	dg.near.basin_uncertain.min	86.7
dg.min.basin_uncertain.min	88.7	dg.mean.basin_certain.sum	85.0	dg.near.basin_prob.median	87.8	dg.near.basin_prob.median	87.4
dcc.convex.hard	88.8	dg.mean.basin_uncertain.median	86.4	dg.near.basin_certain.mean	88.0	dg.min.basin_uncertain.max	88.4
dg.min.basin_certain.sum	89.0	dg.min.basin_uncertain.median	86.5	dg.mean_uncertain	89.9	dg.near.basin_certain.min	89.3
dg.near_uncertain	89.1	dg.near.basin_uncertain.min	87.1	dg.mean.basin_certain.mean	91.2	dg.min.basin_prob.median	89.5
dg.near.basin_certain.sum	89.3	dg.near.basin_uncertain.min	87.8	dg.min.basin_uncertain.max	92.7	dg.mean_uncertain	90.2
dg.min.basin_certain.mean	89.9	dg.near.basin_certain.max	87.8	dg.mean.basin_uncertain.max	93.3	dg.near.basin_uncertain.max	92.7
dg.mean.basin_certain.sum	90.7	dg.min.basin_uncertain.max	95.0	dg.min.basin_uncertain.min	93.9	dg.mean.basin_certain.max	93.0
dg.near.basin_uncertain.max	91.9	dg.min.basin_certain.mean	95.7	dg.min.basin_uncertain.mean	94.0	dg.mean.basin_uncertain.max	93.4
dg.mean.basin_uncertain.max	93.1	dcc.convex.hard	96.1	dg.min.basin_prob.mean	94.0	dg.mean.basin_certain.mean	95.2
dg.mean.basin_certain.mean	93.2	dg.mean.basin_uncertain.max	96.9	dg.near.basin_certain.max	94.4	dg.min.basin_uncertain.mean	95.6
dg.min.basin_uncertain.max	93.3	dg.mean.basin_certain.mean	97.0	dg.mean.basin_certain.median	95.0	dg.min.basin_prob.mean	96.2
dg.min.basin_certain.max	96.6	dg.near.basin_certain.median	97.1	dg.mean.basin_certain.max	96.4	dg.min.basin_certain.mean	96.9
dg.min.basin_certain.median	96.9	dg.min.basin_uncertain.min	97.5	dg.min.basin_certain.sum	98.7	dg.near.basin_certain.max	97.2
dg.near.basin_certain.median	97.7	dg.mean_uncertain	97.7	dg.min.basin_uncertain.median	99.1	dg.min.basin_uncertain.median	98.1
dg.near.basin_uncertain.min	98.1	dg.min.basin_certain.sum	98.5	dg.min_uncertain	99.2	dg.min.basin_certain.sum	99.5
dg.mean.basin_certain.max	98.2	dg.mean.basin_certain.max	99.0	dcc.convex.hard	99.7	dg.mean.basin_certain.median	99.7
dg.mean_uncertain	98.5	dg.min.basin_certain.max	100.0	dg.near.basin_certain.median	101.2	dg.min_uncertain	99.8
dg.near.basin_uncertain.median	98.8	dg.min.basin_certain.median	102.0	dg.min.basin_certain.mean	101.3	dcc.convex.hard	100.2
dg.mean.tcells	99.5	dg.min_uncertain	102.0	dg.near.basin_uncertain.median	101.8	dg.min.basin_certain.max	100.4
dg.mean.basin_uncertain.min	100.0	dg.mean.basin_certain.median	102.5	dg.min.basin_certain.median	103.9	dg.min.basin_uncertain.min	101.3
dg.near.basin_certain.max	100.3	dg.near.basin_uncertain.median	103.1	dg.near.basin_prob.mean	104.0	dg.min.basin_certain.median	101.4
dg.mean.basin_certain.median	102.6	dg.mean.tcells	105.4	dg.near.basin_uncertain.mean	104.5	dg.near.basin_uncertain.median	105.0
dg.min.tcells	104.0	dg.near.basin_uncertain.mean	105.6	dg.min.basin_certain.max	104.5	dg.mean.tcells	105.4
dg.near.basin_uncertain.mean	107.8	dg.near.attractors	106.0	dg.mean.tcells	104.7	dg.mean.pcells	111.4
dg.near.basin_prob.mean	109.1	dg.min.tcells	106.1	dg.near.attractors	105.1	dg.min.tcells	111.4
dg.near.attractors	109.5	dg.near.basin_prob.mean	106.7	dg.near.tcells	105.4	dg.near.basin_prob.mean	111.8
dg.mean.pcells	110.5	dg.near.tcells	108.1	dg.min.tcells	108.7	dg.near.basin_uncertain.mean	112.2
dg.near.pcells	110.6	dg.near.pcells	108.3	dg.near.pcells	108.7	dg.mean.attractors	112.4
dg.near.tcells	110.6	dg.mean.pcells	110.3	dg.near.basin_certain.min	111.8	dg.near.attractors	112.9
dg.min.basin_certain.min	111.1	dg.mean.attractors	111.1	dg.mean.attractors	112.6	dg.mean.basin_certain.min	113.1
dg.mean.basin_uncertain.sum	111.1	dg.mean.basin_uncertain.sum	112.0	dg.mean.pcells	112.7	dg.near.tcells	113.3
dg.mean.attractors	111.3	dg.min.basin_uncertain.sum	113.2	dg.mean.basin_certain.min	112.8	dg.mean.basin_uncertain.sum	113.3
dg.min.basin_uncertain.sum	112.6	dg.mean.basin_certain.min	114.2	dg.min.basin_certain.min	113.4	dg.near.pcells	113.5
dg.near.basin_certain.min	115.2	dg.near.basin_certain.min	114.4	dg.mean.basin_uncertain.sum	113.8	dg.min.basin_uncertain.sum	113.6
dg.mean.basin_certain.min	117.8	dg.min.basin_certain.min	116.1	dg.min.basin_uncertain.sum	114.5	dg.min.basin_certain.min	116.1
dg.min.pcells	120.3	dg.min.pcells	118.2	dg.min.attractors	120.5	dg.near.best_attr_no	117.8
dg.min.attractors	121.2	dg.min.attractors	118.6	dg.min.pcells	121.1	dg.min.attractors	120.9
dg.near.best_attr.no	123.5	dg.near.best_attr.no	123.7	dg.near.best_attr.no	124.0	dg.min.pcells	121.3

Table S.5: Average rankings of the d_{cm_angle} (dca), d_{cm_conv} (dcc), d_{cm_grad} (dgc), and d_{gcm} (dg) features in C7-D4 for $n \in \{40, 80, 160, 320, 640\}$.

(a) $n = 40$		(b) $n = 80$		(c) $n = 160$		(d) $n = 320$	
Feature	Rank	Feature	Rank	Feature	Rank	Feature	Rank
dca.y_ratio_best2worst.mean	34.2	dca.y_ratio_best2worst.mean	40.5	dca.y_ratio_best2worst.mean	43.4	dca.y_ratio_best2worst.sd	43.2
dca.y_ratio_best2worst.sd	36.0	dca.y_ratio_best2worst.sd	44.6	dca.y_ratio_best2worst.sd	45.2	dca.y_ratio_best2worst.mean	46.5
dg.mean.basin_prob.min	49.0	dca.angle.mean	48.9	dcc.costs_runtime	47.4	dca.angle.mean	49.2
dca.dist_ctr2best.sd	50.3	dca.angle.sd	54.4	dca.angle.mean	48.4	dcc.costs_runtime	49.3
dgc.sd	53.1	dg.mean.basin_prob.min	54.9	dgc.sd	50.6	dg.near.costs_runtime	49.9
dgc.mean	53.7	dca.dist_ctr2best.mean	55.3	dca.angle.sd	51.6	dca.angle.sd	51.2
dg.mean.basin_prob.median	54.5	dgc.sd	55.4	dgc.mean	51.6	dgc.costs_runtime	51.8
dca.angle.mean	54.8	dgc.costs_runtime	56.7	dgc.costs_runtime	55.2	dca.dist_ctr2worst.mean	52.7
dca.dist_ctr2worst.mean	55.5	dgc.mean	58.4	dg.mean.basin_prob.min	56.6	dca.dist_ctr2best.sd	53.6
dca.dist_ctr2worst.sd	56.9	dcc.costs_runtime	58.9	dg.near.costs_runtime	58.0	dca.dist_ctr2worst.sd	55.8
dgc.costs_runtime	57.8	dca.dist_ctr2worst.sd	59.9	dca.dist_ctr2worst.sd	58.7	dgc.mean	55.9
dg.near.basin_prob.min	59.2	dca.dist_ctr2worst.mean	60.0	dg.near.basin_prob.max	60.3	dca.dist_ctr2best.mean	56.3
dcc.costs_runtime	59.7	dca.dist_ctr2best.sd	60.2	dg.min.basin_prob.min	60.6	dg.min.basin_prob.min	57.1
dca.angle.sd	61.6	dg.near.costs_runtime	61.7	dca.dist_ctr2best.sd	61.3	dca.costs_runtime	57.5
dca.dist_ctr2best.mean	62.6	dg.mean.best_attr.prob	63.1	dca.dist_ctr2best.mean	61.5	dg.near.basin_prob.min	61.2
dg.mean.basin_prob.max	64.3	dg.mean.basin_prob.max	64.3	dca.dist_ctr2best.mean	61.9	dg.mean.basin_prob.max	61.3
dg.near.costs_runtime	64.6	dg.min.basin_prob.min	64.5	dg.near.basin_prob.min	64.1	dg.near.basin_prob.max	61.9
dg.min.basin_prob.min	65.4	dca.costs_runtime	65.6	dg.min.best_attr.prob	66.6	dg.mean.basin_prob.min	63.7
dg.mean.best_attr.prob	65.7	dg.mean.basin_prob.median	65.7	dg.mean.basin_prob.max	66.6	dg.mean.best_attr.prob	64.2
dg.min.best_attr.prob	66.2	dg.min.best_attr.prob	66.7	dca.costs_runtime	68.2	dg.min.best_attr.prob	64.4
dg.min.basin_prob.max	69.3	dg.near.basin_prob.max	69.1	dg.near.basin_prob.median	68.9	dg.min.basin_prob.max	65.5
dca.costs_runtime	70.1	dg.min.basin_prob.max	70.1	dg.min.basin_prob.max	69.2	dg.near.best_attr.prob	72.4
dg.mean.basin_uncertain.mean	71.2	dcc.concave.soft	72.3	dg.min.best_attr.prob	70.5	dg.mean.costs_runtime	73.4
dg.near.best_attr.prob	71.4	dg.near.best_attr.prob	72.6	dg.near.basin_certain.mean	74.1	dg.min.basin_uncertain.min	76.2
dg.mean.basin_prob.mean	72.1	dg.near.basin_prob.min	73.0	dg.mean.best_attr.prob	75.1	dg.min.basin_prob.median	78.5
dg.mean.basin_uncertain.min	72.5	dcc.convex.soft	73.7	dcc.concave.soft	75.6	dg.mean.basin_prob.median	78.7
dg.mean.basin_uncertain.median	72.8	dg.mean.basin_prob.mean	74.7	dcc.convex.soft	76.6	dg.near.basin_certain.mean	79.7
dg.near.basin_prob.max	73.7	dg.mean.basin_uncertain.median	76.6	dg.near.uncertain	77.9	dg.near.basin_prob.median	81.4
dcc.convex.soft	78.9	dg.mean.basin_uncertain.mean	76.7	dg.min.basin_prob.median	78.3	dg.min.costs_runtime	82.1
dg.mean.pcells	80.2	dg.min.basin_prob.median	79.9	dg.near.basin_certain.sum	78.8	dg.near.basin_certain.sum	82.1
dg.mean.attractors	80.7	dg.near.basin_prob.median	82.4	dg.mean.basin_prob.median	83.1	dcc.concave.soft	82.3
dcc.concave.soft	80.7	dg.near.basin_certain.mean	83.4	dg.min.basin_prob.mean	83.2	dg.near.basin_uncertain.min	82.4
dg.min.basin_prob.median	81.0	dg.mean.costs_runtime	84.7	dg.mean.basin_prob.mean	84.3	dg.near.uncertain	82.9
dg.min.costs_runtime	81.8	dg.near.basin_certain.sum	85.4	dg.min.basin_uncertain.min	84.4	dcc.concave.hard	83.3
dg.mean.costs_runtime	84.0	dg.min.basin_uncertain.mean	86.2	dg.near.basin_uncertain.min	85.0	dg.mean.basin_prob.mean	83.7
dg.min.uncertain	84.5	dg.mean.basin_uncertain.min	86.2	dg.mean.basin_uncertain.mean	85.4	dg.near.basin_uncertain.max	84.2
dg.near.basin_prob.median	86.8	dg.mean.basin_uncertain.max	87.4	dg.min.basin_uncertain.median	85.5	dg.mean.basin_uncertain.mean	85.0
dg.min.basin_uncertain.mean	87.0	dg.min.basin_prob.mean	87.7	dcc.concave.hard	86.8	dcc.convex.soft	85.6
dg.mean.basin_certain.sum	89.8	dg.mean.basin_certain.sum	88.9	dg.min.basin_uncertain.mean	87.1	dg.min.basin_uncertain.mean	86.3
dg.mean.uncertain	90.3	dg.near.uncertain	89.0	dg.near.basin_certain.max	87.9	dg.min.uncertain	87.5
dg.min.basin_prob.mean	90.4	dg.near.basin_certain.max	89.2	dg.mean.basin_uncertain.median	88.2	dg.near.basin_uncertain.median	88.0
dg.near.basin_uncertain.max	90.5	dg.min.basin_uncertain.median	90.2	dg.near.basin_uncertain.median	88.5	dg.near.basin_certain.median	88.0
dg.near.basin_uncertain.min	91.2	dg.min.basin_uncertain.min	90.8	dg.near.basin_uncertain.max	89.0	dg.min.basin_prob.mean	90.4
dg.min.basin_uncertain.median	92.7	dg.mean.uncertain	91.2	dg.mean.basin_uncertain.min	91.1	dg.mean.basin_uncertain.max	90.8
dg.near.basin_certain.mean	93.1	dg.mean.basin_certain.mean	91.5	dg.near.basin_certain.mean	93.0	dg.min.basin_uncertain.median	91.4
dg.mean.basin_uncertain.max	93.4	dg.min.costs_runtime	92.2	dg.min.basin_certain.mean	93.1	dg.mean.basin_uncertain.median	92.3
dg.mean.basin_certain.mean	93.7	dg.min.basin_certain.sum	93.0	dg.min.uncertain	94.4	dg.mean.basin_certain.sum	94.7
dg.mean.basin_certain.median	94.1	dg.mean.basin_certain.median	94.4	dg.min.basin_uncertain.max	95.2	dg.mean.uncertain	96.9
dg.min.basin_uncertain.min	94.3	dg.min.basin_certain.mean	96.8	dg.min.basin_certain.sum	96.3	dg.min.basin_uncertain.max	96.9
dg.min.basin_certain.sum	94.7	dg.near.basin_uncertain.max	96.9	dg.min.basin_certain.median	97.3	dg.near.basin_certain.min	97.1
dg.min.basin_uncertain.max	96.0	dg.min.basin_uncertain.max	97.6	dg.mean.tcells	98.3	dg.mean.tcells	97.6
dg.mean.tcells	98.5	dcc.concave.hard	98.3	dg.mean.costs_runtime	98.7	dg.mean.basin_certain.mean	98.0
dg.min.basin_certain.mean	99.2	dcc.convex.hard	98.7	dg.mean.uncertain	98.9	dg.min.basin_certain.sum	98.9
dg.near.basin_certain.median	100.5	dg.mean.basin_certain.max	98.8	dg.min.costs_runtime	99.8	dg.mean.basin_uncertain.sum	99.9
dg.near.uncertain	100.9	dg.min.basin_certain.max	99.3	dg.min.basin_certain.max	100.1	dg.mean.basin_certain.median	100.1
dg.near.basin_certain.sum	101.5	dg.min.basin_certain.median	100.5	dg.mean.basin_certain.sum	101.7	dg.min.tcells	100.7
dg.near.basin_uncertain.median	101.8	dg.mean.tcells	101.7	dg.near.pcells	103.8	dg.mean.basin_uncertain.min	100.7
dcc.concave.hard	103.0	dg.min.uncertain	102.1	dg.min.tcells	103.9	dg.min.basin_certain.mean	100.8
dg.min.basin_certain.max	103.5	dg.near.basin_certain.median	104.0	dg.near.basin_prob.mean	103.9	dg.min.basin_uncertain.sum	100.8
dg.min.basin_certain.median	105.1	dg.near.basin_uncertain.min	104.7	dg.near.basin_certain.min	104.5	dg.near.basin_certain.max	100.8
dg.mean.basin_certain.max	105.3	dg.min.basin_uncertain.sum	105.2	dg.mean.basin_uncertain.max	104.8	dg.min.basin_certain.max	104.3
dg.min.tcells	105.4	dg.mean.basin_uncertain.sum	105.3	dg.near.tcells	105.3	dg.near.attractors	104.9
dg.near.basin_certain.max	106.0	dg.mean.pcells	106.2	dg.mean.basin_certain.mean	105.6	dg.mean.basin_certain.max	104.9
dg.mean.basin_uncertain.sum	107.2	dg.near.basin_uncertain.median	107.0	dg.near.attractors	106.2	dg.near.pcells	107.4
dg.min.basin_uncertain.sum	108.0	dg.mean.attractors	107.2	dcc.convex.hard	106.9	dcc.convex.hard	107.5
dg.near.basin_uncertain.mean	108.1	dg.min.tcells	109.0	dg.near.basin_uncertain.mean	106.9	dg.near.tcells	107.6
dg.near.basin_prob.mean	108.3	dg.mean.basin_certain.min	109.2	dg.mean.basin_certain.median	107.5	dg.min.basin_certain.median	108.0
dg.near.attractors	108.3	dg.min.basin_certain.min	112.3	dg.mean.basin_certain.max	110.3	dg.near.basin_uncertain.mean	108.2
dg.near.tcells	109.1	dg.near.basin_certain.min	112.9	dg.mean.basin_uncertain.sum	111.3	dg.near.best_attr.no	110.7
dg.near.pcells	109.9	dg.near.basin_uncertain.mean	113.4	dg.min.basin_uncertain.sum	111.7	dg.near.basin_prob.mean	110.7
dg.mean.basin_certain.min	110.1	dg.near.tcells	114.2	dg.min.basin_certain.min	111.8	dg.mean.basin_certain.min	110.7
dcc.convex.hard	113.5	dg.near.basin_prob.mean	114.7	dg.mean.attractors	115.0	dg.min.attractors	112.3
dg.min.basin_certain.min	117.3	dg.near.pcells	114.7	dg.near.best_attr.no	116.9	dg.min.pcells	114.3
dg.near.basin_certain.min	120.3	dg.near.attractors	115.4	dg.min.attractors	117.1	dg.min.basin_certain.min	116.1
dg.min.attractors	120.6	dg.min.pcells	116.8	dg.min.pcells	117.7	dg.mean.attractors	120.3
dg.min.pcells	120.7	dg.near.best_attr.no	118.8	dg.mean.pcells	118.3	dg.mean.pcells	120.6
dg.near.best_attr.no	124.7	dg.min.attractors	119.1	dg.mean.basin_certain.min	118.6		

Table S.6: Average rankings of the d_{cm_angle} (dca), d_{cm_conv} (dcc), d_{cm_grad} (dgc), and d_{gcm} (dg) features in C7-D4 for $n = 640$.

(a) $n = 640$

Feature	Rank
dca.y_ratio_best2worst.sd	43.2
dca.angle.mean	44.7
dcc.costs_runtime	47.1
dgc.mean	50.5
dg.near.costs_runtime	50.8
dca.angle.sd	51.1
dca.dist_ctr2worst.mean	51.4
dca.dist_ctr2best.mean	52.2
dca.y_ratio_best2worst.mean	52.6
dca.dist_ctr2best.sd	52.9
dgc.costs_runtime	54.9
dca.dist_ctr2worst.sd	55.4
dg.min.basin_prob.max	57.6
dg.near.basin_prob.min	62.2
dg.min.basin_prob.min	62.3
dca.costs_runtime	62.9
dg.min.best_attr.prob	63.8
dg.min.basin_prob.median	64.3
dg.mean.basin_prob.min	64.9
dg.near.best_attr.prob	65.7
dg.mean.basin_prob.max	67.8
dg.near.basin_prob.max	69.4
dg.mean.best_attr.prob	70.2
dg.min.basin_prob.mean	74.0
dg.near.basin_uncertain.min	75.1
dg.near.basin_prob.median	75.7
dg.min.basin_uncertain.mean	76.1
dg.min.basin_uncertain.median	79.0
dcc.convex.soft	79.6
dg.min.uncertain	81.1
dg.mean.costs_runtime	81.7
dg.near.basin_certain.mean	83.5
dcc.concave.soft	84.1
dg.mean.basin_prob.median	84.2
dg.min.costs_runtime	85.9
dg.near.basin_uncertain.median	86.3
dg.min.basin_certain.median	86.6
dg.min.basin_certain.mean	87.1
dg.min.basin_uncertain.min	88.1
dg.mean.basin_prob.mean	88.8
dg.near.basin_uncertain.max	89.7
dg.min.basin_uncertain.max	91.0
dg.min.basin_certain.sum	92.3
dg.mean.basin_uncertain.median	92.4
dg.mean.basin_uncertain.mean	93.3
dg.mean.uncertain	94.8
dg.mean.basin_uncertain.max	96.0
dg.min.basin_uncertain.sum	96.4
dg.min.basin_certain.max	96.7
dg.near.uncertain	96.7
dcc.concave.hard	96.9
dg.mean.basin_certain.mean	97.9
dg.min.tcells	98.7
dg.near.basin_certain.sum	99.2
dg.mean.basin_uncertain.sum	99.3
dg.near.attractors	100.9
dg.min.attractors	101.0
dg.mean.basin_uncertain.min	101.2
dg.mean.basin_certain.median	101.7
dg.near.basin_prob.mean	104.0
dg.near.tcells	104.3
dg.near.basin_certain.median	104.7
dg.min.pcells	104.8
dg.near.basin_uncertain.mean	105.0
dg.near.best_attr.no	105.1
dg.near.pcells	105.5
dg.mean.basin_certain.sum	106.2
dg.min.basin_certain.min	106.7
dg.near.basin_certain.max	106.9
dg.mean.tcells	109.3
dg.mean.basin_certain.max	109.4
dcc.convex.hard	111.6
dg.near.basin_certain.min	113.0
dg.mean.basin_certain.min	114.1
dg.mean.pcells	118.1
dg.mean.attractors	118.8

Table S.7: Average accuracy of C7-D2 with different m for $n \in \{3, 5, 10, 20, 40, 80, 160, 320, 640\}$.

(a) Multimodality						(b) Global structure					
	$m = 1$	$m = 2$	$m = 3$	$m = 5$	$m = 10$		$m = 1$	$m = 2$	$m = 3$	$m = 5$	$m = 10$
5	0.611 (0.422)	0.622 (0.415)	0.650 (0.432)	Na	Na	5	0.769 (0.395)	0.761 (0.412)	0.764 (0.402)	Na	Na
10	0.583 (0.439)	0.647 (0.434)	0.628 (0.425)	0.572 (0.415)	Na	10	0.700 (0.437)	0.692 (0.435)	0.703 (0.435)	0.686 (0.451)	Na
20	0.617 (0.415)	0.639 (0.413)	0.653 (0.425)	0.647 (0.433)	0.631 (0.430)	20	0.717 (0.421)	0.697 (0.440)	0.714 (0.425)	0.717 (0.429)	0.728 (0.421)
40	0.603 (0.448)	0.617 (0.441)	0.589 (0.434)	0.589 (0.438)	0.600 (0.429)	40	0.711 (0.460)	0.711 (0.460)	0.714 (0.456)	0.714 (0.456)	0.711 (0.460)
80	0.625 (0.455)	0.622 (0.454)	0.625 (0.451)	0.631 (0.459)	0.631 (0.444)	80	0.694 (0.452)	0.697 (0.453)	0.697 (0.453)	0.694 (0.453)	0.697 (0.453)
160	0.544 (0.477)	0.561 (0.475)	0.556 (0.477)	0.592 (0.472)	0.547 (0.474)	160	0.622 (0.471)	0.631 (0.463)	0.633 (0.462)	0.628 (0.469)	0.628 (0.469)
320	0.575 (0.482)	0.578 (0.472)	0.586 (0.471)	0.592 (0.472)	0.572 (0.474)	320	0.664 (0.480)	0.667 (0.482)	0.664 (0.480)	0.664 (0.480)	0.661 (0.478)
640	0.586 (0.478)	0.583 (0.489)	0.581 (0.488)	0.583 (0.488)	0.575 (0.483)	640	0.672 (0.474)	0.678 (0.468)	0.675 (0.471)	0.675 (0.471)	0.675 (0.471)

(c) Separability						(d) Variable scaling					
	$m = 1$	$m = 2$	$m = 3$	$m = 5$	$m = 10$		$m = 1$	$m = 2$	$m = 3$	$m = 5$	$m = 10$
5	0.783 (0.374)	0.761 (0.421)	0.764 (0.400)	Na	Na	5	0.586 (0.475)	0.594 (0.480)	0.592 (0.478)	Na	Na
10	0.761 (0.408)	0.753 (0.411)	0.750 (0.415)	0.758 (0.408)	Na	10	0.564 (0.492)	0.572 (0.496)	0.556 (0.490)	0.528 (0.494)	Na
20	0.736 (0.402)	0.744 (0.401)	0.750 (0.403)	0.728 (0.425)	0.717 (0.433)	20	0.578 (0.499)	0.583 (0.504)	0.583 (0.504)	0.575 (0.498)	0.542 (0.509)
40	0.758 (0.400)	0.758 (0.401)	0.758 (0.398)	0.756 (0.399)	0.750 (0.404)	40	0.542 (0.499)	0.556 (0.492)	0.550 (0.494)	0.550 (0.494)	0.544 (0.497)
80	0.681 (0.454)	0.686 (0.447)	0.683 (0.455)	0.683 (0.452)	0.689 (0.449)	80	0.539 (0.507)	0.581 (0.501)	0.583 (0.504)	0.567 (0.496)	0.583 (0.504)
160	0.669 (0.472)	0.667 (0.476)	0.672 (0.468)	0.667 (0.476)	0.669 (0.472)	160	0.567 (0.496)	0.583 (0.504)	0.583 (0.504)	0.583 (0.504)	0.583 (0.504)
320	0.672 (0.474)	0.669 (0.467)	0.669 (0.472)	0.661 (0.472)	0.672 (0.468)	320	0.547 (0.495)	0.583 (0.504)	0.583 (0.504)	0.583 (0.504)	0.583 (0.504)
640	0.694 (0.419)	0.669 (0.453)	0.658 (0.460)	0.775 (0.390)	0.781 (0.400)	640	0.542 (0.509)	0.542 (0.509)	0.542 (0.509)	0.542 (0.509)	0.569 (0.496)

(e) Homogeneity						(f) Basin size					
	$m = 1$	$m = 2$	$m = 3$	$m = 5$	$m = 10$		$m = 1$	$m = 2$	$m = 3$	$m = 5$	$m = 10$
5	0.669 (0.418)	0.647 (0.408)	0.664 (0.410)	Na	Na	5	0.525 (0.386)	0.522 (0.373)	0.517 (0.375)	Na	Na
10	0.767 (0.341)	0.769 (0.338)	0.758 (0.345)	0.758 (0.350)	Na	10	0.603 (0.376)	0.636 (0.384)	0.642 (0.365)	0.581 (0.372)	Na
20	0.775 (0.376)	0.731 (0.403)	0.731 (0.396)	0.717 (0.424)	0.736 (0.402)	20	0.536 (0.404)	0.558 (0.409)	0.569 (0.403)	0.581 (0.405)	0.533 (0.421)
40	0.811 (0.325)	0.744 (0.407)	0.744 (0.413)	0.739 (0.412)	0.731 (0.414)	40	0.586 (0.431)	0.614 (0.423)	0.608 (0.421)	0.619 (0.409)	0.608 (0.424)
80	0.717 (0.431)	0.742 (0.412)	0.717 (0.419)	0.678 (0.448)	0.675 (0.452)	80	0.594 (0.466)	0.597 (0.460)	0.600 (0.465)	0.583 (0.471)	0.583 (0.467)
160	0.678 (0.444)	0.683 (0.439)	0.669 (0.456)	0.675 (0.459)	0.656 (0.454)	160	0.611 (0.456)	0.614 (0.447)	0.617 (0.448)	0.628 (0.444)	0.619 (0.439)
320	0.742 (0.438)	0.761 (0.417)	0.747 (0.441)	0.747 (0.441)	0.739 (0.438)	320	0.497 (0.461)	0.508 (0.446)	0.528 (0.452)	0.511 (0.454)	0.500 (0.456)
640	0.789 (0.414)	0.781 (0.411)	0.742 (0.423)	0.739 (0.438)	0.781 (0.410)	640	0.511 (0.468)	0.528 (0.471)	0.511 (0.467)	0.522 (0.474)	0.517 (0.474)

(g) GL contrast						(h) Overall average					
	$m = 1$	$m = 2$	$m = 3$	$m = 5$	$m = 10$		$m = 1$	$m = 2$	$m = 3$	$m = 5$	$m = 10$
5	0.536 (0.414)	0.536 (0.411)	0.522 (0.426)	Na	Na	5	0.640 (0.417)	0.635 (0.420)	0.639 (0.422)	Na	Na
10	0.600 (0.413)	0.619 (0.410)	0.619 (0.405)	0.617 (0.404)	Na	10	0.654 (0.418)	0.670 (0.415)	0.665 (0.412)	0.643 (0.417)	Na
20	0.628 (0.383)	0.617 (0.384)	0.636 (0.394)	0.600 (0.407)	0.619 (0.408)	20	0.655 (0.417)	0.653 (0.421)	0.662 (0.420)	0.652 (0.429)	0.644 (0.433)
40	0.583 (0.430)	0.597 (0.428)	0.578 (0.433)	0.594 (0.436)	0.589 (0.439)	40	0.656 (0.434)	0.657 (0.436)	0.649 (0.436)	0.652 (0.435)	0.648 (0.438)
80	0.622 (0.459)	0.619 (0.458)	0.617 (0.460)	0.606 (0.457)	0.592 (0.447)	80	0.639 (0.456)	0.649 (0.451)	0.646 (0.453)	0.635 (0.457)	0.636 (0.454)
160	0.631 (0.446)	0.622 (0.445)	0.608 (0.435)	0.608 (0.442)	0.600 (0.444)	160	0.617 (0.460)	0.623 (0.458)	0.620 (0.458)	0.626 (0.460)	0.615 (0.459)
320	0.653 (0.459)	0.647 (0.436)	0.628 (0.428)	0.639 (0.440)	0.639 (0.440)	320	0.621 (0.468)	0.631 (0.459)	0.629 (0.461)	0.628 (0.463)	0.624 (0.463)
640	0.589 (0.492)	0.614 (0.473)	0.633 (0.473)	0.631 (0.482)	0.594 (0.481)	640	0.626 (0.466)	0.628 (0.467)	0.620 (0.468)	0.638 (0.466)	0.642 (0.463)

Table S.8: Average accuracy of C7-D4 with different m for $n \in \{5, 10, 20, 40, 80, 160, 320, 640\}$.

(a) Multimodality				(b) Global structure			
	$m = 2$	$m = 3$	$m = 5$		$m = 2$	$m = 3$	$m = 5$
5	0.522 (0.423)	0.550 (0.436)	Na	5	0.778 (0.400)	0.772 (0.408)	Na
10	0.561 (0.414)	0.558 (0.425)	0.544 (0.419)	10	0.719 (0.426)	0.728 (0.412)	0.728 (0.424)
20	0.550 (0.436)	0.525 (0.434)	0.536 (0.419)	20	0.733 (0.416)	0.733 (0.412)	0.733 (0.413)
40	0.564 (0.449)	0.567 (0.456)	0.575 (0.450)	40	0.714 (0.456)	0.717 (0.448)	0.722 (0.447)
80	0.544 (0.436)	0.567 (0.442)	0.578 (0.440)	80	0.706 (0.440)	0.708 (0.441)	0.714 (0.437)
160	0.528 (0.445)	0.533 (0.450)	0.547 (0.439)	160	0.656 (0.453)	0.661 (0.453)	0.667 (0.448)
320	0.542 (0.472)	0.553 (0.474)	0.542 (0.473)	320	0.664 (0.474)	0.661 (0.478)	0.669 (0.478)
640	0.536 (0.466)	0.528 (0.462)	0.506 (0.468)	640	0.683 (0.461)	0.683 (0.461)	0.678 (0.464)

(c) Separability				(d) Variable scaling			
	$m = 2$	$m = 3$	$m = 5$		$m = 2$	$m = 3$	$m = 5$
5	0.761 (0.409)	0.769 (0.417)	Na	5	0.636 (0.469)	0.633 (0.464)	Na
10	0.758 (0.414)	0.767 (0.413)	0.772 (0.413)	10	0.528 (0.486)	0.536 (0.482)	0.542 (0.478)
20	0.731 (0.410)	0.739 (0.408)	0.722 (0.414)	20	0.536 (0.504)	0.531 (0.501)	0.539 (0.507)
40	0.775 (0.402)	0.778 (0.399)	0.769 (0.395)	40	0.533 (0.490)	0.550 (0.497)	0.553 (0.496)
80	0.719 (0.425)	0.722 (0.423)	0.711 (0.431)	80	0.581 (0.501)	0.583 (0.504)	0.581 (0.501)
160	0.708 (0.440)	0.719 (0.436)	0.725 (0.436)	160	0.583 (0.504)	0.583 (0.504)	0.583 (0.504)
320	0.731 (0.433)	0.733 (0.431)	0.725 (0.432)	320	0.544 (0.506)	0.547 (0.504)	0.558 (0.497)
640	0.744 (0.413)	0.739 (0.419)	0.753 (0.412)	640	0.542 (0.509)	0.542 (0.509)	0.542 (0.509)

(e) Homogeneity				(f) Basin size			
	$m = 2$	$m = 3$	$m = 5$		$m = 2$	$m = 3$	$m = 5$
5	0.636 (0.412)	0.636 (0.421)	Na	5	0.478 (0.403)	0.489 (0.403)	Na
10	0.706 (0.395)	0.697 (0.397)	0.694 (0.410)	10	0.531 (0.388)	0.506 (0.401)	0.508 (0.403)
20	0.769 (0.367)	0.775 (0.359)	0.764 (0.360)	20	0.483 (0.425)	0.481 (0.432)	0.497 (0.437)
40	0.781 (0.368)	0.786 (0.361)	0.789 (0.356)	40	0.533 (0.440)	0.528 (0.441)	0.525 (0.444)
80	0.706 (0.434)	0.733 (0.414)	0.742 (0.418)	80	0.519 (0.448)	0.528 (0.457)	0.508 (0.471)
160	0.656 (0.465)	0.667 (0.449)	0.678 (0.444)	160	0.472 (0.459)	0.475 (0.454)	0.483 (0.457)
320	0.772 (0.408)	0.778 (0.410)	0.761 (0.410)	320	0.400 (0.478)	0.403 (0.476)	0.406 (0.476)
640	0.758 (0.424)	0.758 (0.424)	0.747 (0.435)	640	0.492 (0.475)	0.483 (0.479)	0.492 (0.477)

(g) GL contrast				(h) Overall average			
	$m = 2$	$m = 3$	$m = 5$		$m = 2$	$m = 3$	$m = 5$
5	0.503 (0.407)	0.508 (0.408)	Na	5	0.616 (0.426)	0.623 (0.429)	Na
10	0.592 (0.419)	0.569 (0.398)	0.561 (0.409)	10	0.628 (0.423)	0.623 (0.423)	0.621 (0.427)
20	0.558 (0.410)	0.544 (0.410)	0.542 (0.412)	20	0.623 (0.432)	0.618 (0.432)	0.619 (0.431)
40	0.522 (0.417)	0.508 (0.416)	0.508 (0.417)	40	0.632 (0.440)	0.633 (0.440)	0.635 (0.438)
80	0.553 (0.446)	0.567 (0.444)	0.558 (0.443)	80	0.618 (0.447)	0.630 (0.447)	0.627 (0.450)
160	0.547 (0.440)	0.536 (0.443)	0.547 (0.444)	160	0.593 (0.457)	0.596 (0.455)	0.604 (0.453)
320	0.550 (0.473)	0.558 (0.474)	0.550 (0.478)	320	0.600 (0.471)	0.605 (0.471)	0.602 (0.470)
640	0.544 (0.486)	0.561 (0.480)	0.561 (0.478)	640	0.614 (0.466)	0.613 (0.466)	0.611 (0.467)

Figure S.5: Boxplots of values of `ela_meta.lin_simple.adj_r2` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 160$.

Figure S.6: Boxplots of values of `ela_meta.lin_simple.intercept` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 160$.

Figure S.7: Boxplots of values of `ela_meta.lin_simple.coef.min` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 160$.

Figure S.8: Boxplots of values of `ela_meta.lin_simple.coef.max` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 160$.

Figure S.9: Boxplots of values of `ela_meta.lin_simple.coef.max_by_min` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 160$.

Figure S.10: Boxplots of values of `ela_meta.lin_w_interact.adj_r2` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 160$.

Figure S.11: Boxplots of values of `ela_meta.quad_simple.adj_r2` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 160$.

Figure S.12: Boxplots of values of `ela_meta.quad_simple.cond` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 160$.

Figure S.13: Boxplots of values of `ela_meta.quad_w_interact.adj_r2` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 160$.

Figure S.14: Boxplots of values of `ela_meta.costs_fun_evals` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 160$.

Figure S.15: Boxplots of values of `ela_meta.costs_runtime` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 160$.

Figure S.16: Boxplots of values of `ela_level.mmce_lda_10` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 160$.

Figure S.17: Boxplots of values of `ela_level.mmce_qda_10` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.20: Boxplots of values of `ela_level.lda_mda_10` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.18: Boxplots of values of `ela_level.mmce_mda_10` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.21: Boxplots of values of `ela_level.qda_mda_10` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.19: Boxplots of values of `ela_level.lda_qda_10` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.22: Boxplots of values of `ela_level.mmce_lda_25` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.23: Boxplots of values of `ela_level.mmce_qda_25` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.26: Boxplots of values of `ela_level.lda_mda_25` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.24: Boxplots of values of `ela_level.mmce_mda_25` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.27: Boxplots of values of `ela_level.qda_mda_25` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.25: Boxplots of values of `ela_level.lda_qda_25` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.28: Boxplots of values of `ela_level.mmce_lda_50` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.29: Boxplots of values of `ela_level.mmce_qda_50` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.32: Boxplots of values of `ela_level.llda_mda_50` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.30: Boxplots of values of `ela_level.mmce_mda_50` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.33: Boxplots of values of `ela_level.qda_mda_50` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.31: Boxplots of values of `ela_level.llda_qda_50` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.34: Boxplots of values of `ela_level.costs_fun_evals` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.35: Boxplots of values of `ela_level.costs_runtime` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 160$.

Figure S.36: Boxplots of values of `cm_grad.mean` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.37: Boxplots of values of `cm_grad.sd` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.38: Boxplots of values of `cm_grad.costs_fun_evals` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.39: Boxplots of values of `cm_grad.costs_runtime` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.40: Boxplots of values of `cm_angle.dist_ctr2best.mean` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.41: Boxplots of values of `cm_angle.dist_ctr2best.sd` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.44: Boxplots of values of `cm_angle.angle.mean` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.42: Boxplots of values of `cm_angle.dist_ctr2worst.mean` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.45: Boxplots of values of `cm_angle.angle.sd` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.43: Boxplots of values of `cm_angle.dist_ctr2worst.sd` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.46: Boxplots of values of `cm_angle.y_ratio_best2worst.mean` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.47: Boxplots of values of `cm_angle.y_ratio_best2worst.sd` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.48: Boxplots of values of `cm_angle.costs_fun_evals` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.49: Boxplots of values of `cm_angle.costs_runtime` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.50: Boxplots of values of `cm_conv.convex.hard` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.51: Boxplots of values of `cm_conv.concave.hard` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.52: Boxplots of values of `cm_conv.convex.soft` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.53: Boxplots of values of `cm_conv.concave.soft` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.54: Boxplots of values of `cm_conv.costs_fun_evals` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.55: Boxplots of values of `cm_conv.costs_runtime` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.56: Boxplots of values of `gcm.min.attractors` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.57: Boxplots of values of `gcm.min.pcells` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.58: Boxplots of values of `gcm.min.tcells` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.59: Boxplots of values of `gcm.min.uncertain` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.60: Boxplots of values of `gcm.min.basin_prob.min` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.61: Boxplots of values of `gcm.min.basin_prob.mean` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.62: Boxplots of values of `gcm.min.basin_prob.median` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.63: Boxplots of values of `gcm.min.basin_prob.max` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.64: Boxplots of values of `gcm.min.basin_prob.sd` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.65: Boxplots of values of `gcm.min.basin_certain.min` and its dimensionality reduction version on 15 instances of f_1 , f_6 , f_{10} , f_{15} , and f_{20} with $n = 5$.

Figure S.68: Boxplots of values of `gcm.min.basin_certain.max` and its dimensionality reduction version on 15 instances of f_1 , f_6 , f_{10} , f_{15} , and f_{20} with $n = 5$.

Figure S.66: Boxplots of values of `gcm.min.basin_certain.mean` and its dimensionality reduction version on 15 instances of f_1 , f_6 , f_{10} , f_{15} , and f_{20} with $n = 5$.

Figure S.69: Boxplots of values of `gcm.min.basin_certain.sd` and its dimensionality reduction version on 15 instances of f_1 , f_6 , f_{10} , f_{15} , and f_{20} with $n = 5$.

Figure S.67: Boxplots of values of `gcm.min.basin_certain.median` and its dimensionality reduction version on 15 instances of f_1 , f_6 , f_{10} , f_{15} , and f_{20} with $n = 5$.

Figure S.70: Boxplots of values of `gcm.min.basin_certain.sum` and its dimensionality reduction version on 15 instances of f_1 , f_6 , f_{10} , f_{15} , and f_{20} with $n = 5$.

Figure S.71: Boxplots of values of `gcm.min.basin_uncertain.min` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.74: Boxplots of values of `gcm.min.basin_uncertain.max` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.72: Boxplots of values of `gcm.min.basin_uncertain.mean` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.75: Boxplots of values of `gcm.min.basin_uncertain.sd` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.73: Boxplots of values of `gcm.min.basin_uncertain.median` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.76: Boxplots of values of `gcm.min.basin_uncertain.sum` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.77: Boxplots of values of `gcm.min.best_attr.prob` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.80: Boxplots of values of `gcm.min.costs_runtime` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.78: Boxplots of values of `gcm.min.best_attr.no` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.81: Boxplots of values of `gcm.mean.attractors` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.79: Boxplots of values of `gcm.min.costs_fun_evals` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.82: Boxplots of values of `gcm.mean.pcells` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.83: Boxplots of values of `gcm.mean.tcells` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.86: Boxplots of values of `gcm.mean.basin_prob.mean` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.84: Boxplots of values of `gcm.mean.uncertain` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.87: Boxplots of values of `gcm.mean.basin_prob.median` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.85: Boxplots of values of `gcm.mean.basin_prob.min` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.88: Boxplots of values of `gcm.mean.basin_prob.max` and its dimensionality reduction version on 15 instances of $f_1, f_6, f_{10}, f_{15},$ and f_{20} with $n = 5$.

Figure S.89: Boxplots of values of `gcm.mean.basin_prob.sd` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.90: Boxplots of values of `gcm.mean.basin_certain.min` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.91: Boxplots of values of `gcm.mean.basin_certain.mean` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.92: Boxplots of values of `gcm.mean.basin_certain.median` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.93: Boxplots of values of `gcm.mean.basin_certain.max` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.94: Boxplots of values of `gcm.mean.basin_certain.sd` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.95: Boxplots of values of `gcm.mean.basin_certain.sum` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.96: Boxplots of values of `gcm.mean.basin_uncertain.min` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.97: Boxplots of values of `gcm.mean.basin_uncertain.mean` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.98: Boxplots of values of `gcm.mean.basin_uncertain.median` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.99: Boxplots of values of `gcm.mean.basin_uncertain.max` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.100: Boxplots of values of `gcm.mean.basin_uncertain.sd` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.101: Boxplots of values of `gcm.mean.basin_uncertain.sum` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.102: Boxplots of values of `gcm.mean.best_attr.prob` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.103: Boxplots of values of `gcm.mean.best_attr.no` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.104: Boxplots of values of `gcm.mean.costs_fun_evals` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.105: Boxplots of values of `gcm.mean.costs_runtime` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.106: Boxplots of values of `gcm.near.attractors` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.107: Boxplots of values of `gcm.near.pcells` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.108: Boxplots of values of `gcm.near.tcells` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.109: Boxplots of values of `gcm.near.uncertain` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.110: Boxplots of values of `gcm.near.basin_prob.min` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.111: Boxplots of values of `gcm.near.basin_prob.mean` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.112: Boxplots of values of `gcm.near.basin_prob.median` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.113: Boxplots of values of `gcm.near.basin_prob.max` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.114: Boxplots of values of `gcm.near.basin_prob.sd` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.115: Boxplots of values of `gcm.near.basin_certain.min` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.116: Boxplots of values of `gcm.near.basin_certain.mean` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.117: Boxplots of values of `gcm.near.basin_certain.median` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.118: Boxplots of values of `gcm.near.basin_certain.max` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.119: Boxplots of values of `gcm.near.basin_certain.sd` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.120: Boxplots of values of `gcm.near.basin_certain.sum` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.121: Boxplots of values of `gcm.near.basin_uncertain.min` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.122: Boxplots of values of `gcm.near.basin_uncertain.mean` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.123: Boxplots of values of `gcm.near.basin_uncertain.median` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.124: Boxplots of values of `gcm.near.basin_uncertain.max` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.125: Boxplots of values of `gcm.near.basin_uncertain.sd` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.126: Boxplots of values of `gcm.near.basin_uncertain.sum` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.127: Boxplots of values of `gcm.near.best_attr.prob` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.128: Boxplots of values of `gcm.near.best_attr.no` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.129: Boxplots of values of `gcm.near.costs_fun_evals` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.130: Boxplots of values of `gcm.near.costs_runtime` and its dimensionality reduction version on 15 instances of f_1, f_6, f_{10}, f_{15} , and f_{20} with $n = 5$.

Figure S.131: Kendall τ values of ela_level and d_ela_level for $n = 160$.

Figure S.132: Kendall τ values of gcm and d_gcm for $n = 5$.

Figure S.133: Kendall τ values of `cm_angle` and `d_cm_angle` for $n = 5$.

Figure S.134: Kendall τ values of cm_conv and d_cm_conv for $n = 5$.

Figure S.135: Kendall τ values of `cm_grad` and `d_cm_grad` for $n = 5$.