HNCO
Influence of the learning rate on the performances of PBIL

August 21, 2017

Abstract

PBIL is applied many times to the same collection of fitness functions, each time with a different learning rate taken from a finite set of values. All learning rates are ranked according to their median fitness over 20 independent runs, first for each fitness function, then across the entire collection of fitness functions. The mean and standard deviation of fitness are also plotted as a function of the learning rate.

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1 Default parameters

```
# algorithm = 100
# bm_mc_reset_strategy = 1
# bm_num_gs_cycles = 1
# bm_num_gs_steps = 100
# bm_sampling = 1
# budget = 10000
# bv_size = 100
# ea_lambda = 100
# ea_mu = 10
# fun_num_traps = 10
# fun_prefix_length = 2
# fun_threshold = 10
# function = 0
# ga_crossover_probability = 0.5
# ga_tournament_size = 10
# hea_binary_dynamics = 0
# hea_delay = 10000
# hea_num_par_updates = 1
# hea_num_seq_updates = 100
# hea_rate_strategy = 0
# hea_reset_period = 0
# hea_sampling_method = 0
# hea_time_constant = 1000
# hea_weight = 1
# learning_rate = 0.001
# map = 0
# map_input_size = 100
# map_path = nopath
# neighborhood = 0
# neighborhood_iterator = 0
# noise_stddev = 1
# num_iterations = 0
# num_threads = 1
# path = nopath
# plugin_function_name = nofunction
# population_size = 10
# pv_log_num_components = 5
# radius = 2
# rls_patience = 50
# sa_initial_acceptance_probability = 0.6
# sa_num_transitions = 50
# sa_num_trials = 100
# sa_rate = 1.2
# scaled_mutation_probability = 1
# seed = 0
# selection_size = 1
# target = 100
# print_default_parameters
# last_parameter
# exec_name = hnco
# version = 0.6
# Generated from hnco.json
```

2 Plan

```
{
    "exec": "hnco",
    "opt": "-s 100 --map 1 --map-random -i 0 -b 200000 --print-performance",
    "num_runs": 20,
    "results": "results",
    "graphics": "graphics",
```

```
"report": "report",
"parameter": {
    "id": "learning-rate",
    "values": [ 1e-4, 2e-4, 5e-4, 1e-3, 2e-3, 5e-3, 1e-2, 2e-2, 5e-2, 1e-1, 2e-1, 5e-1, 1 ],
    "logscale": true,
    "boxwidth": "($1*0.3)"
},
"functions": [
    {
        "id": "one-max",
        "opt": "-F 0 --stop-on-maximum",
        "col": ">{{\\nprounddigits{0}}}N{3}{0}"
    },
    {
        "id": "lin",
        "opt": "-F 1 -p instances/lin.100",
        "col": ">{{\\nprounddigits{2}}}N{2}{2}"
    },
    {
        "id": "leading-ones",
        "opt": "-F 10 --stop-on-maximum",
        "col": ">{{\\nprounddigits{0}}}N{3}{0}"
    },
    {
        "id": "ridge",
        "opt": "-F 11 --stop-on-maximum",
        "col": ">{{\\nprounddigits{0}}}N{3}{0}"
    },
    {
        "id": "jmp-5",
        "opt": "-F 30 --stop-on-maximum -t 5",
        "col": ">{{\\nprounddigits{0}}}N{3}{0}"
    },
    {
        "id": "jmp-10",
        "opt": "-F 30 --stop-on-maximum -t 10",
        "col": ">{{\\nprounddigits{0}}}N{3}{0}"
    },
    {
        "id": "djmp-5",
        "opt": "-F 31 --stop-on-maximum -t 5",
        "col": ">{{\\nprounddigits{0}}}N{3}{0}"
    },
    {
        "id": "djmp-10",
        "opt": "-F 31 --stop-on-maximum -t 10",
        "col": ">{{\\nprounddigits{0}}}N{3}{0}"
    },
    {
        "id": "fp-5",
        "opt": "-F 40 --stop-on-maximum -t 5",
        "col": ">{{\\nprounddigits{0}}}N{3}{0}"
    },
    {
        "id": "fp-10",
        "opt": "-F 40 --stop-on-maximum -t 10",
        "col": ">{{\\nprounddigits{0}}}N{3}{0}"
    },
    {
        "id": "nk",
        "opt": "-F 60 -p instances/nk.100.4",
        "col": ">{{\\nprounddigits{2}}}N{1}{2}"
    },
```

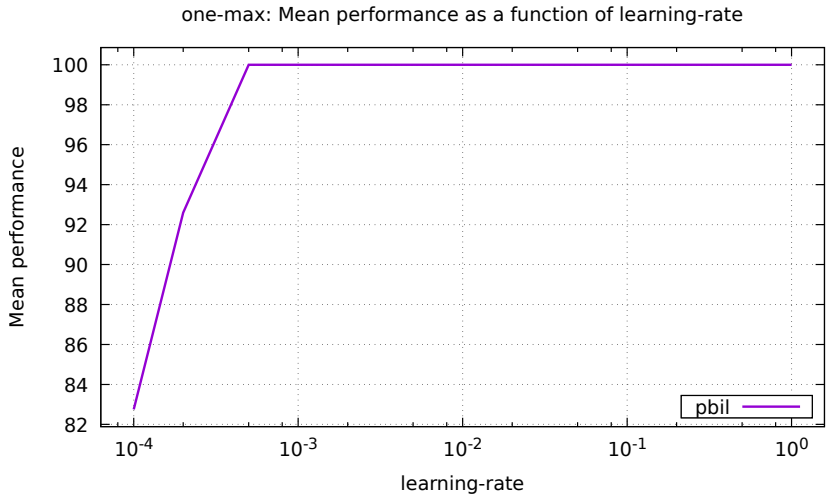
```
        {
            "id": "max-sat",
            "opt": "-F 70 -p instances/ms.100.3.1000 --cache",
            "col": ">{{\\nprounddigits{0}}}N{3}{0}"
        },
        {
            "id": "labs",
            "opt": "-F 80",
            "col": ">{{\\nprounddigits{2}}}N{1}{2}"
        },
        {
            "id": "ep",
            "opt": "-F 90 -p instances/ep.100",
            "reverse": true,
            "logscale": true,
            "col": ">{{\\nprounddigits{2}}}N{1}{2}"
        },
        {
            "id": "cancel",
            "opt": "-F 100 -s 99",
            "reverse": true,
            "col": ">{{\\nprounddigits{2}}}N{1}{2}"
        },
        {
            "id": "trap",
            "opt": "-F 110 --stop-on-maximum --fun-num-traps 10",
            "col": ">{{\\nprounddigits{0}}}N{3}{0}"
        },
        {
            "id": "hiff",
            "opt": "-F 120 --stop-on-maximum -s 128",
            "col": ">{{\\nprounddigits{0}}}N{3}{0}"
        },
        {
            "id": "plateau",
            "opt": "-F 130 --stop-on-maximum",
            "col": ">{{\\nprounddigits{0}}}N{3}{0}"
        },
        {
            "id": "walsh2",
            "opt": "-F 162 -p instances/walsh2.100 --cache",
            "col": ">{{\\nprounddigits{2}}}N{3}{2}"
        }
    ],
    "algorithms": [
        {
            "id": "pbil",
            "opt": "-A 500 -x 10 -y 1"
        }
    ]
}
```

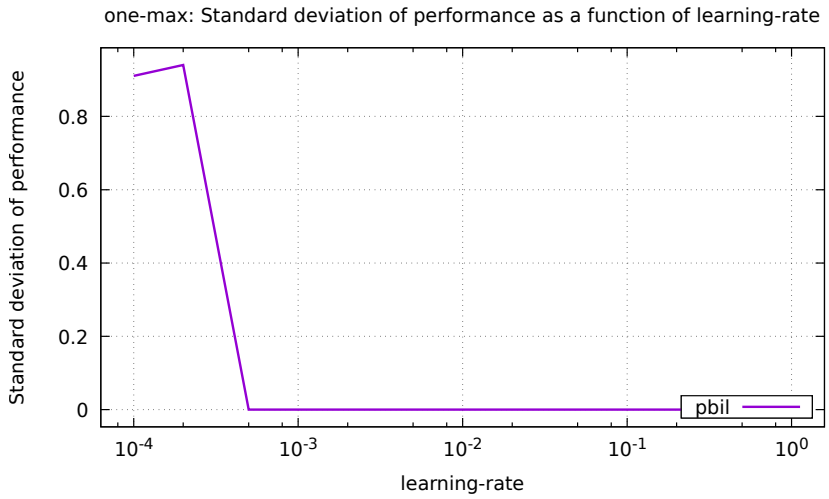
3 Rankings

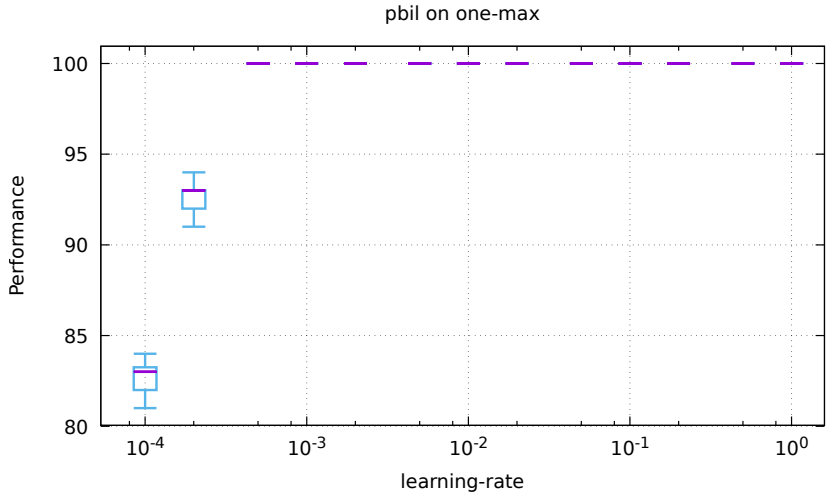
algorithm	rank distribution												
	1	2	3	4	5	6	7	8	9	10	11	12	13
pbil-0.005	10	2	1	3	0	2	1	0	0	0	0	0	0
pbil-1	10	1	0	2	0	2	1	1	0	2	0	0	0
pbil-0.002	9	3	1	1	1	1	0	1	1	1	0	0	0
pbil-0.01	8	2	2	1	4	0	2	0	0	0	0	0	0
pbil-0.02	8	1	1	2	3	2	0	2	0	0	0	0	0
pbil-0.05	8	1	0	0	1	2	3	3	1	0	0	0	0
pbil-0.001	7	1	1	1	0	1	1	0	1	5	1	0	0
pbil-0.0005	6	1	1	0	1	0	0	1	0	0	8	0	1
pbil-0.1	6	1	0	0	1	2	3	2	1	1	1	0	1
pbil-0.5	4	3	1	0	0	2	1	1	3	3	0	1	0
pbil-0.2	4	1	1	2	0	3	2	0	3	1	0	2	0
pbil-0.0002	0	0	0	0	0	1	1	0	1	1	0	14	1
pbil-0.0001	0	0	0	0	0	0	0	0	1	1	1	1	15

4 Function one-max

algorithm	min	Q_1	med.	Q_3	max	rk
`pbil-0.0001`	81	82	83	83	84	13
`pbil-0.0002`	91	92	93	93	94	12
`pbil-0.0005`	100	100	100	100	100	1
`pbil-0.001`	100	100	100	100	100	1
`pbil-0.002`	100	100	100	100	100	1
`pbil-0.005`	100	100	100	100	100	1
`pbil-0.01`	100	100	100	100	100	1
`pbil-0.02`	100	100	100	100	100	1
`pbil-0.05`	100	100	100	100	100	1
`pbil-0.1`	100	100	100	100	100	1
`pbil-0.2`	100	100	100	100	100	1
`pbil-0.5`	100	100	100	100	100	1
`pbil-1`	100	100	100	100	100	1

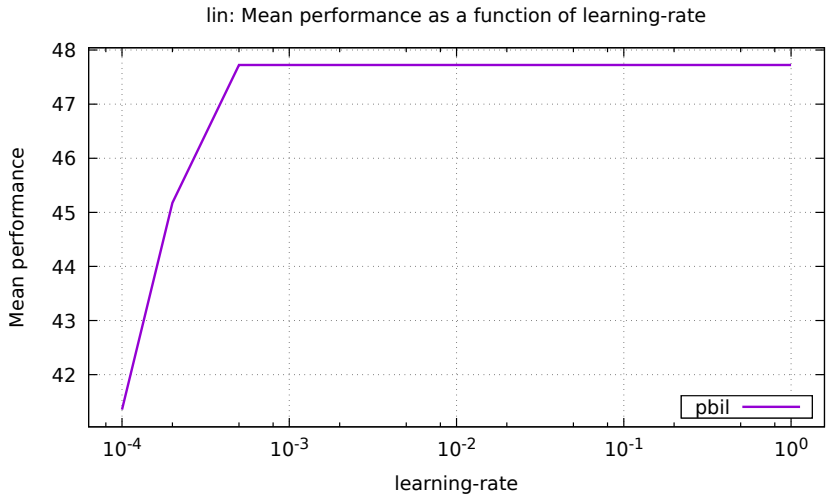


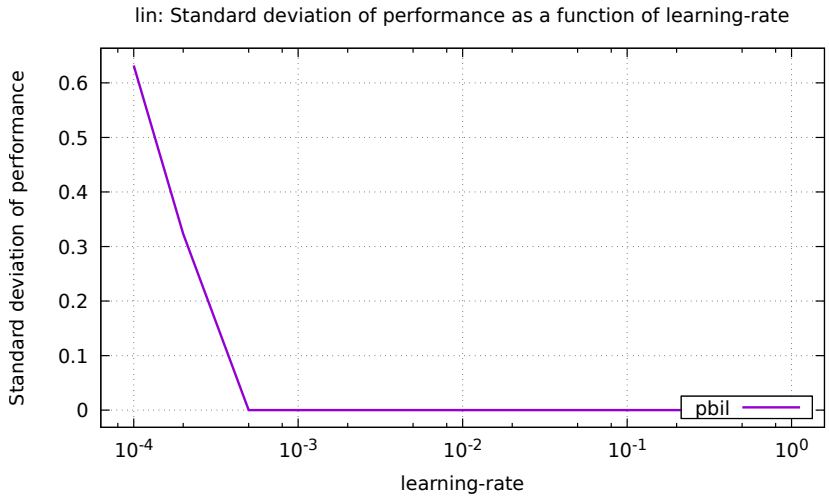


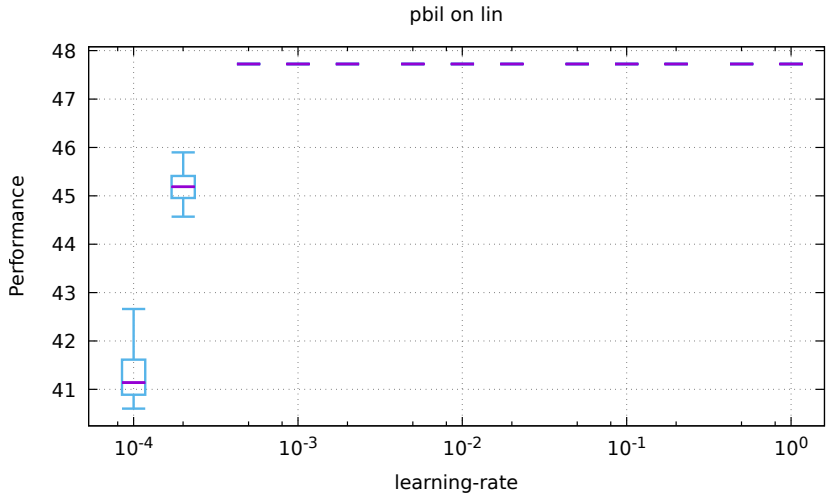


5 Function lin

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	40.60	40.89	41.14	41.61	42.66	13
pbil-0.0002	44.57	44.96	45.18	45.41	45.90	12
pbil-0.0005	47.72	47.72	47.72	47.72	47.72	1
pbil-0.001	47.72	47.72	47.72	47.72	47.72	1
pbil-0.002	47.72	47.72	47.72	47.72	47.72	1
pbil-0.005	47.72	47.72	47.72	47.72	47.72	1
pbil-0.01	47.72	47.72	47.72	47.72	47.72	1
pbil-0.02	47.72	47.72	47.72	47.72	47.72	1
pbil-0.05	47.72	47.72	47.72	47.72	47.72	1
pbil-0.1	47.72	47.72	47.72	47.72	47.72	1
pbil-0.2	47.72	47.72	47.72	47.72	47.72	1
pbil-0.5	47.72	47.72	47.72	47.72	47.72	1
pbil-1	47.72	47.72	47.72	47.72	47.72	1

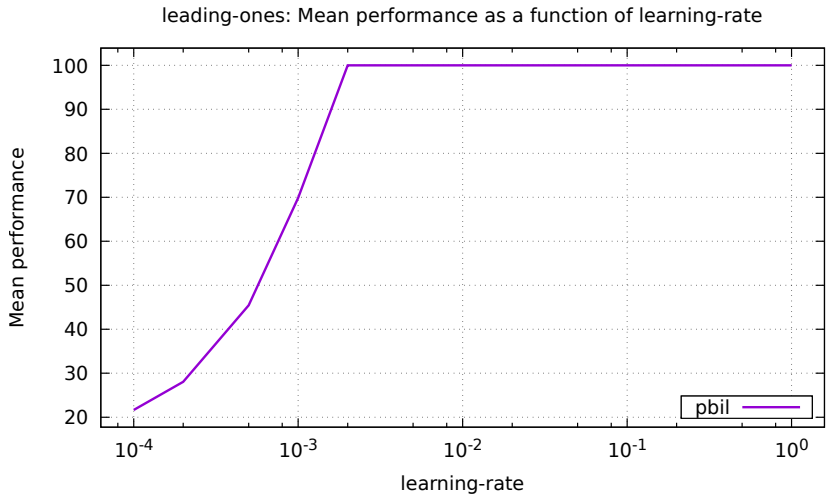

lin: Mean performance as a function of learning-rate
Mean performance
48
47
46
45
44
43
42
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

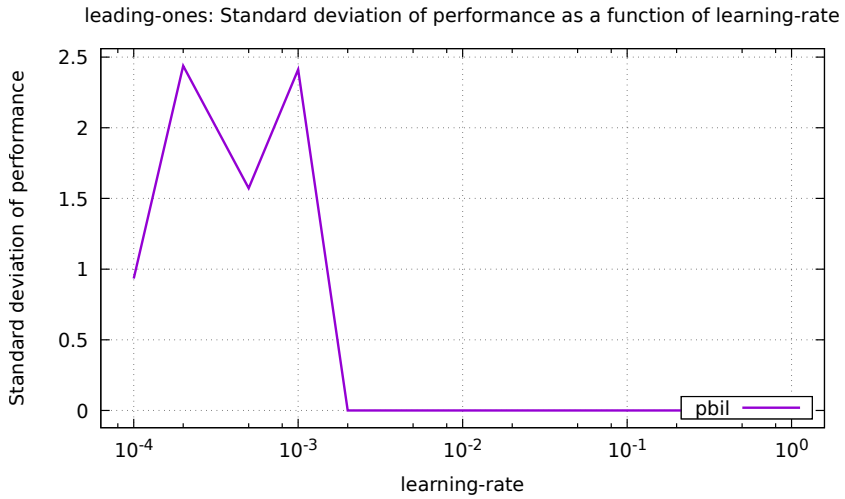

lin: Standard deviation of performance as a function of learning-rate
Standard deviation of performance
0.6
0.5
0.4
0.3
0.2
0.1
0
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

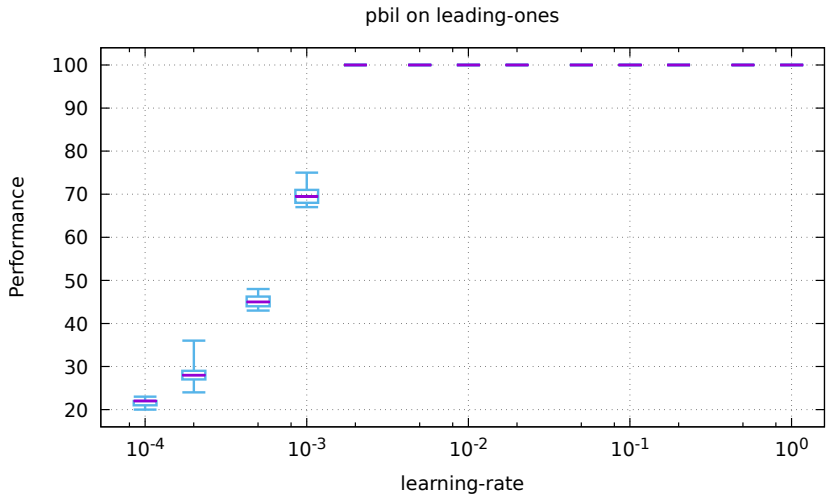

pbil on lin
Performance
48
47
46
45
44
43
42
41
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

6 Function leading-ones

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	20	21	22	22	23	13
pbil-0.0002	24	27	28	29	36	12
pbil-0.0005	43	44	45	46	48	11
pbil-0.001	67	68	70	71	75	10
pbil-0.002	100	100	100	100	100	1
pbil-0.005	100	100	100	100	100	1
pbil-0.01	100	100	100	100	100	1
pbil-0.02	100	100	100	100	100	1
pbil-0.05	100	100	100	100	100	1
pbil-0.1	100	100	100	100	100	1
pbil-0.2	100	100	100	100	100	1
pbil-0.5	100	100	100	100	100	1
pbil-1	100	100	100	100	100	1

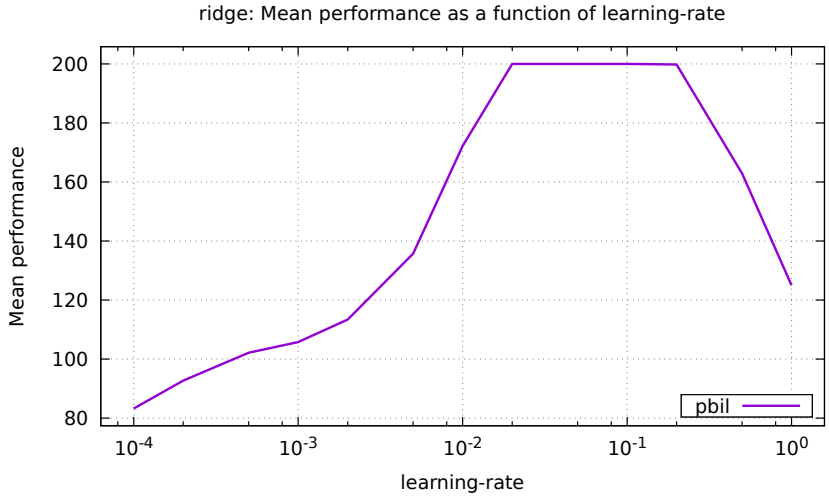


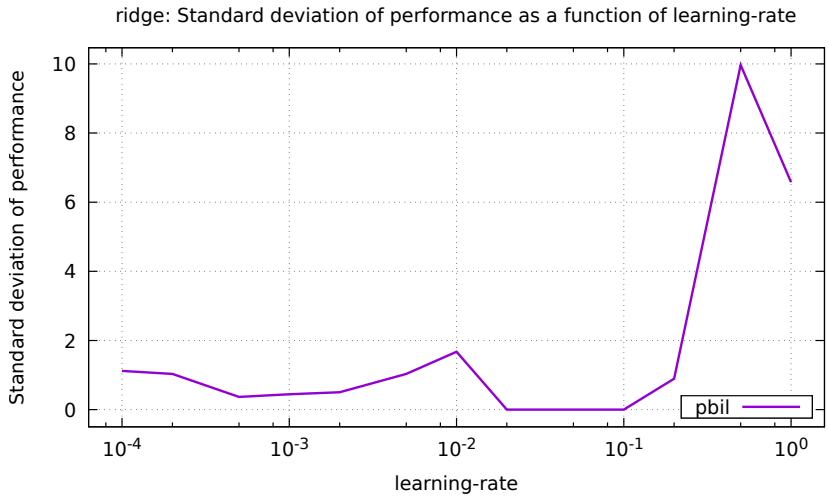


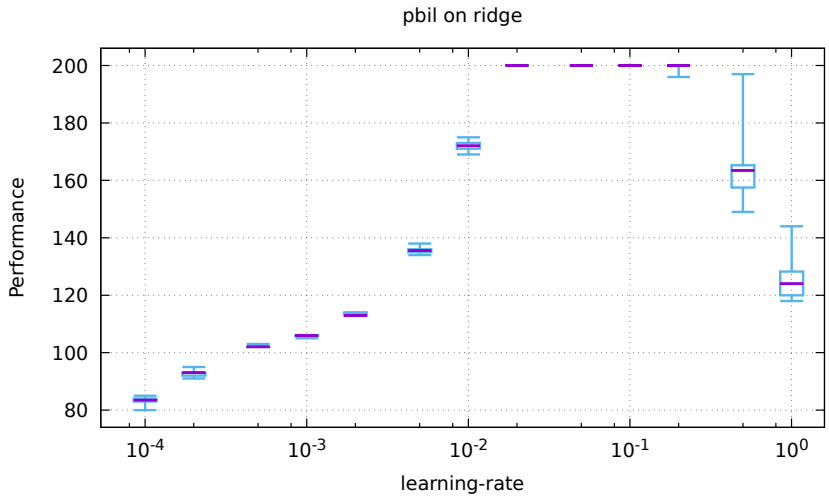


7 Function ridge

algorithm	min	Q_1	med.	Q_3	max	rk
`pbil-0.0001`	80	83	84	84	85	13
`pbil-0.0002`	91	92	93	93	95	12
`pbil-0.0005`	102	102	102	102	103	11
`pbil-0.001`	105	106	106	106	106	10
`pbil-0.002`	113	113	113	114	114	9
`pbil-0.005`	134	135	136	136	138	7
`pbil-0.01`	169	171	172	173	175	5
`pbil-0.02`	200	200	200	200	200	1
`pbil-0.05`	200	200	200	200	200	1
`pbil-0.1`	200	200	200	200	200	1
`pbil-0.2`	196	200	200	200	200	4
`pbil-0.5`	149	158	164	165	197	6
`pbil-1`	118	120	124	128	144	8

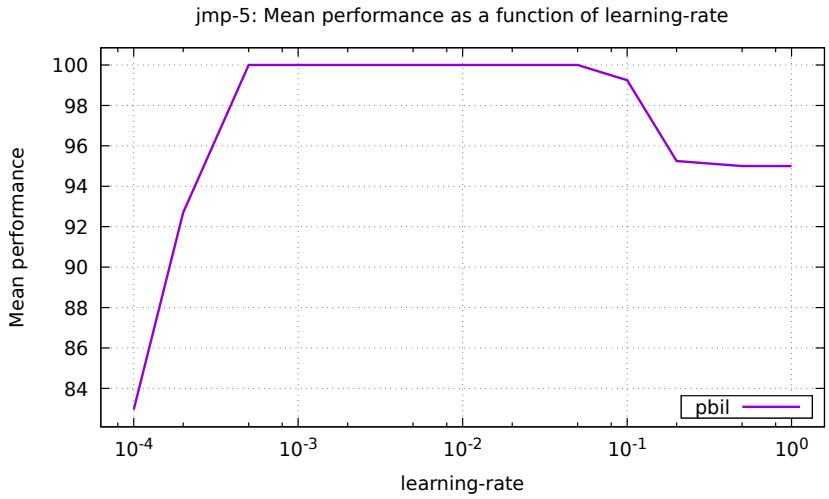


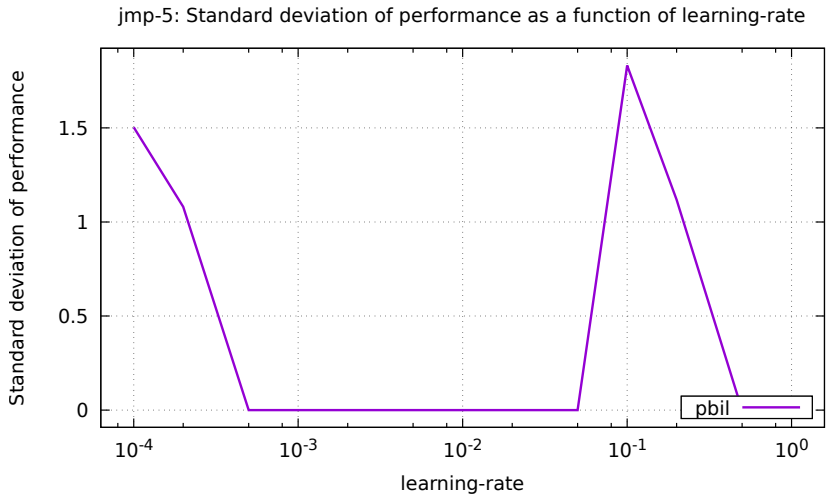


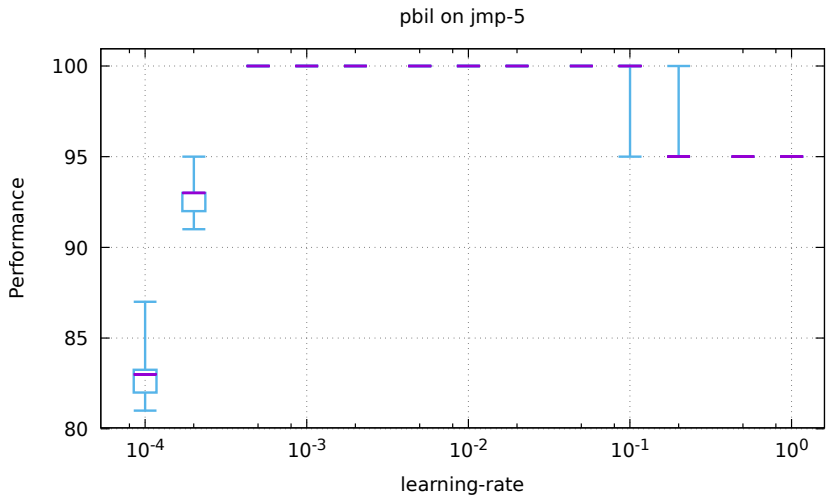


8 Function jmp-5

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	81	82	83	83	87	13
pbil-0.0002	91	92	93	93	95	12
pbil-0.0005	100	100	100	100	100	1
pbil-0.001	100	100	100	100	100	1
pbil-0.002	100	100	100	100	100	1
pbil-0.005	100	100	100	100	100	1
pbil-0.01	100	100	100	100	100	1
pbil-0.02	100	100	100	100	100	1
pbil-0.05	100	100	100	100	100	1
pbil-0.1	95	100	100	100	100	8
pbil-0.2	95	95	95	95	100	9
pbil-0.5	95	95	95	95	95	10
pbil-1	95	95	95	95	95	10

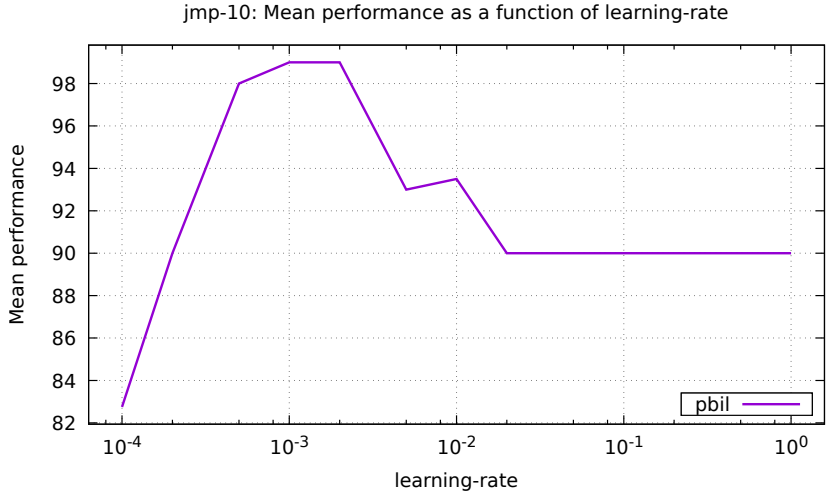

jmp-5: Mean performance as a function of learning-rate
Mean performance
100
98
96
94
92
90
88
86
84
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

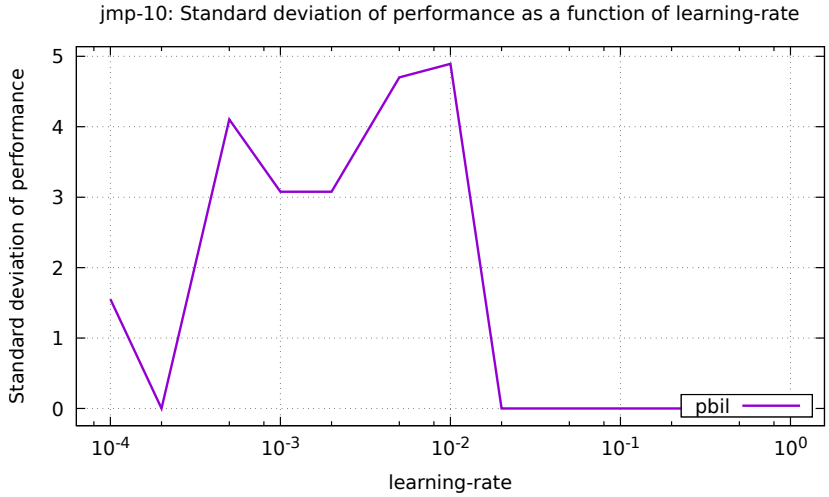

jmp-5: Standard deviation of performance as a function of learning-rate
Standard deviation of performance
1.5
1
0.5
0
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

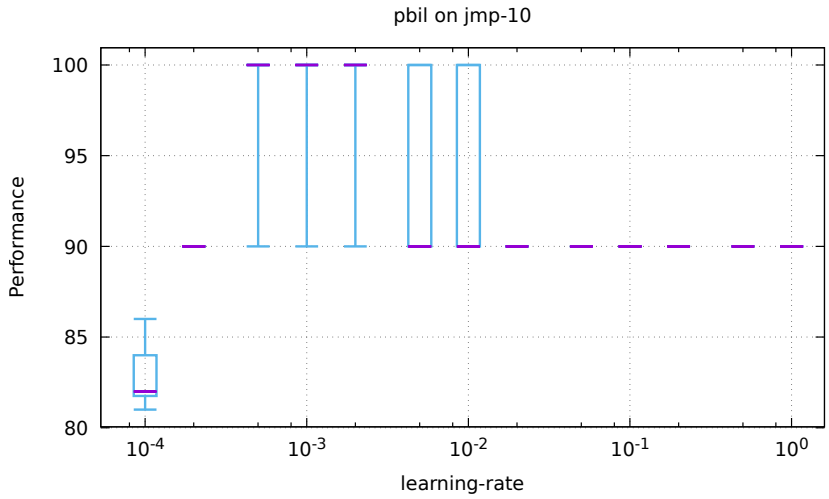

pbil on jmp-5
Performance
100
95
90
85
80
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

9 Function jmp-10

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	81	82	82	84	86	13
pbil-0.0002	90	90	90	90	90	6
pbil-0.0005	90	100	100	100	100	1
pbil-0.001	90	100	100	100	100	1
pbil-0.002	90	100	100	100	100	1
pbil-0.005	90	90	90	100	100	4
pbil-0.01	90	90	90	100	100	4
pbil-0.02	90	90	90	90	90	6
pbil-0.05	90	90	90	90	90	6
pbil-0.1	90	90	90	90	90	6
pbil-0.2	90	90	90	90	90	6
pbil-0.5	90	90	90	90	90	6
pbil-1	90	90	90	90	90	6

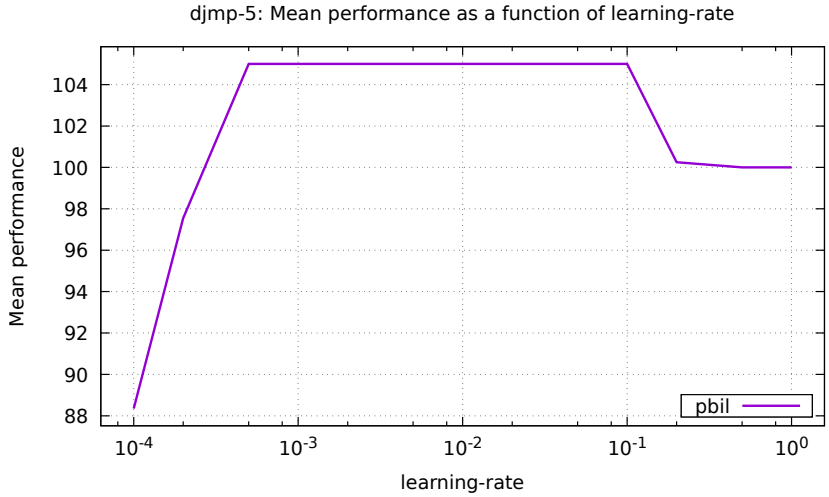


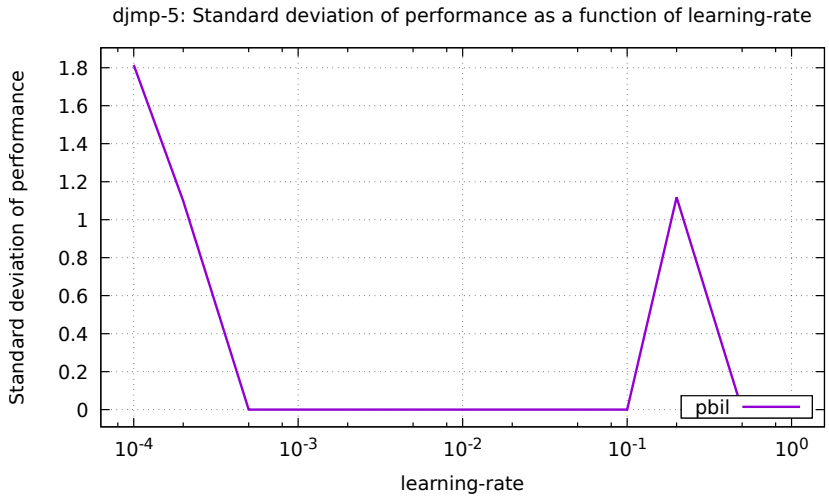


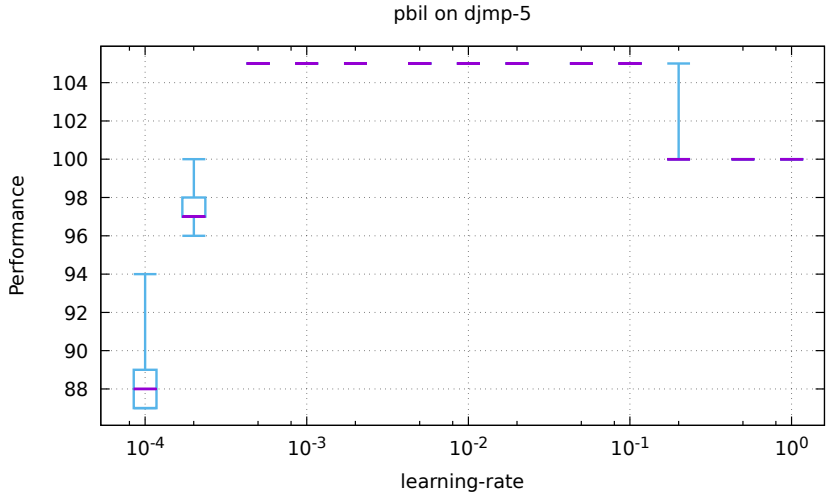


10 Function djmp-5

algorithm	min	Q_1	med.	Q_3	max	rk
`pbil-0.0001`	87	87	88	89	94	13
`pbil-0.0002`	96	97	97	98	100	12
`pbil-0.0005`	105	105	105	105	105	1
`pbil-0.001`	105	105	105	105	105	1
`pbil-0.002`	105	105	105	105	105	1
`pbil-0.005`	105	105	105	105	105	1
`pbil-0.01`	105	105	105	105	105	1
`pbil-0.02`	105	105	105	105	105	1
`pbil-0.05`	105	105	105	105	105	1
`pbil-0.1`	105	105	105	105	105	1
`pbil-0.2`	100	100	100	100	105	9
`pbil-0.5`	100	100	100	100	100	10
`pbil-1`	100	100	100	100	100	10

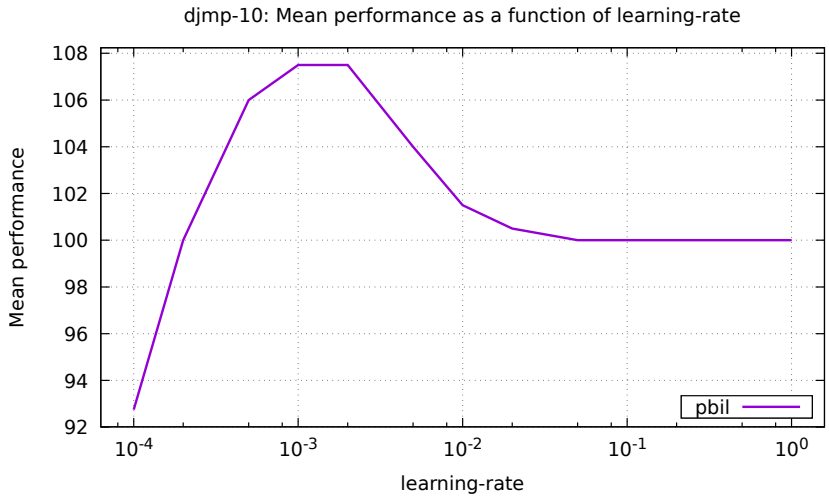


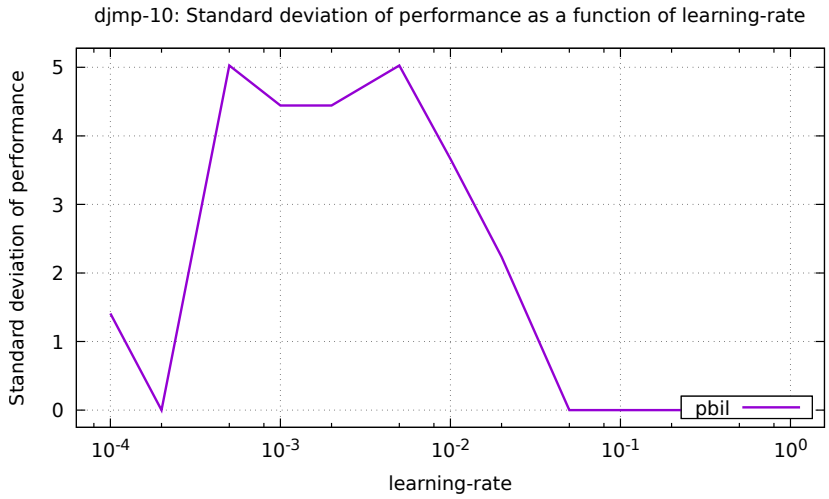


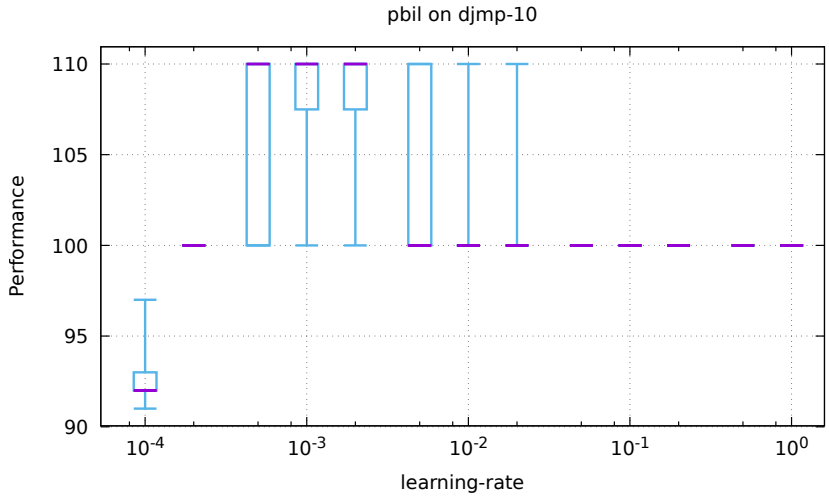


11 Function djmp-10

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	91	92	92	93	97	13
pbil-0.0002	100	100	100	100	100	7
pbil-0.0005	100	100	110	110	110	3
pbil-0.001	100	108	110	110	110	1
pbil-0.002	100	108	110	110	110	1
pbil-0.005	100	100	100	110	110	4
pbil-0.01	100	100	100	100	110	5
pbil-0.02	100	100	100	100	110	5
pbil-0.05	100	100	100	100	100	7
pbil-0.1	100	100	100	100	100	7
pbil-0.2	100	100	100	100	100	7
pbil-0.5	100	100	100	100	100	7
pbil-1	100	100	100	100	100	7

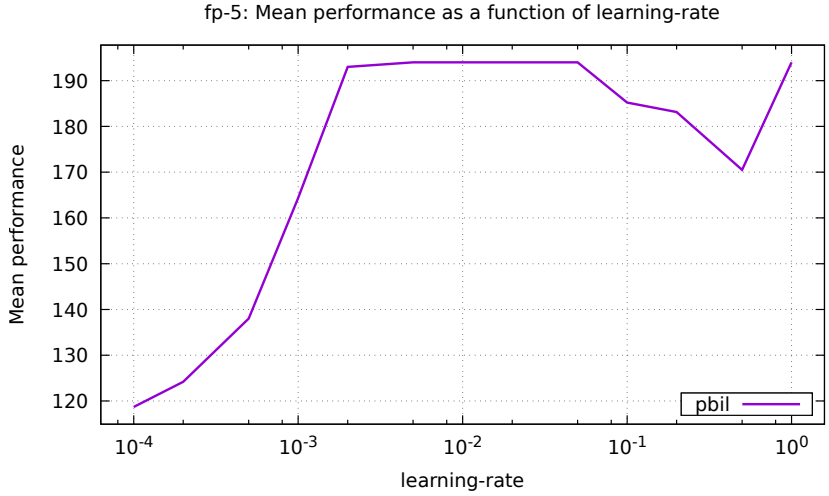

djmp-10: Mean performance as a function of learning-rate
Mean performance
learning-rate
pbil
108
106
104
102
100
98
96
94
92
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}

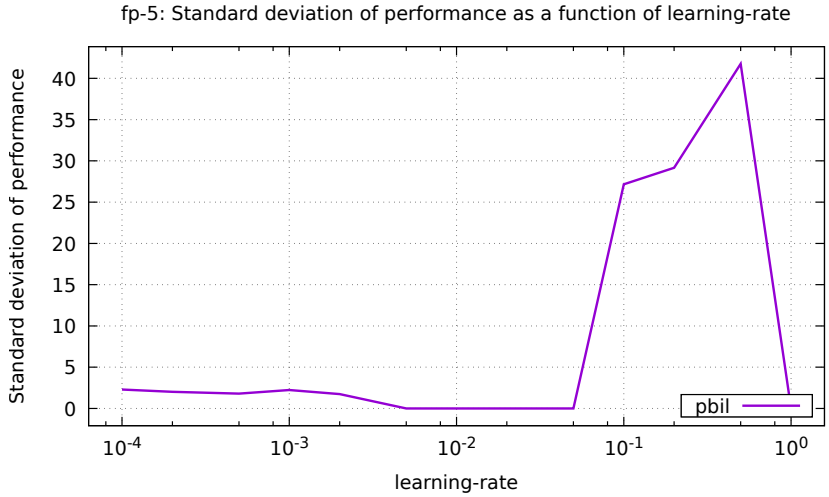

djmp-10: Standard deviation of performance as a function of learning-rate
Standard deviation of performance
learning-rate
pbil
5
4
3
2
1
0
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}

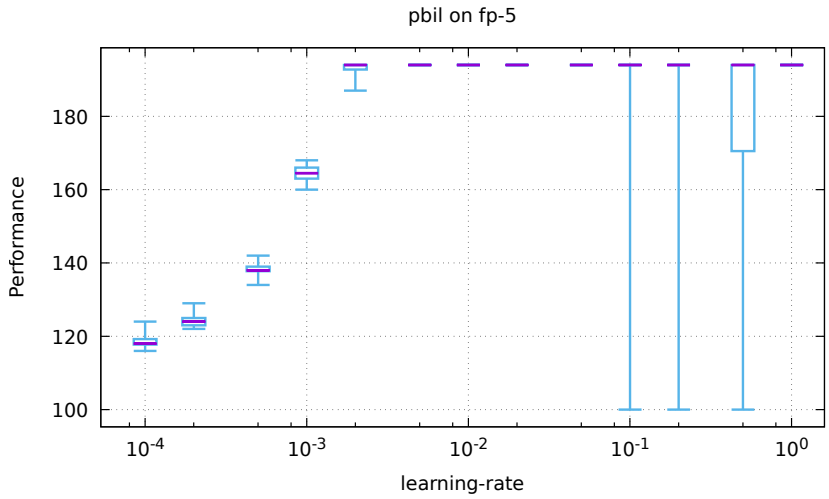

pbil on djmp-10
Performance
learning-rate
110
105
100
95
90
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}

12 Function fp-5

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	116	118	118	119	124	13
pbil-0.0002	122	123	124	125	129	12
pbil-0.0005	134	138	138	139	142	11
pbil-0.001	160	163	165	166	168	10
pbil-0.002	187	193	194	194	194	8
pbil-0.005	194	194	194	194	194	1
pbil-0.01	194	194	194	194	194	1
pbil-0.02	194	194	194	194	194	1
pbil-0.05	194	194	194	194	194	1
pbil-0.1	100	194	194	194	194	6
pbil-0.2	100	194	194	194	194	6
pbil-0.5	100	171	194	194	194	9
pbil-1	194	194	194	194	194	1

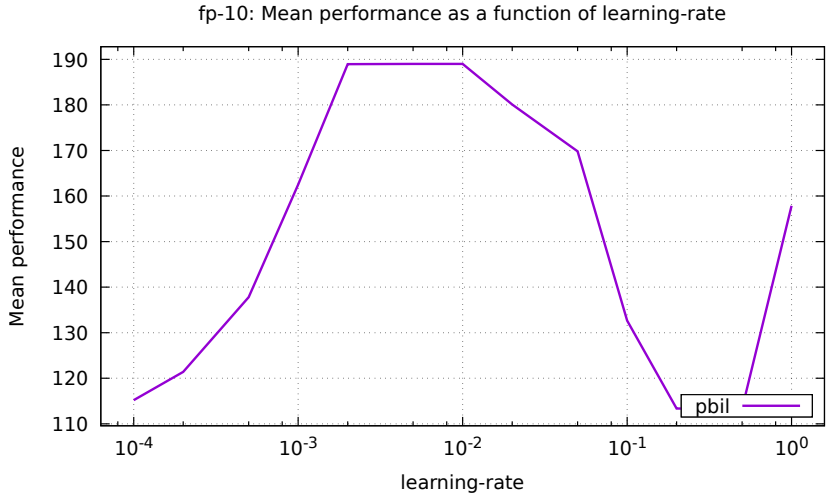


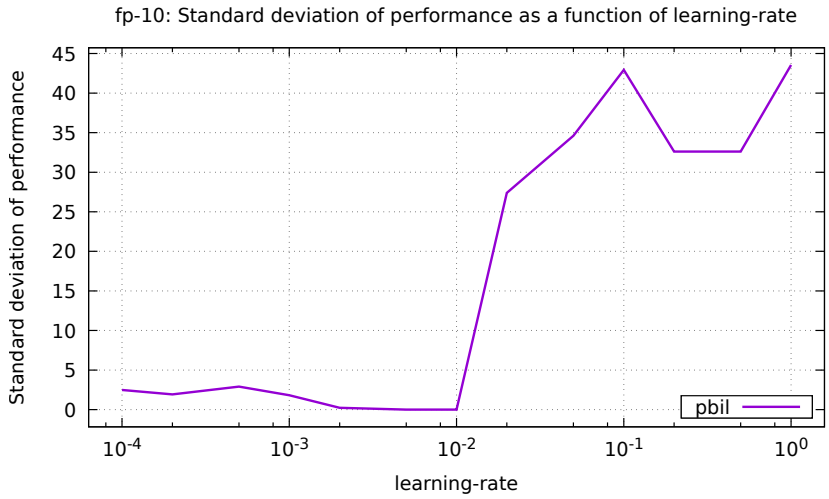


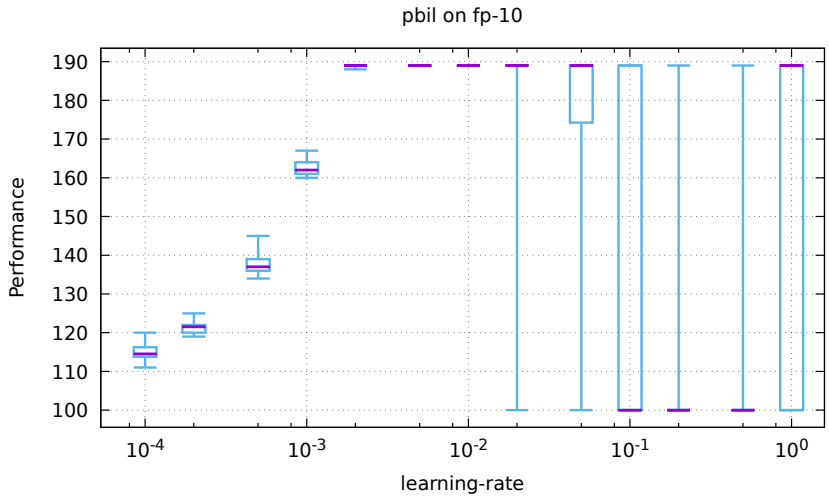


13 Function fp-10

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	111	114	115	116	120	10
pbil-0.0002	119	120	122	122	125	9
pbil-0.0005	134	136	137	139	145	8
pbil-0.001	160	161	162	164	167	7
pbil-0.002	188	189	189	189	189	3
pbil-0.005	189	189	189	189	189	1
pbil-0.01	189	189	189	189	189	1
pbil-0.02	100	189	189	189	189	4
pbil-0.05	100	174	189	189	189	5
pbil-0.1	100	100	100	189	189	11
pbil-0.2	100	100	100	100	189	12
pbil-0.5	100	100	100	100	189	12
pbil-1	100	100	189	189	189	6

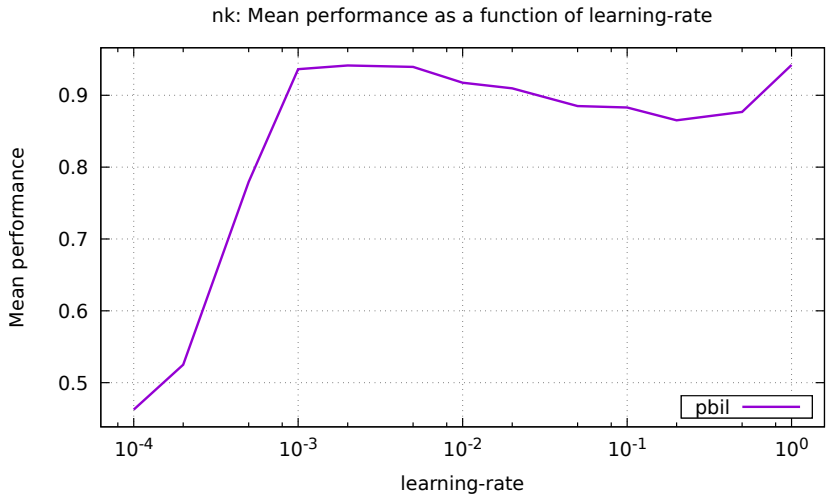


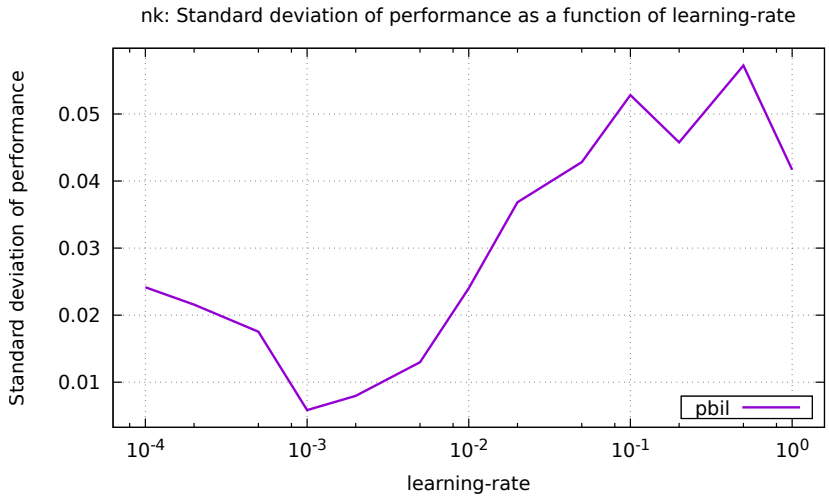


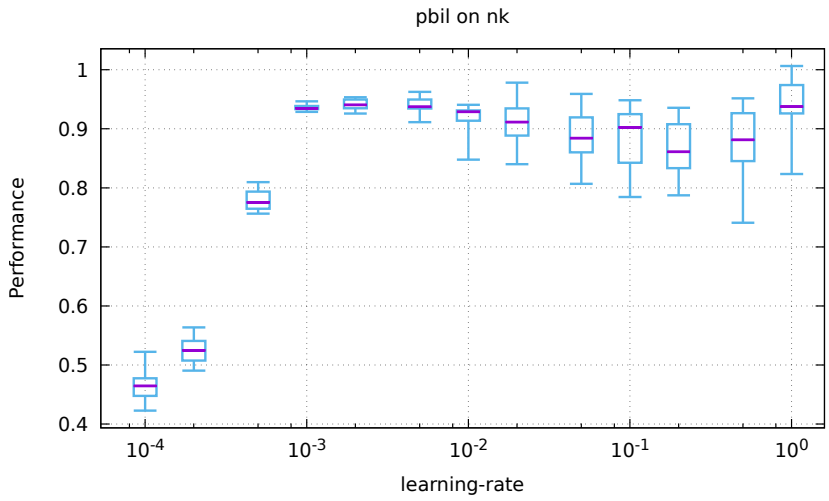


14 Function nk

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	0.42	0.45	0.46	0.48	0.52	13
pbil-0.0002	0.49	0.51	0.52	0.54	0.56	12
pbil-0.0005	0.76	0.76	0.78	0.79	0.81	11
pbil-0.001	0.93	0.93	0.93	0.94	0.95	4
pbil-0.002	0.93	0.93	0.94	0.95	0.95	1
pbil-0.005	0.91	0.93	0.94	0.95	0.96	3
pbil-0.01	0.85	0.91	0.93	0.93	0.94	5
pbil-0.02	0.84	0.89	0.91	0.93	0.98	6
pbil-0.05	0.81	0.86	0.88	0.92	0.96	8
pbil-0.1	0.78	0.84	0.90	0.92	0.95	7
pbil-0.2	0.79	0.83	0.86	0.91	0.94	10
pbil-0.5	0.74	0.85	0.88	0.93	0.95	9
pbil-1	0.82	0.93	0.94	0.97	1.01	2

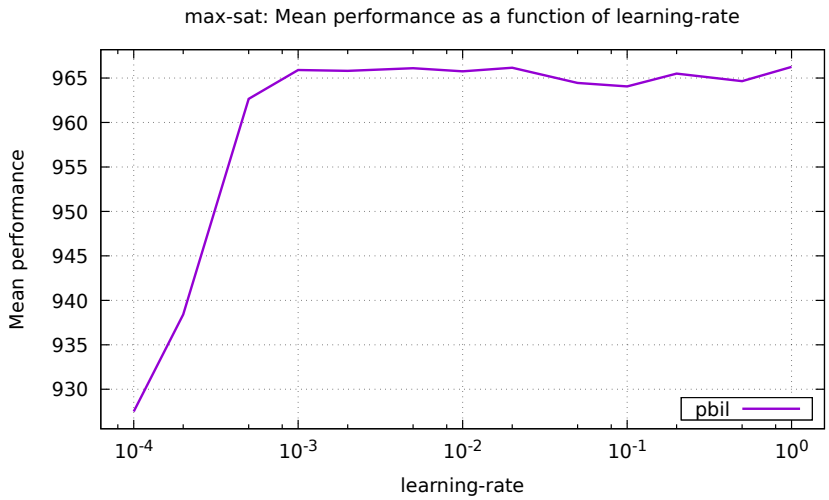

nk: Mean performance as a function of learning-rate
Mean performance
0.9
0.8
0.7
0.6
0.5
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

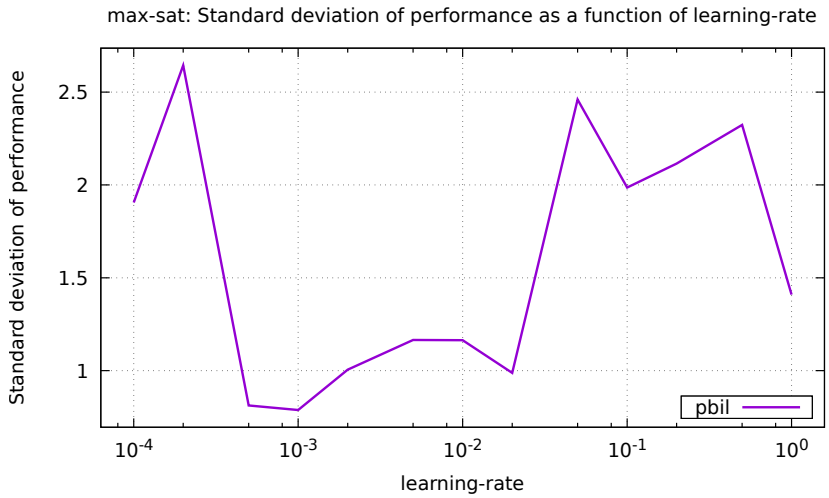

nk: Standard deviation of performance as a function of learning-rate
Standard deviation of performance
0.05
0.04
0.03
0.02
0.01
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

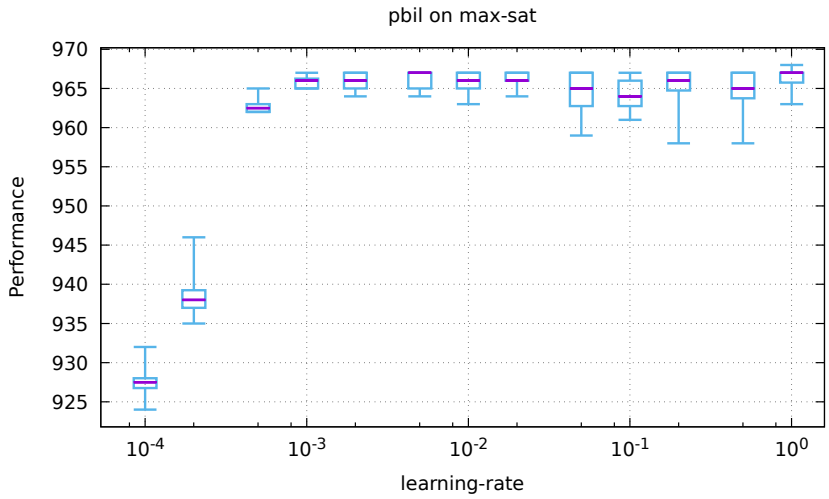

pbil on nk
Performance
1
0.9
0.8
0.7
0.6
0.5
0.4
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

15 Function max-sat

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	924	927	928	928	932	13
pbil-0.0002	935	937	938	939	946	12
pbil-0.0005	962	962	963	963	965	11
pbil-0.001	965	965	966	966	967	6
pbil-0.002	964	965	966	967	967	4
pbil-0.005	964	965	967	967	967	2
pbil-0.01	963	965	966	967	967	5
pbil-0.02	964	966	966	967	967	3
pbil-0.05	959	963	965	967	967	9
pbil-0.1	961	963	964	966	967	10
pbil-0.2	958	965	966	967	967	7
pbil-0.5	958	964	965	967	967	8
pbil-1	963	966	967	967	968	1

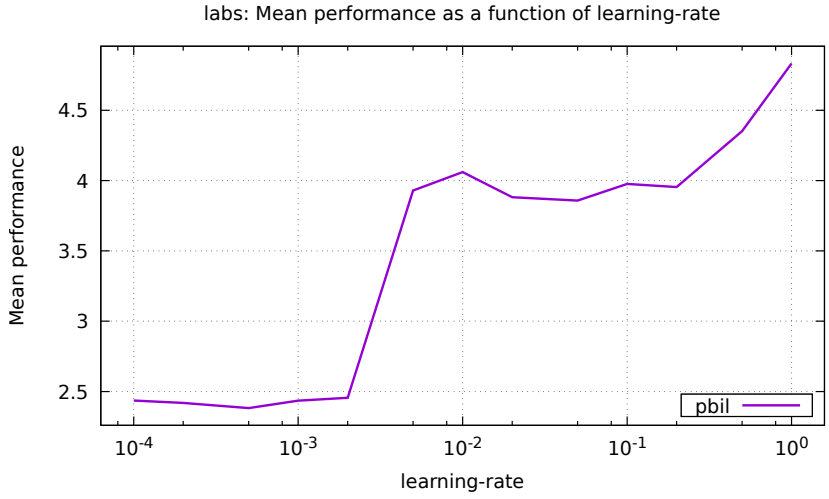


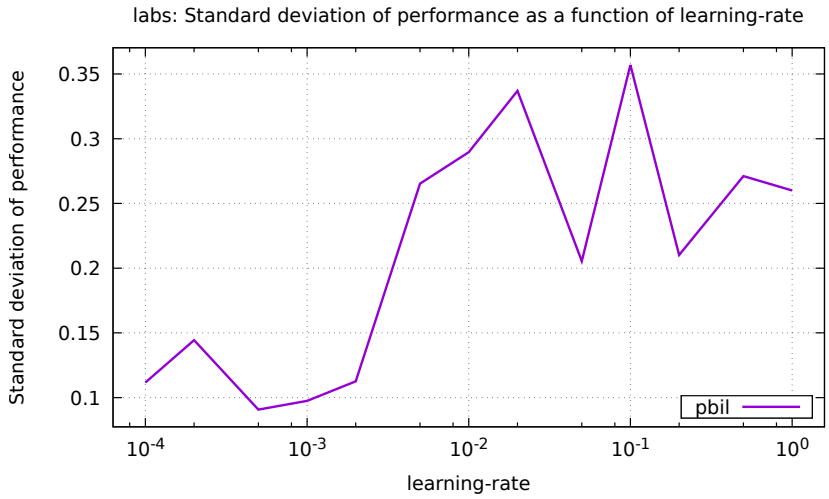


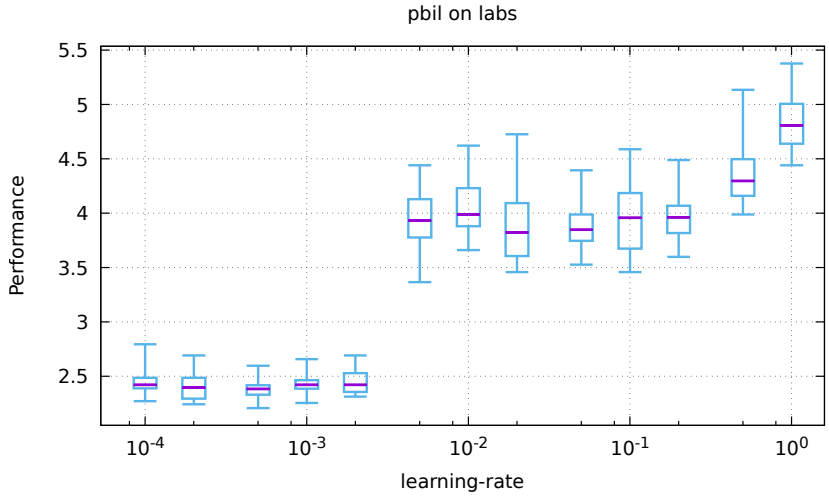


16 Function labs

algorithm	min	Q_1	med.	Q_3	max	rk
`pbil-0.0001`	2.27	2.39	2.42	2.49	2.79	11
`pbil-0.0002`	2.24	2.29	2.39	2.49	2.69	12
`pbil-0.0005`	2.21	2.33	2.38	2.42	2.60	13
`pbil-0.001`	2.25	2.39	2.42	2.46	2.66	9
`pbil-0.002`	2.31	2.36	2.42	2.53	2.69	10
`pbil-0.005`	3.36	3.78	3.93	4.13	4.44	6
`pbil-0.01`	3.66	3.88	3.99	4.23	4.62	3
`pbil-0.02`	3.46	3.60	3.82	4.09	4.73	8
`pbil-0.05`	3.53	3.75	3.85	3.99	4.39	7
`pbil-0.1`	3.46	3.67	3.96	4.18	4.59	5
`pbil-0.2`	3.60	3.82	3.96	4.07	4.49	4
`pbil-0.5`	3.99	4.16	4.30	4.50	5.13	2
`pbil-1`	4.44	4.64	4.81	5.01	5.38	1

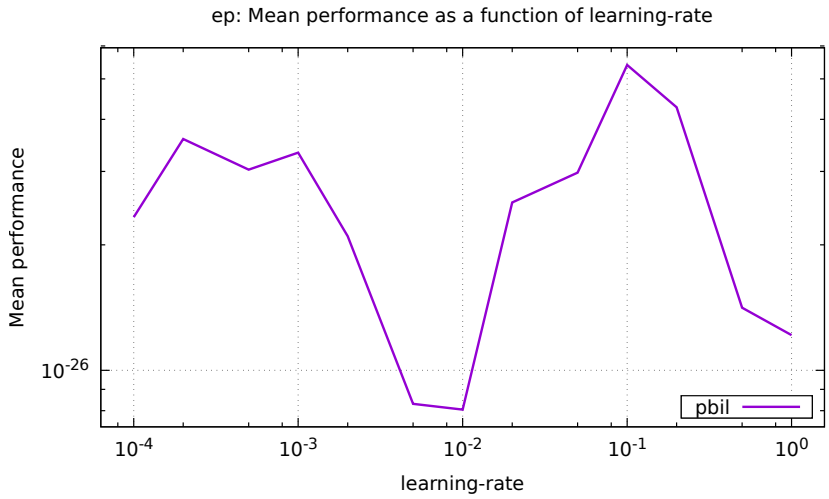


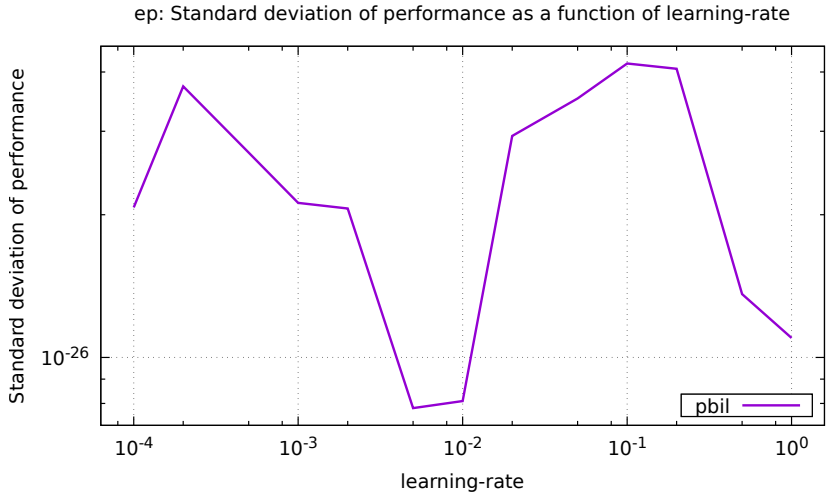


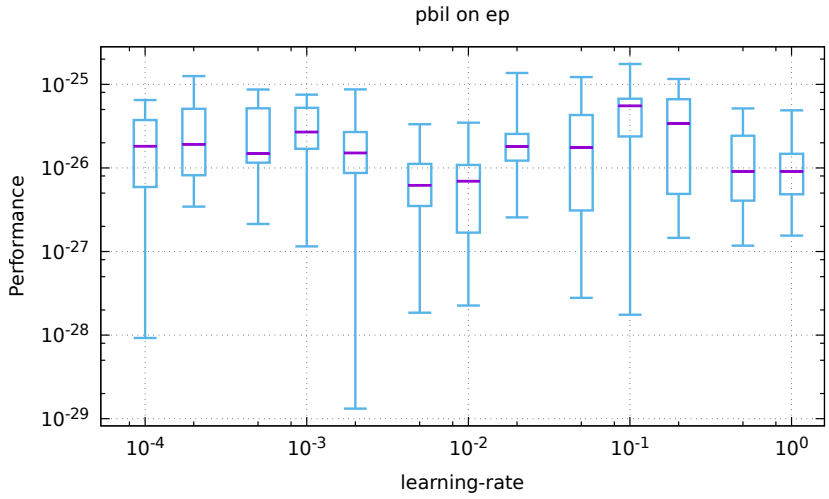


17 Function ep

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	9.24×10^{-29}	5.92×10^{-27}	1.82×10^{-26}	3.74×10^{-26}	6.49×10^{-26}	9
pbil-0.0002	3.45×10^{-27}	8.18×10^{-27}	1.92×10^{-26}	5.09×10^{-26}	1.25×10^{-25}	10
pbil-0.0005	2.13×10^{-27}	1.15×10^{-26}	1.48×10^{-26}	5.17×10^{-26}	8.68×10^{-26}	5
pbil-0.001	1.15×10^{-27}	1.70×10^{-26}	2.69×10^{-26}	5.22×10^{-26}	7.52×10^{-26}	11
pbil-0.002	1.32×10^{-29}	8.70×10^{-27}	1.51×10^{-26}	2.69×10^{-26}	8.70×10^{-26}	6
pbil-0.005	1.86×10^{-28}	3.50×10^{-27}	6.22×10^{-27}	1.12×10^{-26}	3.33×10^{-26}	1
pbil-0.01	2.26×10^{-28}	1.69×10^{-27}	6.96×10^{-27}	1.09×10^{-26}	3.48×10^{-26}	2
pbil-0.02	2.56×10^{-27}	1.22×10^{-26}	1.81×10^{-26}	2.55×10^{-26}	1.37×10^{-25}	8
pbil-0.05	2.79×10^{-28}	3.10×10^{-27}	1.75×10^{-26}	4.30×10^{-26}	1.22×10^{-25}	7
pbil-0.1	1.75×10^{-28}	2.38×10^{-26}	5.51×10^{-26}	6.73×10^{-26}	1.75×10^{-25}	13
pbil-0.2	1.46×10^{-27}	4.88×10^{-27}	3.38×10^{-26}	6.64×10^{-26}	1.16×10^{-25}	12
pbil-0.5	1.18×10^{-27}	4.07×10^{-27}	9.07×10^{-27}	2.42×10^{-26}	5.14×10^{-26}	3
pbil-1	1.55×10^{-27}	4.83×10^{-27}	9.12×10^{-27}	1.48×10^{-26}	4.88×10^{-26}	4

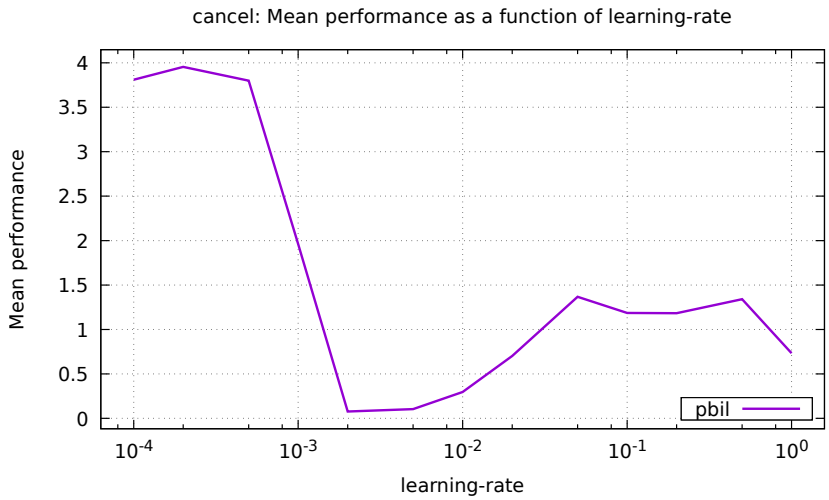

ep: Mean performance as a function of learning-rate
Mean performance
10^{-26}
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

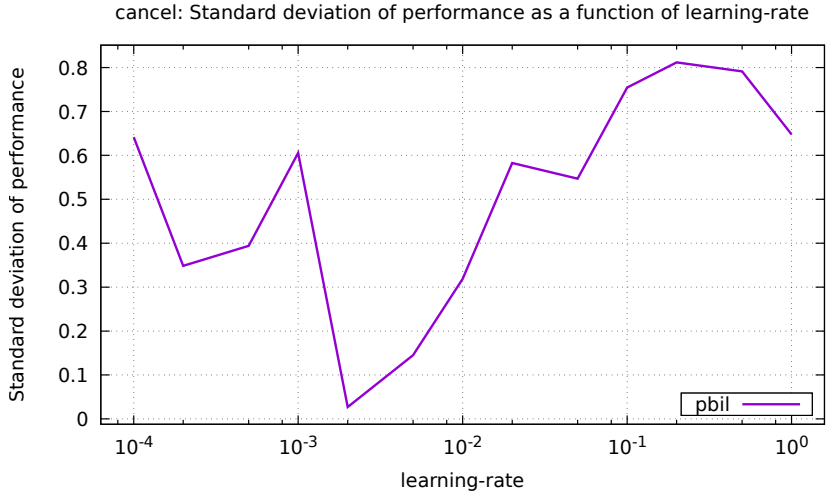

ep: Standard deviation of performance as a function of learning-rate
Standard deviation of performance
10^{-26}
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

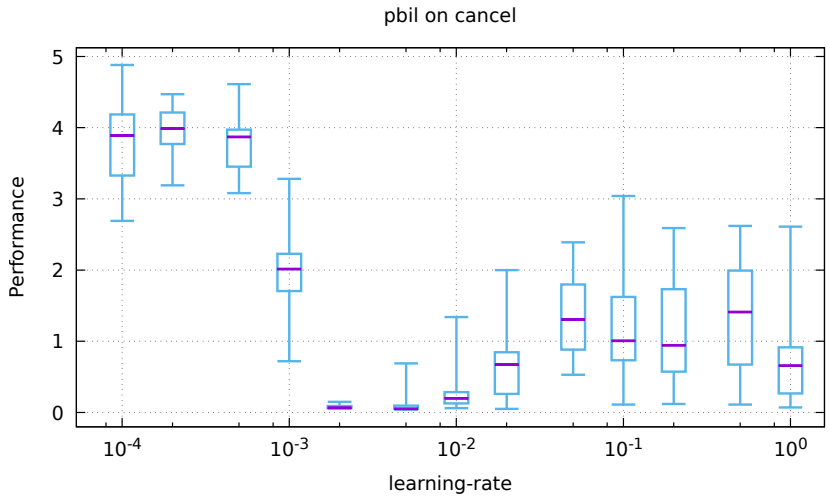

pbil on ep
Performance
10^{-25}
10^{-26}
10^{-27}
10^{-28}
10^{-29}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

18 Function cancel

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	2.69	3.33	3.89	4.19	4.88	12
pbil-0.0002	3.19	3.77	3.99	4.21	4.47	13
pbil-0.0005	3.08	3.45	3.87	3.97	4.61	11
pbil-0.001	0.72	1.71	2.02	2.23	3.28	10
pbil-0.002	0.05	0.06	0.07	0.09	0.15	2
pbil-0.005	0.04	0.05	0.05	0.10	0.69	1
pbil-0.01	0.06	0.13	0.20	0.29	1.34	3
pbil-0.02	0.05	0.26	0.67	0.85	2.00	5
pbil-0.05	0.53	0.88	1.31	1.80	2.39	8
pbil-0.1	0.11	0.73	1.01	1.62	3.04	7
pbil-0.2	0.12	0.57	0.95	1.73	2.59	6
pbil-0.5	0.11	0.67	1.41	1.99	2.62	9
pbil-1	0.07	0.27	0.66	0.92	2.61	4

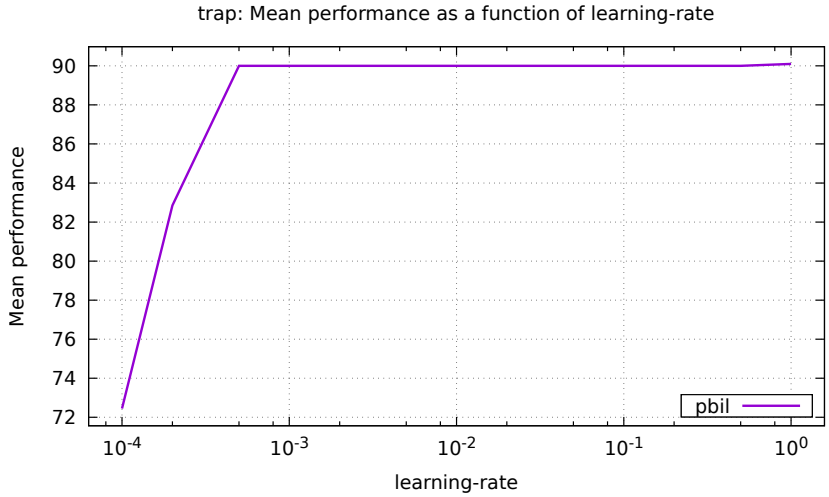


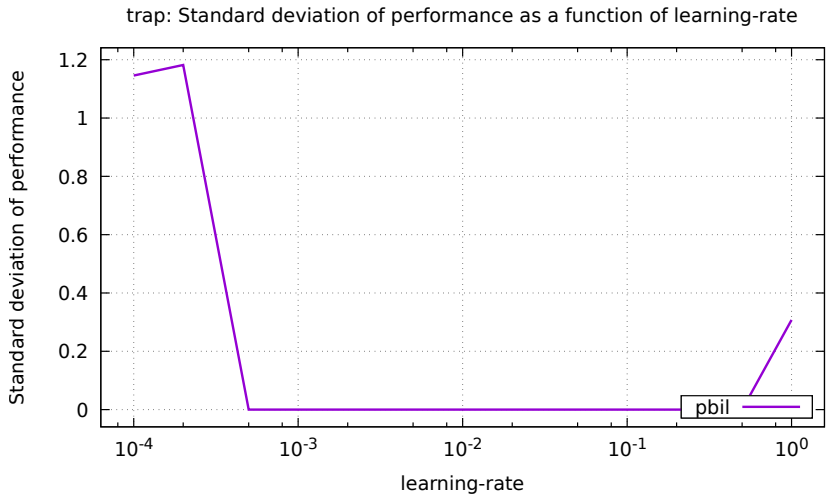


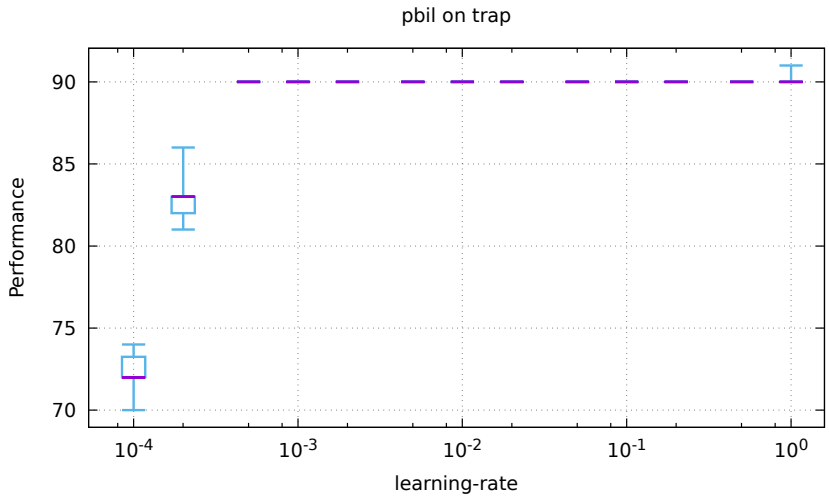


19 Function trap

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	70	72	72	73	74	13
pbil-0.0002	81	82	83	83	86	12
pbil-0.0005	90	90	90	90	90	2
pbil-0.001	90	90	90	90	90	2
pbil-0.002	90	90	90	90	90	2
pbil-0.005	90	90	90	90	90	2
pbil-0.01	90	90	90	90	90	2
pbil-0.02	90	90	90	90	90	2
pbil-0.05	90	90	90	90	90	2
pbil-0.1	90	90	90	90	90	2
pbil-0.2	90	90	90	90	90	2
pbil-0.5	90	90	90	90	90	2
pbil-1	90	90	90	90	91	1

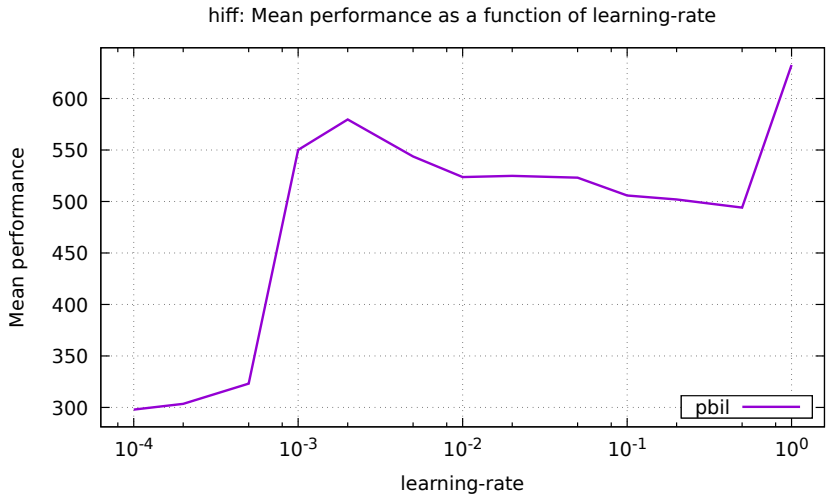


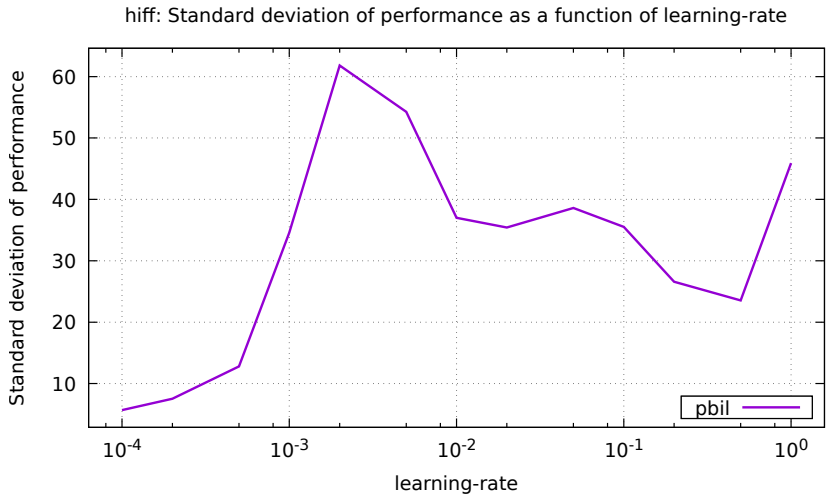


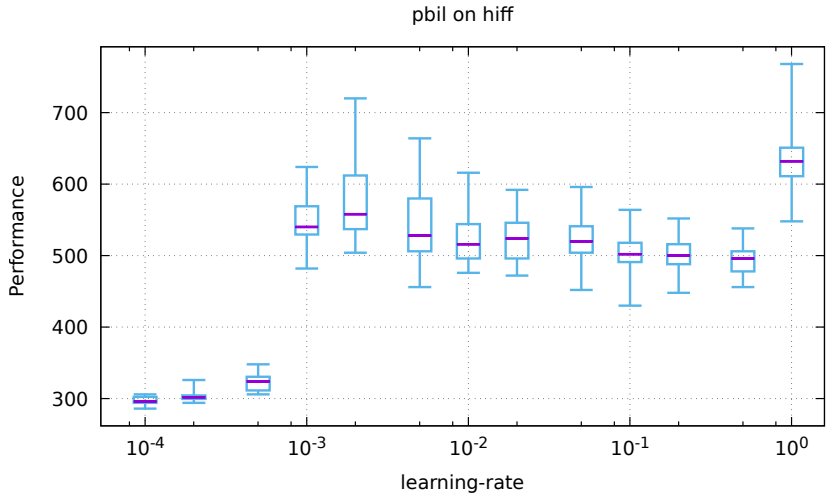


20 Function hiff

algorithm	min	Q_1	med.	Q_3	max	rk
`pbil-0.0001`	286	294	296	303	306	13
`pbil-0.0002`	294	300	302	305	326	12
`pbil-0.0005`	306	312	324	331	348	11
`pbil-0.001`	482	530	540	569	624	3
`pbil-0.002`	504	537	558	612	720	2
`pbil-0.005`	456	506	528	580	664	4
`pbil-0.01`	476	496	516	544	616	7
`pbil-0.02`	472	496	524	546	592	5
`pbil-0.05`	452	504	520	541	596	6
`pbil-0.1`	430	491	502	518	564	8
`pbil-0.2`	448	488	500	516	552	9
`pbil-0.5`	456	478	496	506	538	10
`pbil-1`	548	611	632	651	768	1

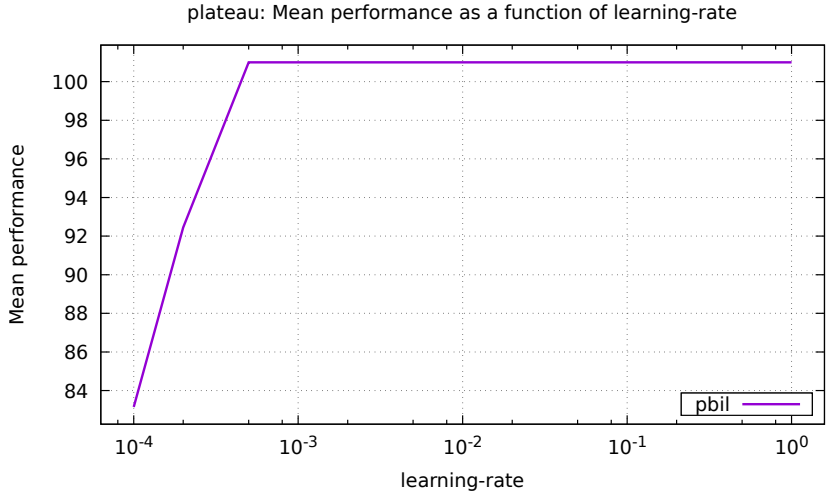

hiff: Mean performance as a function of learning-rate
Mean performance
600
550
500
450
400
350
300
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

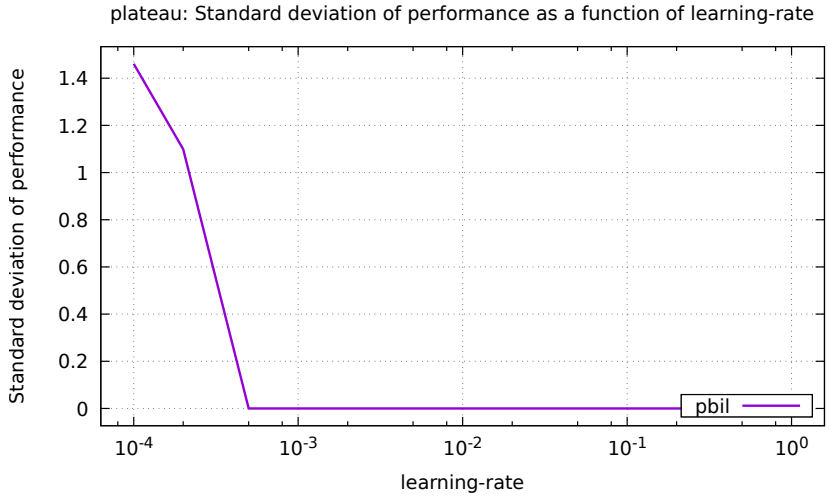

hiff: Standard deviation of performance as a function of learning-rate
Standard deviation of performance
60
50
40
30
20
10
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

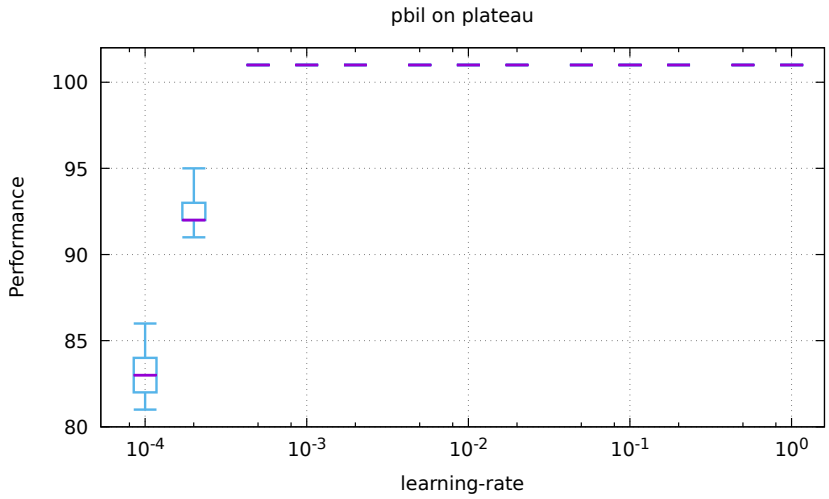

pbil on hiff
Performance
700
600
500
400
300
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

21 Function plateau

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	81	82	83	84	86	13
pbil-0.0002	91	92	92	93	95	12
pbil-0.0005	101	101	101	101	101	1
pbil-0.001	101	101	101	101	101	1
pbil-0.002	101	101	101	101	101	1
pbil-0.005	101	101	101	101	101	1
pbil-0.01	101	101	101	101	101	1
pbil-0.02	101	101	101	101	101	1
pbil-0.05	101	101	101	101	101	1
pbil-0.1	101	101	101	101	101	1
pbil-0.2	101	101	101	101	101	1
pbil-0.5	101	101	101	101	101	1
pbil-1	101	101	101	101	101	1

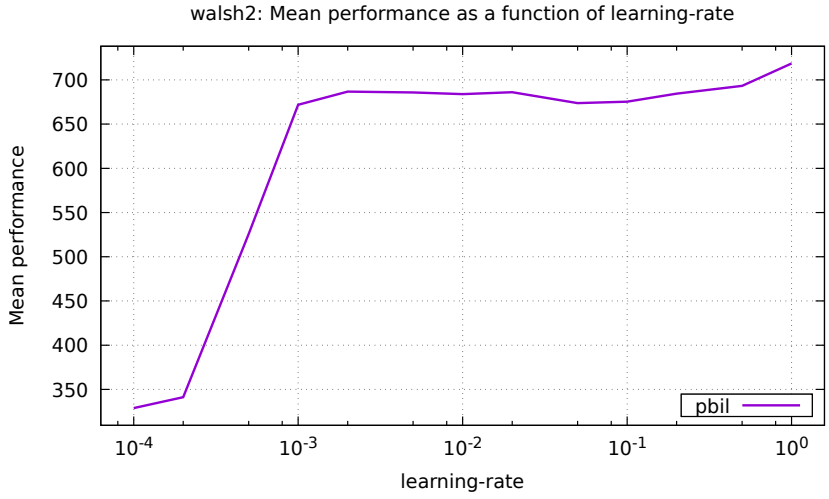


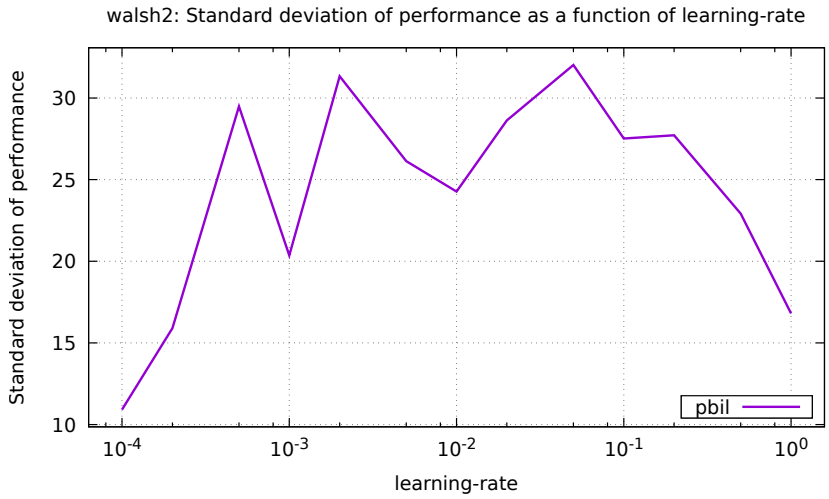


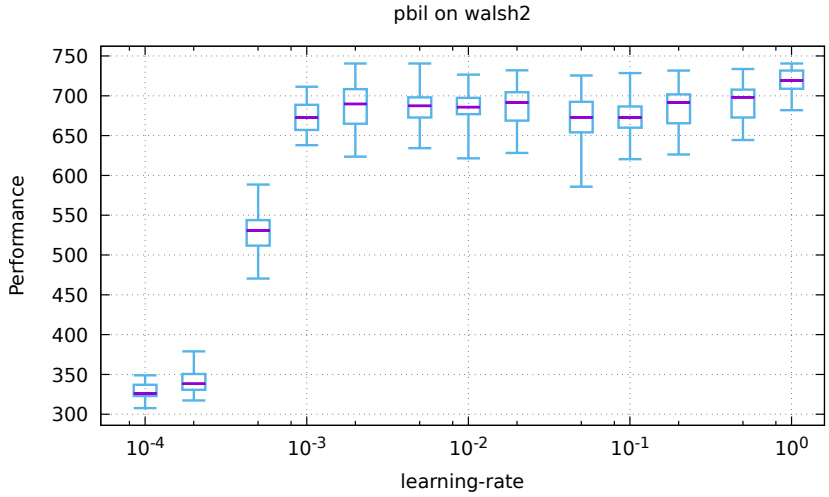


22 Function walsh2

algorithm	min	Q_1	med.	Q_3	max	rk
`pbil-0.0001`	307.72	322.90	326.25	337.09	348.91	13
`pbil-0.0002`	317.42	330.67	338.19	350.58	379.01	12
`pbil-0.0005`	470.43	511.74	530.64	543.87	588.49	11
`pbil-0.001`	638.04	657.11	672.56	688.65	711.35	10
`pbil-0.002`	623.52	664.89	689.71	708.33	740.55	5
`pbil-0.005`	634.19	672.64	687.29	697.93	740.55	6
`pbil-0.01`	621.40	676.92	685.76	697.36	726.48	7
`pbil-0.02`	628.22	668.74	691.49	704.51	732.02	4
`pbil-0.05`	585.80	654.06	673.03	692.35	725.50	8
`pbil-0.1`	620.39	659.92	672.73	686.61	728.55	9
`pbil-0.2`	626.24	665.55	691.66	701.76	731.69	3
`pbil-0.5`	644.45	672.67	698.14	707.74	733.57	2
`pbil-1`	681.93	708.86	719.10	731.69	740.55	1




walsh2: Standard deviation of performance as a function of learning-rate
Standard deviation of performance
30
25
20
15
10
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate


pbil on walsh2
Performance
750
700
650
600
550
500
450
400
350
300
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate