Appendix to the book chapter

Jekabsons G. Adaptive Basis Function Construction: An approach for adaptive building of sparse polynomial regression models. Machine Learning, In-Tech, 2010, pp. 127-156.

1. Introduction

This appendix offers detailed results of the performed empirical comparisons of the different regression modelling / metamodelling methods. The compared methods are the following: "Full" Polynomials (FP), polynomial subset selection using Sequential Forward Selection (SFS), polynomial subset selection using Sequential Floating Forward Selection (SFFS), Floating Adaptive Basis Function Construction (F-ABFC), Ensemble of F-ABFC (EF-ABFC), M5' Regression Tree (RT), M5' Model Tree (MT), Multivariate Adaptive Regression Splines (MARS), Support Vector Machine (SVM), Multi-Layer Perceptron (MLP), Locally-Weighted Polynomials (LWP; also called Moving Least Squares), Radial Basis Function interpolation (RBF), and Kriging interpolation.
For details and summary of the results see the book chapter.
Software (including open source) implementing most of the compared regression modelling methods (as well as some of the used data sets) can be downloaded at the author's webpage: http://www.cs.rtu.lv/jekabsons/.

2. The results

2.1 Synthetic data sets

Table 1.1 and Table 1.2 give detailed results extending Table 1 and Table 2 of the chapter.

No noise	$n = 25$		$n = 50$		$n = 100$	
Method	**RRMSE**	**Time (s)**	**RRMSE**	**Time (s)**	**RRMSE**	**Time (s)**
FP, $p = 1$	114.68 (8.38)	-	107.25 (4.13)	-	103.43 (2.03)	-
FP, $p = 2$	9.29 (1.88)	-	6.74 (0.55)	-	5.78 (0.28)	-
FP, $p = 3$	-	-	13.13 (2.42)	-	7.35 (0.72)	-
FP, $p = 4$	-	-	-	-	0.78 (0.21)	-
FP, $p \in [1, 4]$	9.29 (1.88)	-	6.74 (0.55)	-	0.78 (0.21)	-
SFS, $p = 1$	110.73 (8.28)	< 0.1	106.79 (4.71)	< 0.1	102.90 (2.09)	< 0.1
SFS, $p = 2$	7.17 (1.03)	< 0.1	6.38 (0.58)	< 0.1	5.63 (0.28)	< 0.1
SFS, $p = 3$	10.28 (3.11)	< 0.1	8.39 (1.41)	< 0.1	6.46 (0.71)	0.1
SFS, $p = 4$	1.01 (0.38)	< 0.1	0.70 (0.20)	0.2	0.46 (0.08)	0.5
SFS, $p = 5$	1.19 (0.28)	0.1	0.87 (0.29)	0.6	0.69 (0.19)	2.7
SFS, $p = 6$	0.77 (2.24)	0.3	0.06 (0.02)	1.4	0.04 (1e-2)	8.0
SFS, $p = 7$	1.75 (4.94)	0.4	0.07 (0.02)	2.7	0.05 (1e-2)	17.3
SFS, $p = 8$	1.79 (4.17)	0.7	0.03 (0.03)	4.9	3e-3 (1e-3)	34.3
SFS, $p = 9$	2.74 (6.91)	1.1	0.03 (0.04)	8.2	3e-3 (2e-3)	59.0
SFS, $p = 10$	3.19 (7.41)	1.8	0.03 (0.04)	16.1	2e-3 (7e-3)	104.3
SFS, $p \in [1, 10]$	0.77 (2.24)	4.4	0.03 (0.03)	34.1	2e-3 (7e-3)	226.1
SFFS, $p \in [1, 10]$	0.77 (2.24)	4.5	0.03 (0.03)	30.4	2e-4 (1e-4)	236.9
F-ABFC	0.11 (0.15)	0.1	0.01 (0.02)	2.0	3e-7 (5e-7)	43.8
EF-ABFC	0.27 (0.31)	0.8	0.02 (0.02)	11.5	1e-4 (4e-4)	250.6

SNR = 4						
FP, $p = 1$	115.37 (6.81)	-	106.86 (5.24)	-	103.71 (2.19)	-
FP, $p = 2$	42.71 (16.31)	-	18.36 (2.53)	-	12.12 (1.59)	-
FP, $p = 3$	-	-	60.98 (12.88)	-	24.15 (5.69)	-
FP, $p = 4$	-	-	-	-	73.97 (23.06)	-
FP, $p \in [1, 4]$	42.71 (16.31)	-	18.36 (2.53)	-	12.12 (1.59)	-
SFS, $p = 1$	110.45 (7.99)	< 0.1	104.76 (5.82)	< 0.1	102.79 (2.33)	< 0.1
SFS, $p = 2$	24.24 (10.87)	< 0.1	15.62 (2.99)	< 0.1	10.64 (2.38)	< 0.1
SFS, $p = 3$	33.20 (9.41)	< 0.1	21.37 (5.84)	< 0.1	14.05 (3.84)	< 0.1
SFS, $p = 4$	37.33 (14.21)	< 0.1	29.41 (8.17)	0.1	17.88 (4.83)	0.1
SFS, $p = 5$	52.18 (31.67)	< 0.1	40.77 (17.10)	0.2	23.56 (7.58)	0.4
SFS, $p = 6$	59.37 (28.09)	0.1	41.37 (11.76)	0.3	25.60 (9.49)	0.8
SFS, $p = 7$	68.73 (40.41)	0.2	61.66 (47.84)	0.8	32.29 (10.07)	1.8
SFS, $p = 8$	94.69 (73.18)	0.3	66.61 (34.66)	1.6	33.20 (11.53)	2.9
SFS, $p = 9$	85.93 (70.64)	0.4	71.57 (40.38)	2.4	43.68 (25.38)	5.5
SFS, $p = 10$	112.02 (149.28)	0.7	74.10 (40.38)	3.4	39.23 (10.92)	7.9
SFS, $p \in [1, 10]$	24.24 (10.87)	1.7	15.62 (2.99)	8.7	10.64 (2.38)	19.5
SFFS, $p \in [1, 10]$	24.24 (10.87)	1.8	15.62 (2.99)	7.6	10.64 (2.38)	21.0
F-ABFC	39.05 (17.97)	< 0.1	33.13 (15.64)	0.1	22.64 (10.73)	0.3
EF-ABFC	20.24 (6.76)	0.3	13.65 (3.82)	0.8	9.08 (3.16)	2.1
SNR = 2						
FP, $p = 1$	115.67 (7.21)	-	110.24 (6.95)	-	104.39 (2.98)	-
FP, $p = 2$	79.40 (37.25)	-	35.97 (8.35)	-	21.79 (4.29)	-
FP, $p = 3$	-	-	111.73 (37.85)	-	40.46 (7.20)	-
FP, $p = 4$	-	-	-	-	144.00 (37.49)	-
FP, $p \in [1, 4]$	79.40 (37.25)	-	35.97 (8.35)	-	21.79 (4.29)	-
SFS, $p = 1$	110.77 (8.34)	< 0.1	106.84 (7.00)	< 0.1	103.15 (3.46)	< 0.1
SFS, $p = 2$	36.35 (12.40)	< 0.1	26.51 (9.87)	< 0.1	18.55 (4.35)	< 0.1
SFS, $p = 3$	53.56 (23.53)	< 0.1	34.47 (11.59)	< 0.1	24.69 (5.61)	< 0.1
SFS, $p = 4$	64.59 (18.34)	< 0.1	51.43 (24.80)	< 0.1	29.32 (7.15)	0.1
SFS, $p = 5$	80.68 (27.69)	< 0.1	54.80 (15.16)	0.1	36.02 (7.78)	0.3
SFS, $p = 6$	88.32 (32.57)	0.1	70.34 (24.81)	0.3	47.11 (16.95)	1.0
SFS, $p = 7$	84.54 (37.84)	0.1	78.44 (37.08)	0.5	51.98 (17.55)	1.4
SFS, $p = 8$	125.16 (113.45)	0.2	71.00 (28.66)	0.7	58.61 (24.03)	2.5
SFS, $p = 9$	112.40 (63.50)	0.4	88.70 (36.87)	1.4	67.34 (22.39)	5.4
SFS, $p = 10$	209.98 (213.00)	0.8	99.26 (40.07)	2.8	78.04 (31.78)	8.1
SFS, $p \in [1, 10]$	36.35 (12.40)	1.7	26.51 (9.87)	5.9	18.55 (4.35)	18.7
SFFS, $p \in [1, 10]$	36.35 (12.40)	1.7	26.64 (10.08)	6.3	18.55 (4.35)	19.5
F-ABFC	58.43 (19.72)	< 0.1	72.44 (62.43)	< 0.1	39.93 (19.91)	0.2
EF-ABFC	35.23 (11.04)	0.3	24.94 (6.18)	0.7	17.67 (4.45)	1.8

Table 1.1. The results of the performed experiments for function Synth1

No noise	***n* = 25**		***n* = 50**		***n* = 100**	
Method	**RRMSE**	**Time (s)**	**RRMSE**	**Time (s)**	**RRMSE**	**Time (s)**
FP, $p = 1$	45.40 (4.86)	-	38.73 (2.06)	-		-
FP, $p = 2$	-	-	-	-	13.07 (1.37)	-
FP, $p \in [1, 2]$	45.40 (4.86)	-	38.73 (2.06)	-	13.07 (1.37)	-
SFS, $p = 1$	50.06 (8.79)	< 0.1	38.74 (2.68)	< 0.1	35.65 (0.63)	< 0.1
SFS, $p = 2$	38.17 (13.99)	< 0.1	19.13 (3.20)	0.2	11.27 (1.35)	1.0
SFS, $p = 3$	59.03 (17.71)	0.2	25.07 (9.11)	1.9	7.41 (1.34)	14.5
SFS, $p = 4$	71.99 (23.08)	1.6	29.31 (16.13)	11.4	4.64 (0.88)	100.3
SFS, $p = 5$	80.25 (23.80)	12.8	29.13 (12.73)	53.6	4.66 (2.79)	542.9
SFS, $p \in [1, 5]$	38.17 (13.99)	14.7	19.13 (3.20)	57.1	4.64 (0.88)	658.7
SFFS, $p \in [1, 5]$	37.40 (12.36)	15.9	20.20 (4.03)	82.5	4.01 (2.87)	680.4
F-ABFC	52.86 (11.46)	< 0.1	13.14 (6.96)	0.7	1.59 (1.58)	16.5

EF-ABFC	56.39 (16.40)	0.3	12.92 (3.08)	4.2	0.95 (0.46)	98.7
SNR = 4						
FP, $p = 1$	51.78 (8.53)	-	41.31 (3.25)	-	37.38 (1.51)	-
FP, $p = 2$	-	-	-	-	42.57 (9.90)	-
FP, $p \in [1, 2]$	51.78 (8.53)	-	41.31 (3.25)	-	37.38 (1.51)	-
SFS, $p = 1$	60.30 (14.08)	< 0.1	40.99 (3.89)	< 0.1	37.09 (1.38)	< 0.1
SFS, $p = 2$	58.85 (15.18)	< 0.1	35.44 (7.05)	0.1	23.63 (4.02)	0.3
SFS, $p = 3$	75.67 (23.10)	0.2	49.91 (7.78)	1.1	30.43 (8.34)	4.4
SFS, $p = 4$	96.71 (44.94)	2.1	66.61 (18.17)	10.6	41.71 (9.84)	35.4
SFS, $p = 5$	180.68 (68.02)	10.7	82.78 (23.99)	66.0	62.00 (10.43)	258.7
SFS, $p \in [1, 5]$	58.85 (15.18)	13.1	35.44 (7.05)	77.8	23.63 (4.02)	298.8
SFFS, $p \in [1, 5]$	61.01 (17.19)	14.2	35.88 (8.69)	78.2	24.21 (3.57)	373.5
F-ABFC	79.07 (35.39)	< 0.1	45.59 (9.28)	0.1	28.89 (7.25)	0.5
EF-ABFC	62.79 (11.47)	0.3	35.57 (7.35)	1.3	20.37 (3.51)	6.3
SNR = 2						
FP, $p = 1$	61.23 (9.17)	-	46.61 (4.73)	-	40.81 (3.12)	-
FP, $p = 2$	-	-	-	-	81.53 (14.09)	-
FP, $p \in [1, 2]$	61.23 (9.17)	-	46.61 (4.73)	-	40.81 (3.12)	-
SFS, $p = 1$	74.26 (10.09)	< 0.1	47.92 (6.96)	< 0.1	40.29 (3.47)	< 0.1
SFS, $p = 2$	73.81 (17.63)	< 0.1	51.69 (8.15)	0.1	37.20 (6.57)	0.2
SFS, $p = 3$	114.27 (29.99)	0.3	75.80 (19.06)	0.9	56.14 (14.54)	3.0
SFS, $p = 4$	145.55 (53.25)	2.0	110.39 (36.95)	8.9	83.07 (22.63)	40.9
SFS, $p = 5$	180.68 (68.02)	11.0	135.99 (37.13)	47.6	115.01 (31.12)	208.9
SFS, $p \in [1, 5]$	73.81 (17.63)	13.3	47.92 (6.96)	57.4	37.20 (6.57)	253.0
SFFS, $p \in [1, 5]$	76.43 (11.56)	14.3	50.41 (9.44)	64.3	35.15 (5.16)	369.3
F-ABFC	82.42 (18.79)	< 0.1	68.08 (15.40)	0.1	49.61 (13.73)	0.3
EF-ABFC	70.84 (9.52)	0.2	51.11 (8.79)	0.8	34.54 (5.93)	3.9

Table 1.2. The results of the performed experiments for function Synth2

2.2 Real-world machine learning data sets

Table 3.1 repeats Table 3 of the chapter and Tables 3.2 through 3.12 give detailed results for each of the ten data sets.

Method	RRMSE	Time (s)	Degree
SFS, $p = 1$	49.64 (12.05)	< 0.1	1
SFS, $p = 2$	40.89 (15.11)	4.8	2
SFS, $p = 3$	37.83 (14.21)	227.4	3
SFS, $p = 4$	47.10 (27.96)	2486.8	4
SFS, p = automatic	34.83 (10.20)	2207.5	3.0
F-ABFC	39.61 (16.93)	108.7	6.4
EF-ABFC	31.24 (10.86)	607.8	7.2
RT	50.76 (9.85)	0.3	-
MT	34.79 (12.35)	0.4	-
MARS	40.81 (17.29)	3.2	-
MARS + CV	39.87 (15.57)	265.8	-
SVM	31.87 (10.73)	360.5	-
MLP	41.50 (18.04)	345.2	-

Table 3.1. The average results of the performed experiments for the ten machine learning data sets

Method	RRMSE	Time (s)	Degree
FP, $p = 1$	44.13	-	1
FP, $p = 2$	37.17	-	2
FP, $p = 3$	54.29	-	3
SFS, $p = 1$	44.55 (3.90)	< 0.1	1
SFS, $p = 2$	36.77 (5.95)	0.2	2
SFS, $p = 3$	37.28 (5.43)	2.5	3
SFS, $p = 4$	37.82 (4.61)	21.3	4
SFS, p = automatic	35.75 (5.85)	849.8	6
F-ABFC	37.66 (5.74)	0.6	4.5
EF-ABFC	36.21 (5.26)	3.0	5.8
RT	45.84 (6.18)	0.2	-
MT	37.04 (7.15)	0.3	-
MARS	43.02 (6.94)	0.4	-
MARS + CV	39.28 (5.39)	35.9	-
SVM	35.32 (6.59)	339.4	-
MLP	45.40 (9.40)	334.8	-

Table 3.2. The results of the performed experiments for the AutoMPG data set

Method	RRMSE	Time (s)	Degree
FP, $p = 1$	48.98	-	1
FP, $p = 2$	1e6	-	2
FP, $p = 3$	-	-	3
SFS, $p = 1$	52.00 (11.36)	< 0.1	1
SFS, $p = 2$	53.10 (18.64)	1.3	2
SFS, $p = 3$	50.35 (15.76)	30.9	3
SFS, $p = 4$	57.66 (26.28)	216.8	4
SFS, p = automatic	50.35 (15.76)	248.9	3
F-ABFC	46.21 (16.01)	3.5	6.0
EF-ABFC	41.40 (12.93)	18.3	6.1
RT	52.86 (8.36)	0.2	-
MT	39.68 (9.38)	0.2	-
MARS	56.62 (28.22)	0.1	-
MARS + CV	59.25 (26.70)	5.4	-
SVM	43.25 (9.59)	33.3	-
MLP	53.19 (19.60)	218.8	-

Table 3.3. The results of the performed experiments for the AutoPrice data set

Method	RRMSE	Time (s)	Degree
FP, $p = 1$	13.83	-	1
FP, $p = 2$	23.05	-	2
FP, $p = 3$	-	-	3
SFS, $p = 1$	13.23 (14.16)	< 0.1	1
SFS, $p = 2$	15.30 (12.86)	0.8	2
SFS, $p = 3$	14.14 (13.72)	7.9	3
SFS, $p = 4$	14.87 (13.78)	108.1	4
SFS, p = automatic	13.23 (14.16)	0.8	1
F-ABFC	11.94 (13.32)	0.2	7.8
EF-ABFC	10.50 (14.55)	10.8	8.9
RT	33.09 (4.76)	0.2	-
MT	11.42 (14.52)	0.2	-
MARS	16.41 (13.76)	0.2	-
MARS + CV	15.40 (14.06)	18.9	-
SVM	11.37 (16.12)	53.2	-
MLP	14.09 (13.89)	302.3	-

Table 3.4. The results of the performed experiments for the Badyfat data set

Method	RRMSE	Time (s)	Degree
FP, p = 1	42.75	-	1
FP, p = 2	18.27	-	2
FP, p = 3	74.65	-	3
SFS, p = 1	43.03 (7.80)	< 0.1	1
SFS, p = 2	14.91 (2.92)	< 0.1	2
SFS, p = 3	19.94 (5.07)	0.5	3
SFS, p = 4	18.15 (5.98)	2.8	4
SFS, p = automatic	14.91 (2.92)	0.6	2
F-ABFC	18.87 (5.54)	0.1	5.9
EF-ABFC	16.81 (4.56)	1.4	6.5
RT	48.97 (9.99)	0.1	-
MT	18.20 (4.87)	0.1	-
MARS	17.27 (5.49)	< 0.1	-
MARS + CV	18.69 (7.31)	3.2	-
SVM	16.39 (5.08)	104.3	-
MLP	17.86 (4.31)	128.1	-

Table 3.5. The results of the performed experiments for the Fishcatch data set

Method	RRMSE	Time (s)	Degree
FP, p = 1	53.66	-	1
FP, p = 2	41.14	-	2
FP, p = 3	-	-	3
SFS, p = 1	43.03 (9.50)	0.1	1
SFS, p = 2	14.91 (12.82)	22.9	2
SFS, p = 3	38.52 (9.27)	779.1	3
SFS, p = 4	53.63 (23.17)	5222.0	4
SFS, p = automatic	38.52 (9.27)	6024.1	3
F-ABFC	39.94 (7.58)	181.5	7.8
EF-ABFC	33.93 (9.47)	1185.0	8.3
RT	52.16 (6.93)	0.7	-
MT	42.77 (12.28)	0.8	-
MARS	51.39 (28.59)	2.3	-
MARS + CV	51.93 (26.54)	229.5	-
SVM	38.32 (12.95)	1325.2	-
MLP	45.41 (13.16)	619.5	-

Table 3.6. The results of the performed experiments for the Housing data set

Method	RRMSE	Time (s)	Degree
FP, p = 1	49.54	-	1
FP, p = 2	41.00	-	2
FP, p = 3	-	-	3
SFS, p = 1	49.42 (4.09)	< 0.1	1
SFS, p = 2	37.97 (7.26)	13.0	2
SFS, p = 3	38.10 (7.81)	396.5	3
SFS, p = 4	46.35 (18.58)	3277.3	4
SFS, p = automatic	37.97 (7.26)	409.6	2
F-ABFC	39.21 (11.91)	88.4	7.8
EF-ABFC	31.21 (4.56)	529.6	8.5
RT	43.88 (3.29)	0.4	-
MT	36.46 (6.70)	0.4	-
MARS	52.87 (20.60)	2.1	-
MARS + CV	51.32 (19.40)	202.1	-
SVM	34.57 (5.07)	1036.7	-
MLP	41.25 (6.62)	583.4	-

Table 3.7. The results of the performed experiments for the HousingNOX data set

Method	RRMSE	Time (s)	Degree
FP, p = 1	54.76	-	1
FP, p = 2	48.66	-	2
FP, p = 3	278.01	-	3
SFS, p = 1	54.37 (28.11)	< 0.1	1
SFS, p = 2	46.25 (17.19)	0.1	2
SFS, p = 3	35.02 (8.65)	1.5	3
SFS, p = 4	92.55 (95.43)	4.6	4
SFS, p = automatic	35.02 (8.65)	6.2	3
F-ABFC	71.98 (60.41)	0.5	5.5
EF-ABFC	34.29 (14.19)	4.0	5.3
RT	62.79 (16.36)	0.2	-
MT	42.10 (16.85)	0.2	-
MARS	59.24 (22.90)	0.1	-
MARS + CV	51.47 (12.27)	5.1	-
SVM	36.58 (15.70)	80.3	-
MLP	45.31 (22.88)	158.4	-

Table 3.8. The results of the performed experiments for the MachineCPU data set

Method	RRMSE	Time (s)	Degree
FP, p = 1	-	-	1
FP, p = 2	-	-	2
FP, p = 3	-	-	3
SFS, p = 1	70.95 (21.54)	< 0.1	1
SFS, p = 2	91.41 (56.48)	1.8	2
SFS, p = 3	82.57 (59.91)	48.9	3
SFS, p = 4	96.89 (73.98)	2501.5	4
SFS, p = automatic	70.95 (21.54)	1.8	1
F-ABFC	75.55 (33.38)	0.6	4.1
EF-ABFC	53.51 (22.56)	4.5	4.6
RT	78.86 (20.17)	0.1	-
MT	60.73 (30.76)	0.1	-
MARS	60.37 (25.48)	< 0.1	-
MARS + CV	60.80 (23.03	0.9	-
SVM	50.74 (19.71)	9.6	-
MLP	90.08 (65.63)	154.2	-

Table 3.9. The results of the performed experiments for the Pyrimidines data set

Method	RRMSE	Time (s)	Degree
FP, p = 1	79.29	-	1
FP, p = 2	44.44	-	2
FP, p = 3	61.85	-	3
SFS, p = 1	79.29 (15.99)	< 0.1	1
SFS, p = 2	54.31 (15.21)	< 0.1	2
SFS, p = 3	49.36 (15.53)	0.1	3
SFS, p = 4	41.06 (16.57)	0.5	4
SFS, p = automatic	39.59 (15.38)	6.4	5
F-ABFC	41.66 (13.98)	0.2	5.4
EF-ABFC	42.04 (19.43)	1.9	5.7
RT	64.43 (19.44)	0.1	-
MT	45.58 (18.70)	0.1	-
MARS	38.63 (19.81)	< 0.1	-
MARS + CV	38.24 (19.64)	2.1	-
SVM	42.34 (15.56)	91.8	-
MLP	42.19 (21.41)	110.0	-

Table 3.10. The results of the performed experiments for the Servo data set

Method	RRMSE	Time (s)	Degree
FP, $p = 1$	36.20	-	1
FP, $p = 2$	17.29	-	2
FP, $p = 3$	13.03	-	3
SFS, $p = 1$	36.11 (3.99)	< 0.1	1
SFS, $p = 2$	17.19 (1.75)	8.2	2
SFS, $p = 3$	13.03 (0.96)	1006.6	3
SFS, $p = 4$	12.01 (1.18)	13513.0	4
SFS, p = automatic	12.01 (1.18)	14527.2	4
F-ABFC	13.06 (1.46)	811.1	9.3
EF-ABFC	12.46 (1.07)	4318.0	12.2
RT	24.69 (3.04)	1.2	-
MT	13.94 (2.25)	1.3	-
MARS	12.30 (1.06)	26.48	-
MARS + CV	12.35 (1.39)	2154.4	-
SVM	9.81 (0.90)	531.3	-
MLP	20.20 (3.56)	842.8	-

Table 3.11. The results of the performed experiments for the Stock data set

2.3 Real-world metamodelling data sets

Table 4.1 repeats Table 4 of the chapter and Tables 4.2 through 4.5 give detailed results for each of the four output variables.

Method	RRMSE	Time (s)
FP, $p = 1$	49.85 (4.82)	-
FP, $p = 2$	23.81 (3.10)	-
FP, $p = 3$	12.81 (1.77)	-
FP, $p = 4$	9.88 (1.46)	-
FP, $p \in [1, 4]$	9.17 (1.28)	-
SFS, $p = 1$	49.75 (4.68)	< 0.1
SFS, $p = 2$	23.42 (3.15)	0.2
SFS, $p = 3$	11.74 (1.84)	4.2
SFS, $p = 4$	7.31 (1.35)	41.1
SFS, $p = 5$	5.62 (1.14)	220.3
SFS, $p = 6$	5.03 (0.78)	959.1
SFS, $p = 7$	5.05 (1.12)	1828.4
SFS, $p \in [1, 7]$	4.92 (0.75)	3053.4
F-ABFC	4.28 (0.55)	71.9
EF-ABFC	4.19 (0.55)	715.4
RT	60.18 (7.87)	1.0
MT	22.27 (4.97)	4.7
MARS	5.87 (0.96)	0.9
MARS + CV	5.31 (0.84)	77.5
SVM	13.14 (2.57)	414.7
MLP	8.47 (1.03)	331.3
LWP, $p = 1$	40.22 (4.12)	2.8
LWP, $p = 2$	20.23 (2.79)	26.2
LWP, $p = 3$	11.66 (1.68)	210.6
LWP, $p = 4$	9.76 (1.42)	1576.7
RBF	14.48 (3.42)	1.9
Kriging	7.40 (1.21)	16.3

Table 4.1. The average results of the performed experiments for the four metamodelling data sets

Method	RRMSE	Time (s)
FP, $p = 1$	63.08 (4.58)	-
FP, $p = 2$	35.51 (4.33)	-
FP, $p = 3$	20.41 (2.95)	-
FP, $p = 4$	13.27 (2.30)	-
FP, $p \in [1, 4]$	13.27 (2.30)	-
SFS, $p = 1$	62.86 (4.51)	< 0.1
SFS, $p = 2$	34.58 (4.31)	0.1
SFS, $p = 3$	17.65 (3.45)	1.4
SFS, $p = 4$	9.42 (1.64)	29.6
SFS, $p = 5$	4.99 (1.35)	310.6
SFS, $p = 6$	3.02 (0.88)	2057.6
SFS, $p = 7$	3.28 (1.87)	4472.7
SFS, $p \in [1, 7]$	3.02 (0.88)	6872.0
F-ABFC	1.82 (0.78)	257.9
EF-ABFC	1.69 (0.83)	2603.4
RT	52.15 (7.00)	0.9
MT	18.93 (6.84)	1.0
MARS	3.70 (0.66)	0.9
MARS + CV	3.32 (0.45)	81.3
SVM	20.76 (4.01)	1240.0
MLP	6.56 (1.72)	327.5
LWP, $p = 1$	47.49 (5.21)	2.7
LWP, $p = 2$	27.28 (4.70)	25.6
LWP, $p = 3$	17.19 (2.86)	201.6
LWP, $p = 4$	12.87 (2.17)	1490.2
RBF	22.00 (5.33)	1.9
Kriging	2.29 (0.42)	15.8

Table 4.2. The results of the performed experiments for the first metamodelling data set (DEF_BOT)

Method	RRMSE	Time (s)
FP, $p = 1$	41.78 (2.99)	-
FP, $p = 2$	17.44 (1.81)	-
FP, $p = 3$	9.57 (0.92)	-
FP, $p = 4$	9.99 (1.28)	-
FP, $p \in [1, 4]$	9.57 (0.92)	-
SFS, $p = 1$	41.68 (2.92)	< 0.1
SFS, $p = 2$	17.45 (1.97)	0.3
SFS, $p = 3$	9.84 (1.08)	5.7
SFS, $p = 4$	8.59 (1.79)	50.5
SFS, $p = 5$	8.19 (1.42)	155.7
SFS, $p = 6$	8.41 (1.31)	617.0
SFS, $p = 7$	8.01 (1.20)	1300.2
SFS, $p \in [1, 7]$	8.01 (1.20)	2129.4
F-ABFC	7.36 (0.78)	6.1
EF-ABFC	7.47 (0.80)	80.0
RT	55.45 (3.98)	1.1
MT	27.52 (4.89)	1.3
MARS	11.30 (1.77)	0.8
MARS + CV	9.52 (1.61)	70.8
SVM	11.91 (2.05)	78.5
MLP	10.21 (0.46)	333.0
LWP, $p = 1$	36.86 (2.62)	2.8
LWP, $p = 2$	15.52 (1.58)	27.2
LWP, $p = 3$	9.43 (1.01)	214.5

LWP, $p = 4$	9.99 (1.29)	1453.7
RBF	11.73 (2.13)	1.9
Kriging	13.39 (1.99)	16.0

Table 4.3. The results of the performed experiments for the second metamodelling data set (EQV_TOP)

Method	RRMSE	Time (s)
FP, $p = 1$	34.89 (3.97)	-
FP, $p = 2$	12.53 (0.70)	-
FP, $p = 3$	8.10 (0.99)	-
FP, $p = 4$	10.52 (1.35)	-
FP, $p \in [1, 4]$	8.10 (0.99)	-
SFS, $p = 1$	34.91 (3.96)	< 0.1
SFS, $p = 2$	12.38 (0.78)	0.3
SFS, $p = 3$	7.29 (0.75)	5.4
SFS, $p = 4$	7.20 (0.91)	28.4
SFS, $p = 5$	7.16 (0.91)	69.2
SFS, $p = 6$	6.90 (0.71)	178.5
SFS, $p = 7$	6.98 (0.97)	374.6
SFS, $p \in [1, 7]$	6.90 (0.71)	656.3
F-ABFC	6.59 (0.53)	5.1
EF-ABFC	6.40 (0.28)	52.4
RT	61.84 (4.47)	1.1
MT	17.10 (2.07)	1.2
MARS	5.22 (0.83)	0.9
MARS + CV	5.27 (0.72)	79.1
SVM	8.07 (0.62)	83.2
MLP	9.09 (0.53)	332.8
LWP, $p = 1$	24.34 (1.84)	2.9
LWP, $p = 2$	10.58 (0.70)	26.7
LWP, $p = 3$	7.74 (0.84)	210.4
LWP, $p = 4$	10.52 (1.34)	1610.9
RBF	8.75 (0.49)	1.9
Kriging	8.41 (1.21)	16.5

Table 4.4. The results of the performed experiments for the third metamodelling data set (SHEAR_CORE)

Method	RRMSE	Time (s)
FP, $p = 1$	59.64 (7.35)	-
FP, $p = 2$	29.75 (5.55)	-
FP, $p = 3$	13.06 (2.22)	-
FP, $p = 4$	5.73 (0.92)	-
FP, $p \in [1, 4]$	5.73 (0.92)	-
SFS, $p = 1$	59.55 (7.32)	< 0.1
SFS, $p = 2$	29.28 (5.55)	0.1
SFS, $p = 3$	12.16 (2.07)	4.4
SFS, $p = 4$	4.04 (1.06)	56.1
SFS, $p = 5$	2.12 (0.89)	345.7
SFS, $p = 6$	1.77 (0.23)	983.3
SFS, $p = 7$	1.94 (0.44)	1166.1
SFS, $p \in [1, 7]$	1.77 (0.23)	2555.7
F-ABFC	1.33 (0.13)	18.4
EF-ABFC	1.20 (0.28)	125.9
RT	71.26 (16.04)	0.9
MT	25.54 (6.10)	15.4

MARS	3.23 (0.56)	0.9
MARS + CV	3.13 (0.57)	78.9
SVM	11.82 (3.62)	257.1
MLP	8.02 (1.40)	332.1
LWP, $p = 1$	52.20 (6.83)	2.8
LWP, $p = 2$	27.55 (4.16)	25.3
LWP, $p = 3$	12.28 (2.03)	215.8
LWP, $p = 4$	5.68 (0.89)	1752.1
RBF	15.44 (5.73)	1.9
Kriging	5.51 (1.21)	16.8

Table 4.5. The results of the performed experiments for the fourth metamodelling data set (DEF_DIF)