HNCO
Influence of the learning rate
on the performances of PBIL

October 17, 2016

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.

Contents

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
# exhaustive_neighborhood = 0
# fun_num_traps = 10
# 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
# noise_stddev = 1
# num_iterations = 0
# path = nopath
# patience = 50
# plugin_function_name = nofunction
# population_size = 10
# radius = 2
# 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
# print_default_parameters
# last_parameter
# exec_name = hnco
# version = 1.13
# Generated from hnco.json
```

2 Plan

```
{
    "exec": "hnco",
    "opt": "--no-header -s 100 --map 1 --map-random -i 0 -b 200000 --print-performances",
    "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 ],
```

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    "logscale": true,
    "boxwidth": "($1*0.3)"
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"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}"
    },
    {
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        "opt": "-F 31 --stop-on-maximum -t 10",
        "col": ">{{\\nprounddigits{0}}}N{3}{0}"
    },
    {
        "id": "fp-5",
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    {
        "id": "fp-10",
        "opt": "-F 40 --stop-on-maximum -t 10",
        "col": ">{{\\nprounddigits{0}}}N{3}{0}"
    },
    {
        "id": "quad",
        "opt": "-F 50 -p instances/quad.100 --cache",
        "col": ">{{\\nprounddigits{2}}}N{3}{2}"
    },
    {
        "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}"
        },
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            "opt": "-F 90 -p instances/ep.100",
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            "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}"
        },
        {
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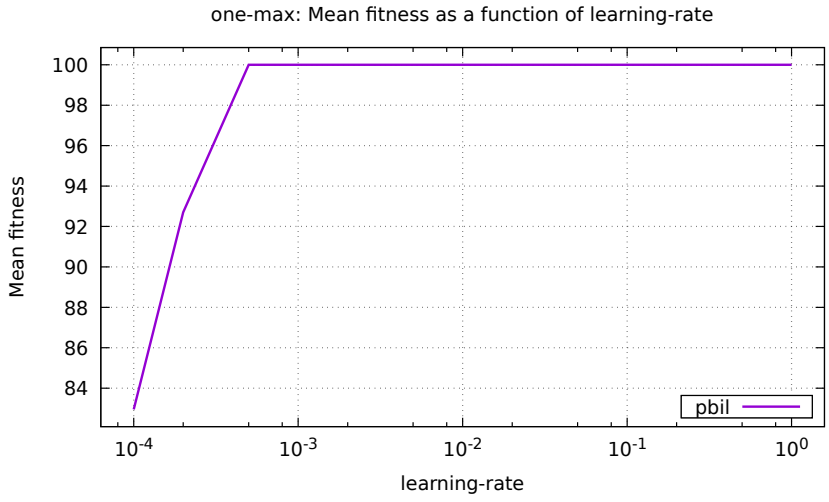
            "opt": "-F 120 --stop-on-maximum -s 128",
            "col": ">{{\\nprounddigits{0}}}N{3}{0}"
        },
        {
            "id": "plateau",
            "opt": "-F 130 --stop-on-maximum",
            "col": ">{{\\nprounddigits{0}}}N{3}{0}"
        }
    ],
    "algorithms": [
        {
            "id": "pbil",
            "opt": "-A 500 -x 10 -y 1"
        }
    ]
}
```

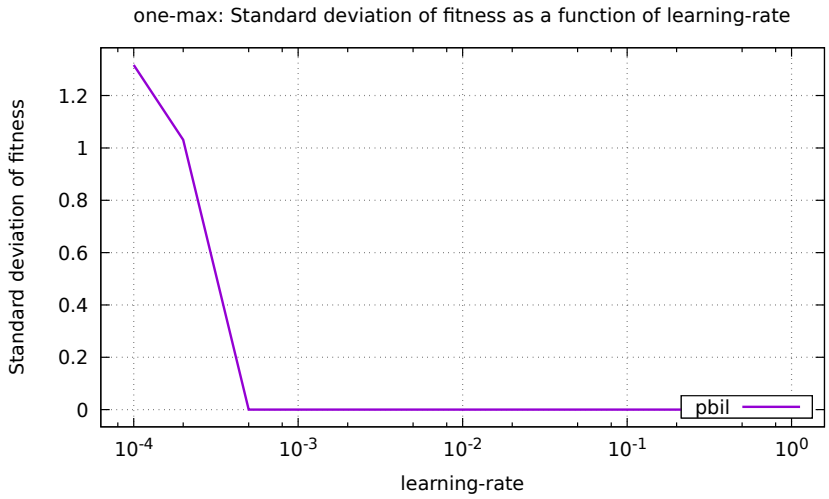
3 Rankings

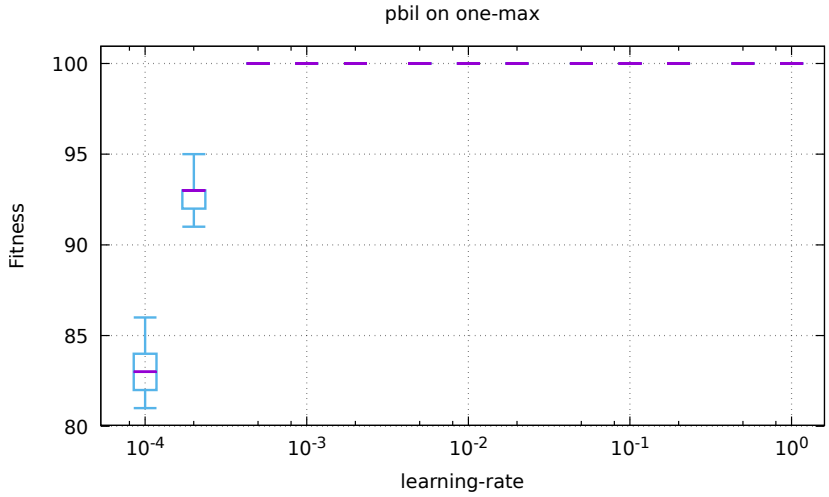
algorithm	rank distribution												
	1	2	3	4	5	6	7	8	9	10	11	12	13
pbil-1	12	0	0	0	2	1	0	2	0	2	0	0	0
pbil-0.002	8	4	2	0	0	0	0	2	3	0	0	0	0
pbil-0.005	8	3	3	2	0	1	1	1	0	0	0	0	0
pbil-0.01	8	1	3	2	2	1	0	1	1	0	0	0	0
pbil-0.02	8	1	0	2	4	3	1	0	0	0	0	0	0
pbil-0.05	8	1	0	0	2	2	1	1	1	2	0	0	1
pbil-0.001	7	2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

4 Function one-max

algorithm	min	Q_1	med.	Q_3	max	rk
`pbil-0.0001`	81	82	83	84	86	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`	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

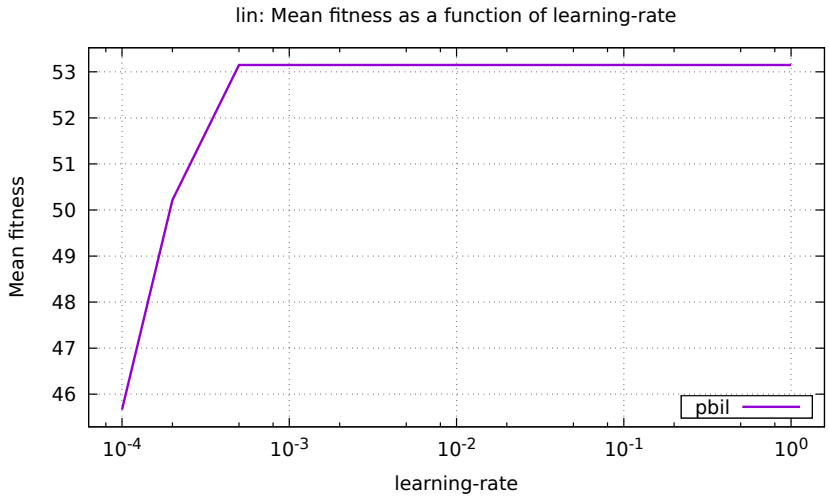


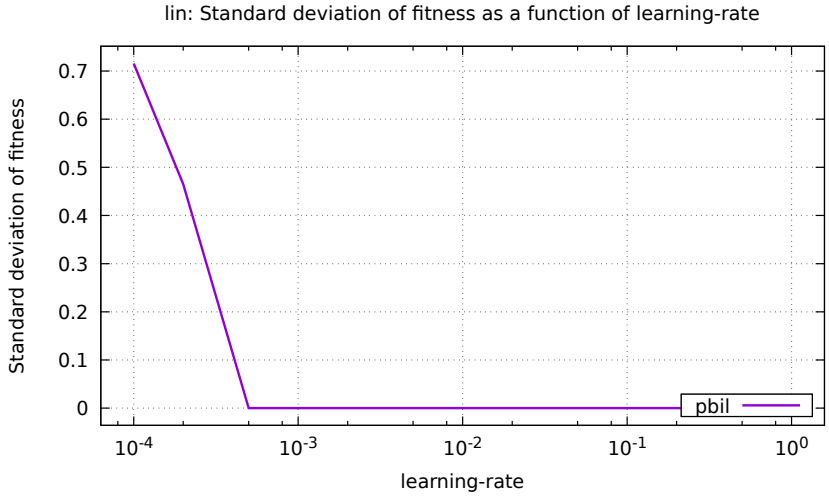


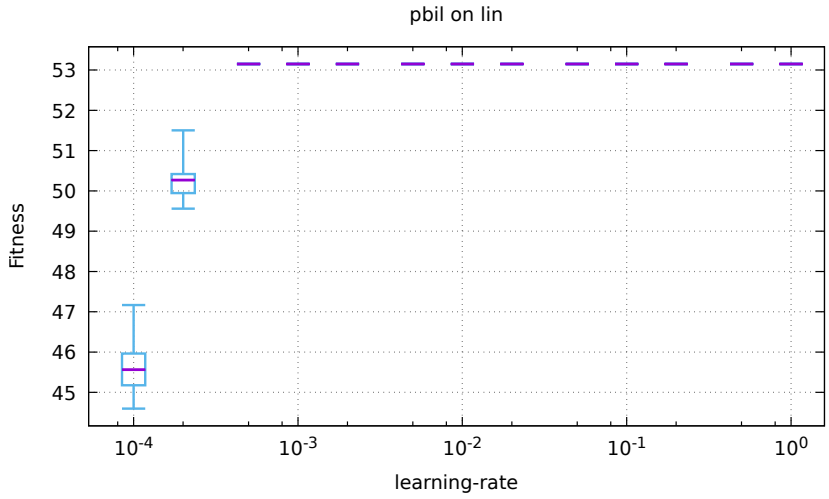


5 Function lin

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	44.60	45.18	45.56	45.96	47.17	13
pbil-0.0002	49.56	49.95	50.27	50.42	51.50	12
pbil-0.0005	53.15	53.15	53.15	53.15	53.15	1
pbil-0.001	53.15	53.15	53.15	53.15	53.15	1
pbil-0.002	53.15	53.15	53.15	53.15	53.15	1
pbil-0.005	53.15	53.15	53.15	53.15	53.15	1
pbil-0.01	53.15	53.15	53.15	53.15	53.15	1
pbil-0.02	53.15	53.15	53.15	53.15	53.15	1
pbil-0.05	53.15	53.15	53.15	53.15	53.15	1
pbil-0.1	53.15	53.15	53.15	53.15	53.15	1
pbil-0.2	53.15	53.15	53.15	53.15	53.15	1
pbil-0.5	53.15	53.15	53.15	53.15	53.15	1
pbil-1	53.15	53.15	53.15	53.15	53.15	1

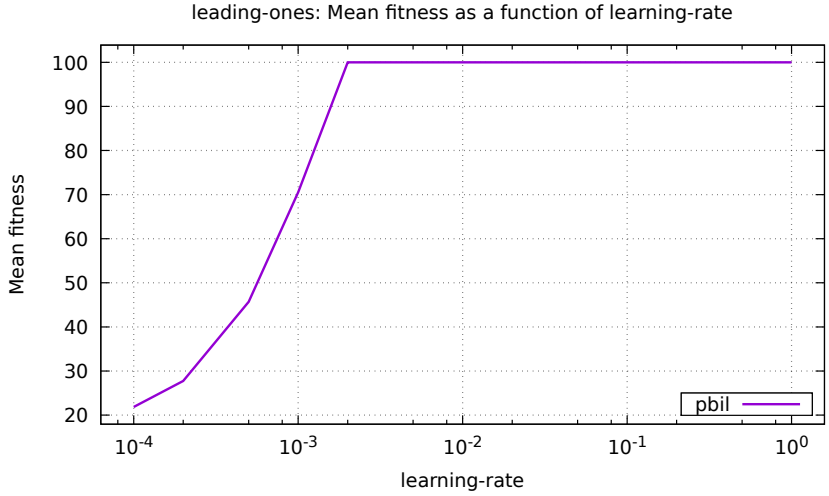

lin: Mean fitness as a function of learning-rate
Mean fitness
53
52
51
50
49
48
47
46
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate
pbil

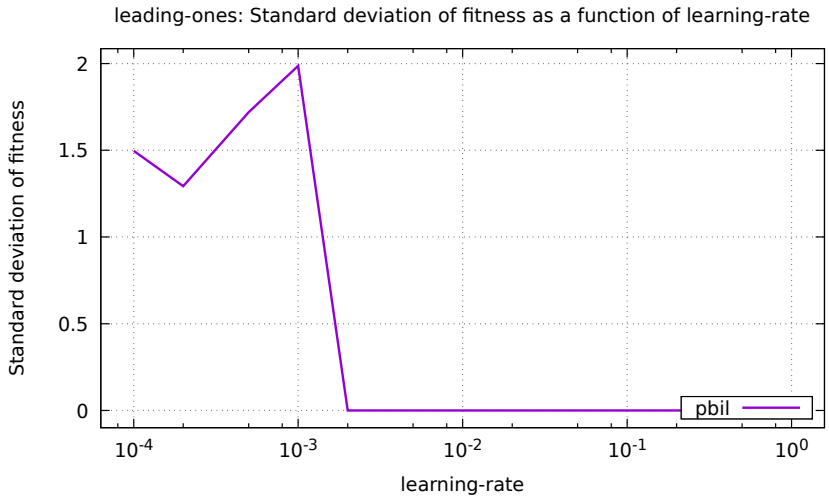

lin: Standard deviation of fitness as a function of learning-rate
Standard deviation of fitness
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate
pbil

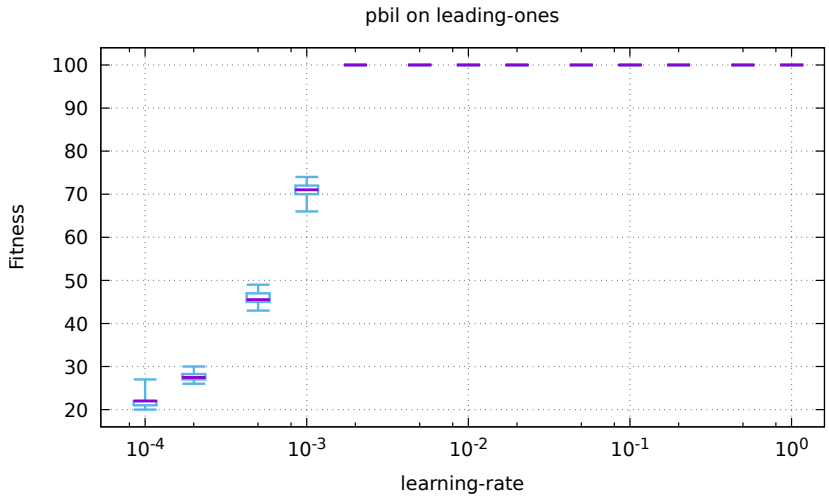

pbil on lin
Fitness
53
52
51
50
49
48
47
46
45
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

6 Function leading-ones

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	20	21	22	22	27	13
pbil-0.0002	26	27	28	28	30	12
pbil-0.0005	43	45	46	47	49	11
pbil-0.001	66	70	71	72	74	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

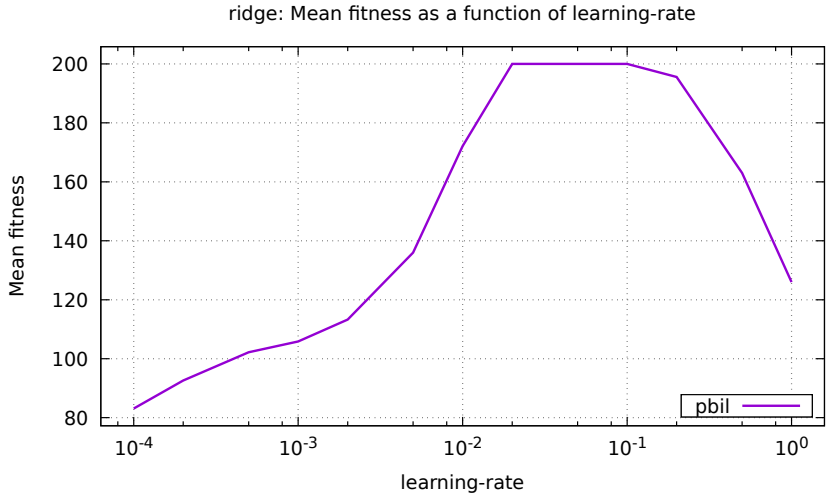


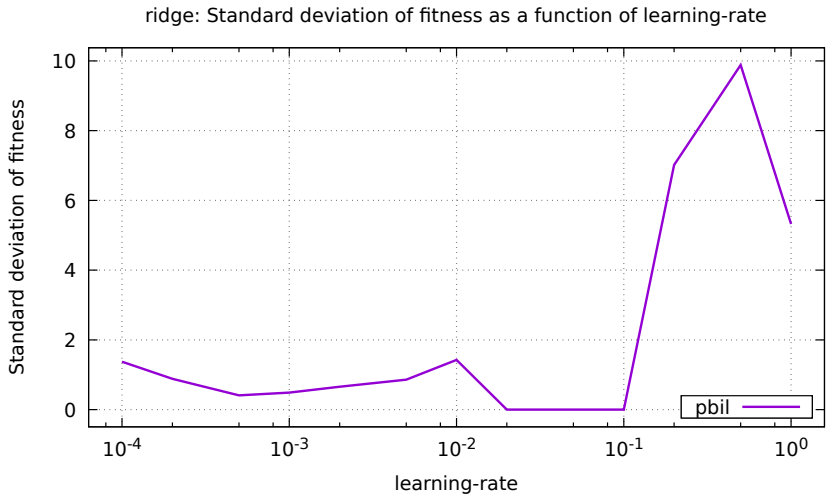


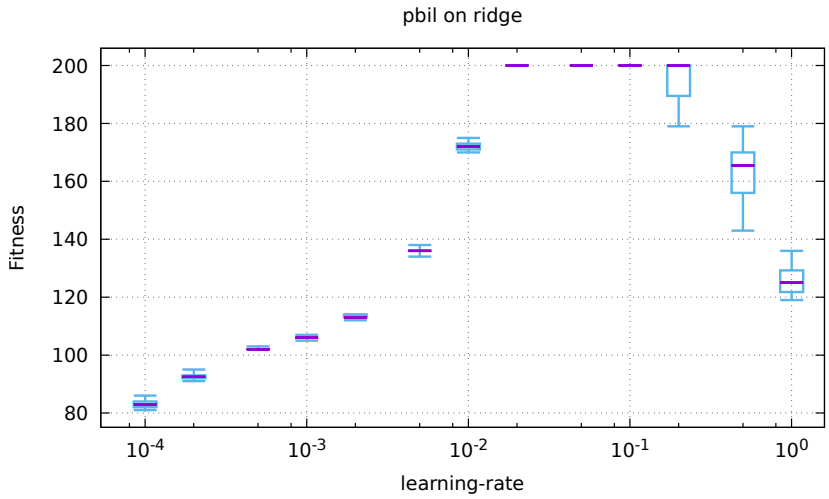


7 Function ridge

algorithm	min	Q_1	med.	Q_3	max	rk
`pbil-0.0001`	81	82	83	84	86	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	107	10
`pbil-0.002`	112	113	113	114	114	9
`pbil-0.005`	134	136	136	136	138	7
`pbil-0.01`	170	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`	179	190	200	200	200	4
`pbil-0.5`	143	156	166	170	179	6
`pbil-1`	119	122	125	129	136	8

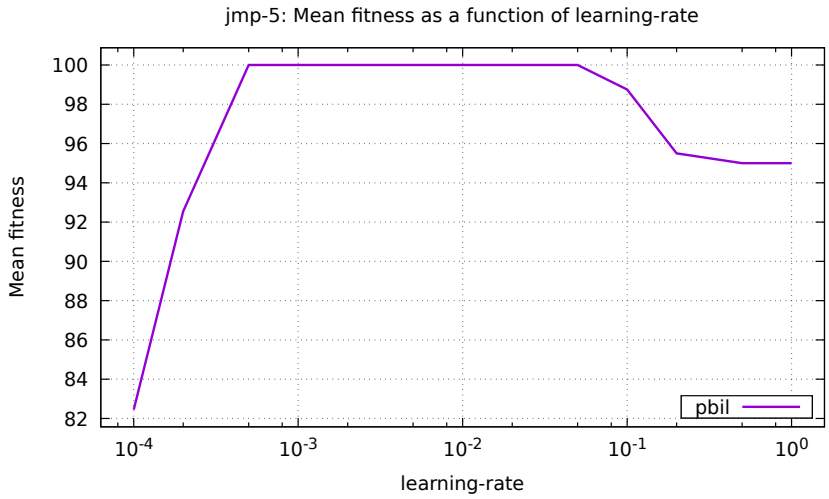


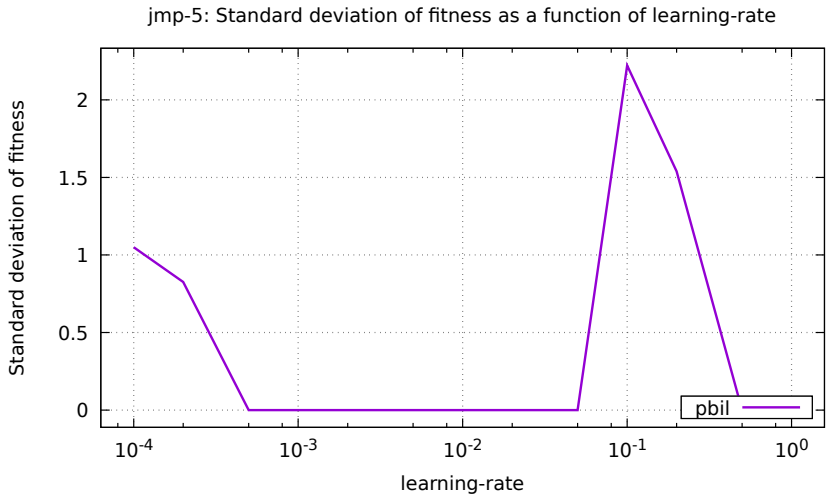


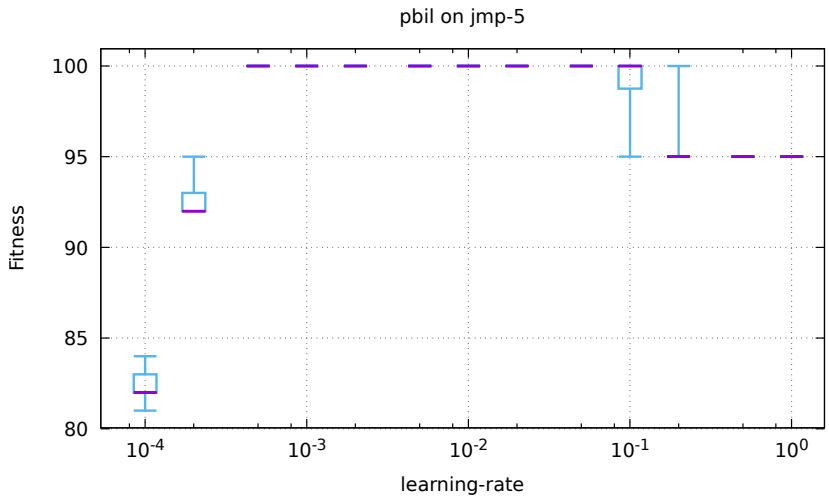


8 Function jmp-5

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	81	82	82	83	84	13
pbil-0.0002	92	92	92	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	99	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

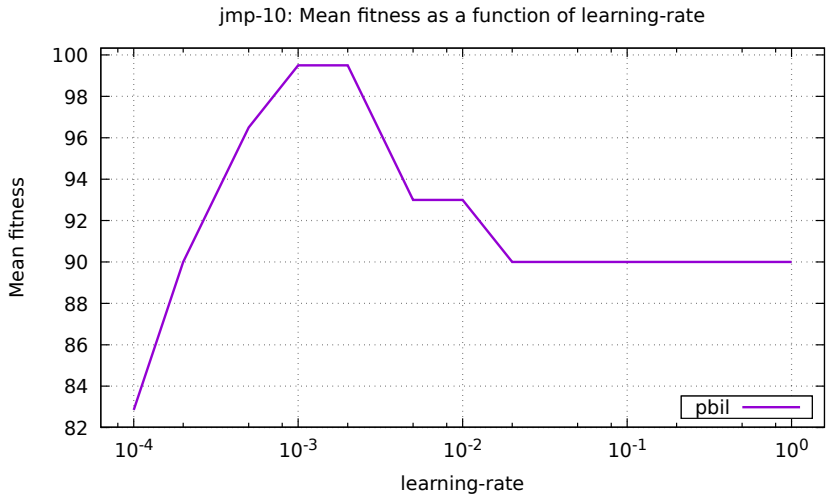

jmp-5: Mean fitness as a function of learning-rate
Mean fitness
100
98
96
94
92
90
88
86
84
82
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate
pbil

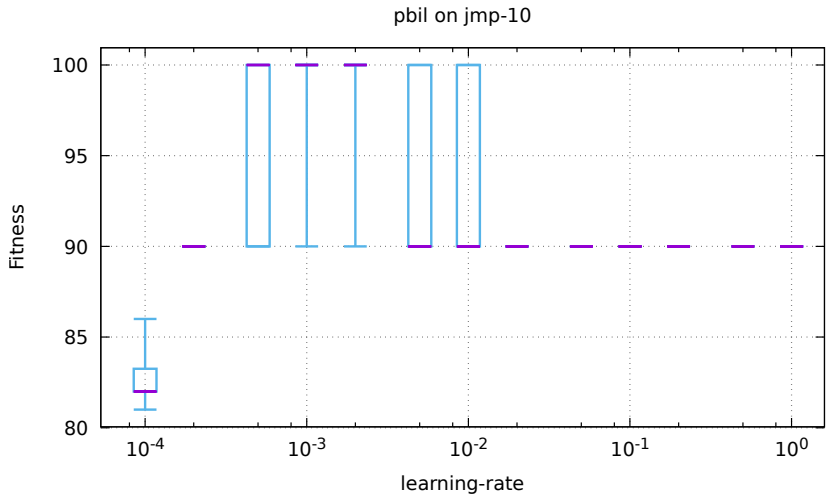

jmp-5: Standard deviation of fitness as a function of learning-rate
Standard deviation of fitness
2
1.5
1
0.5
0
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate
pbil


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

9 Function jmp-10

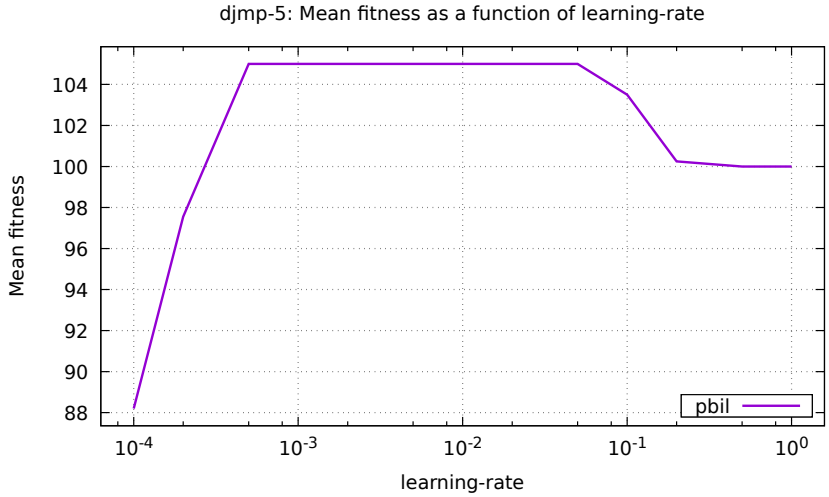
algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	81	82	82	83	86	13
pbil-0.0002	90	90	90	90	90	6
pbil-0.0005	90	90	100	100	100	3
pbil-0.001	90	100	100	100	100	1
pbil-0.002	90	100	100	100	100	1
pbil-0.005	90	90	90	100	100	4
pbil-0.01	90	90	90	100	100	4
pbil-0.02	90	90	90	90	90	6
pbil-0.05	90	90	90	90	90	6
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

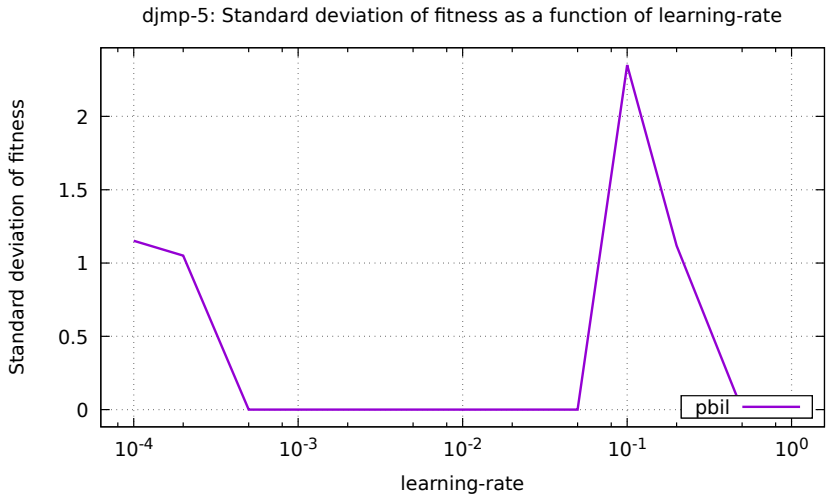


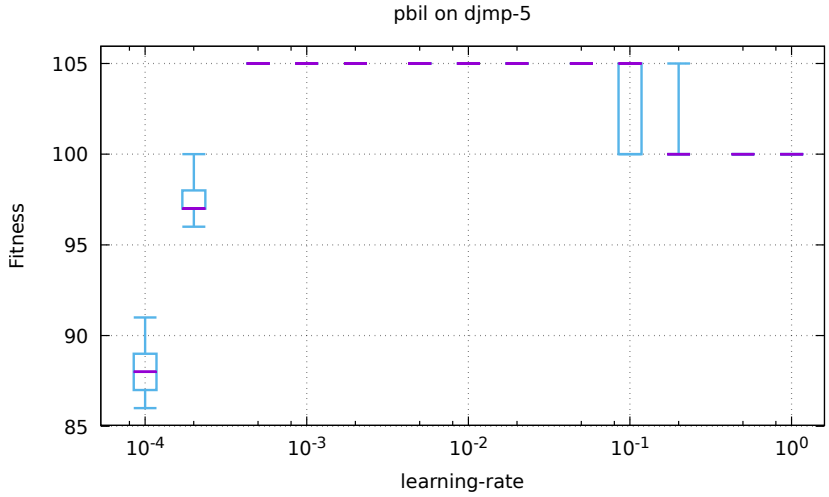


10 Function djmp-5

algorithm	min	Q_1	med.	Q_3	max	rk
`pbil-0.0001`	86	87	88	89	91	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`	100	100	105	105	105	8
`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

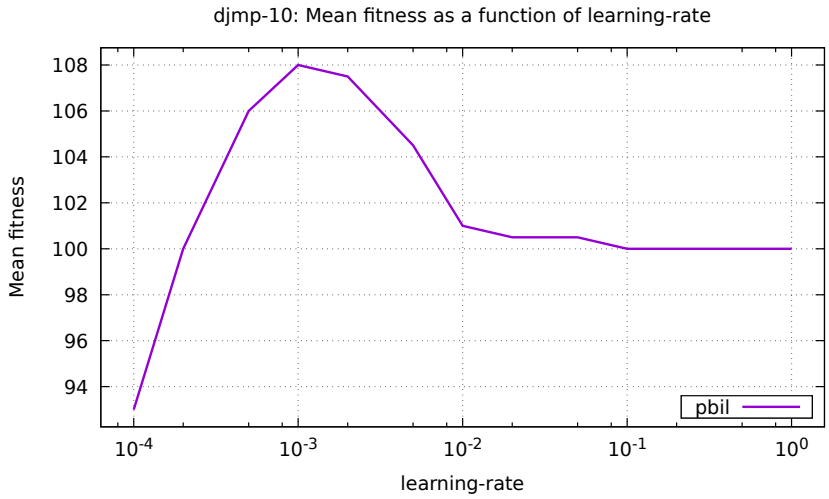


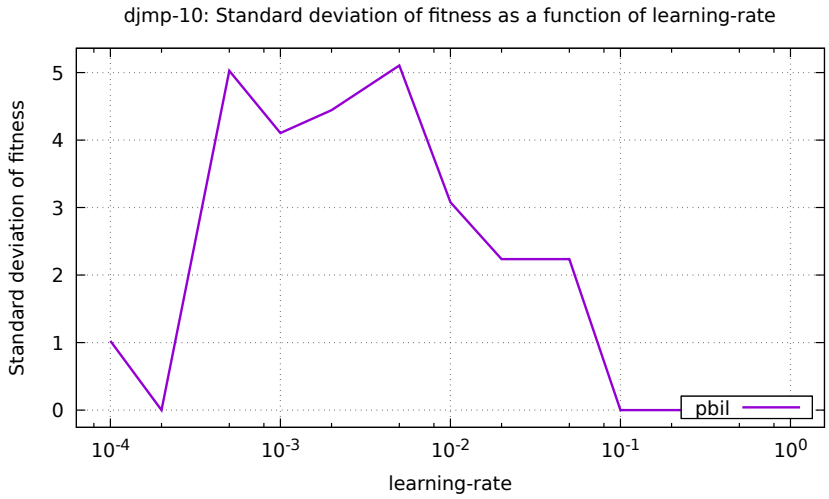


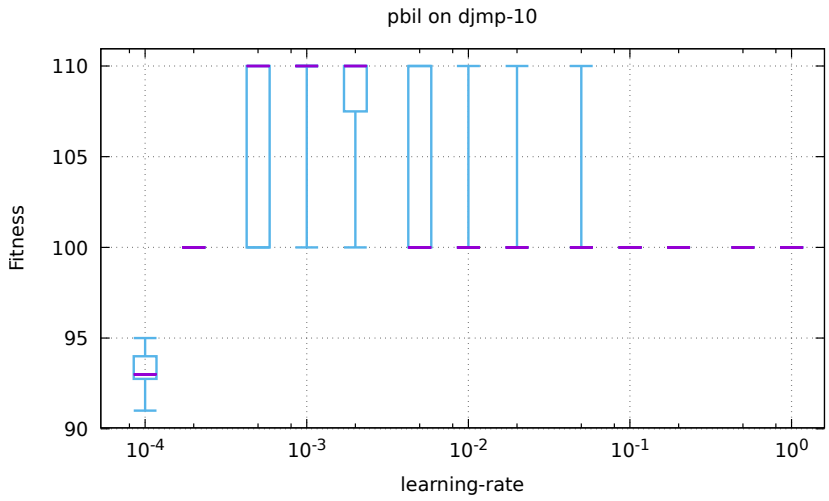


11 Function djmp-10

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	91	93	93	94	95	13
pbil-0.0002	100	100	100	100	100	8
pbil-0.0005	100	100	110	110	110	3
pbil-0.001	100	110	110	110	110	1
pbil-0.002	100	108	110	110	110	2
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	110	5
pbil-0.1	100	100	100	100	100	8
pbil-0.2	100	100	100	100	100	8
pbil-0.5	100	100	100	100	100	8
pbil-1	100	100	100	100	100	8

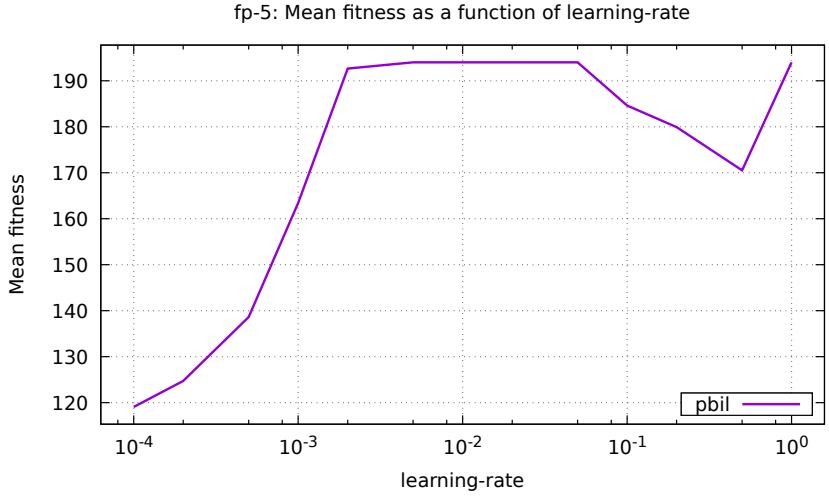

djmp-10: Mean fitness as a function of learning-rate
Mean fitness
108
106
104
102
100
98
96
94
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

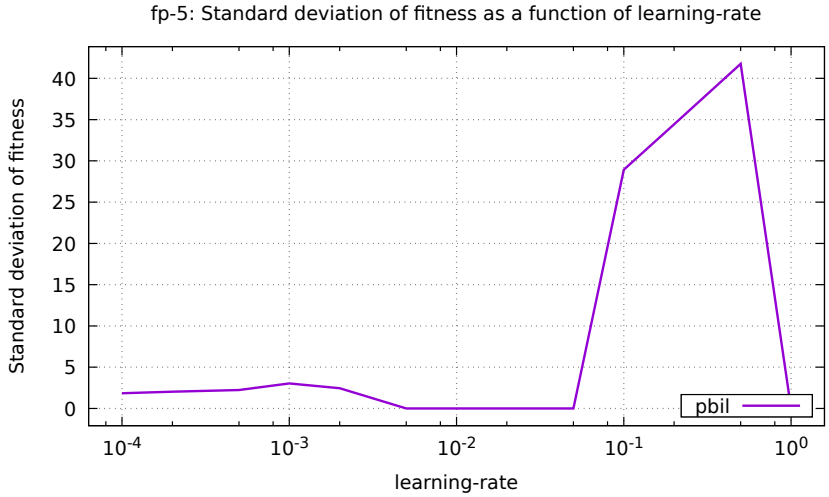

djmp-10: Standard deviation of fitness as a function of learning-rate
Standard deviation of fitness
5
4
3
2
1
0
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

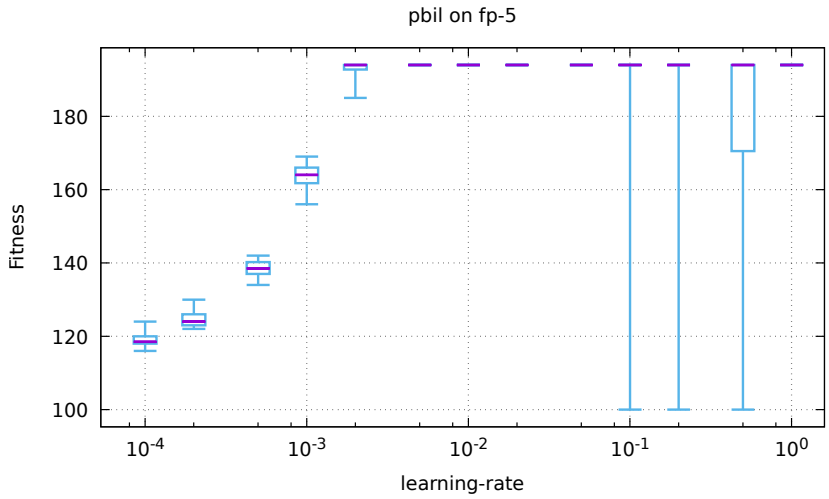

pbil on djmp-10
Fitness
110
105
100
95
90
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

12 Function fp-5

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	116	118	119	120	124	13
pbil-0.0002	122	123	124	126	130	12
pbil-0.0005	134	137	139	140	142	11
pbil-0.001	156	162	164	166	169	10
pbil-0.002	185	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

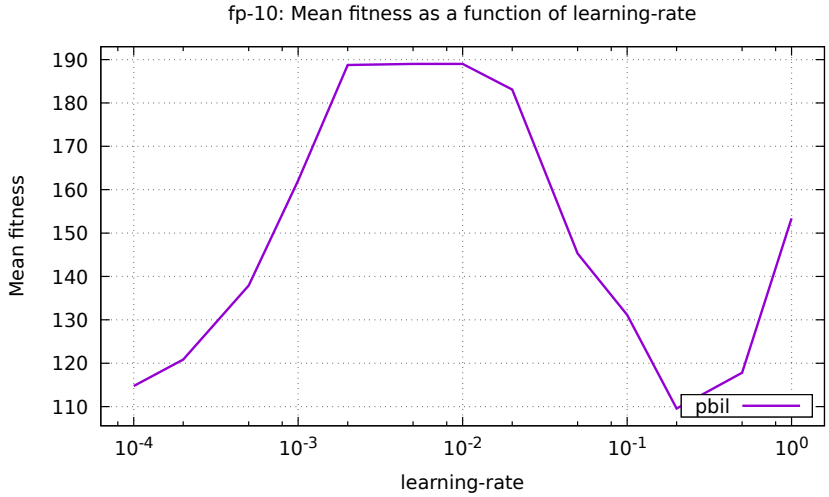


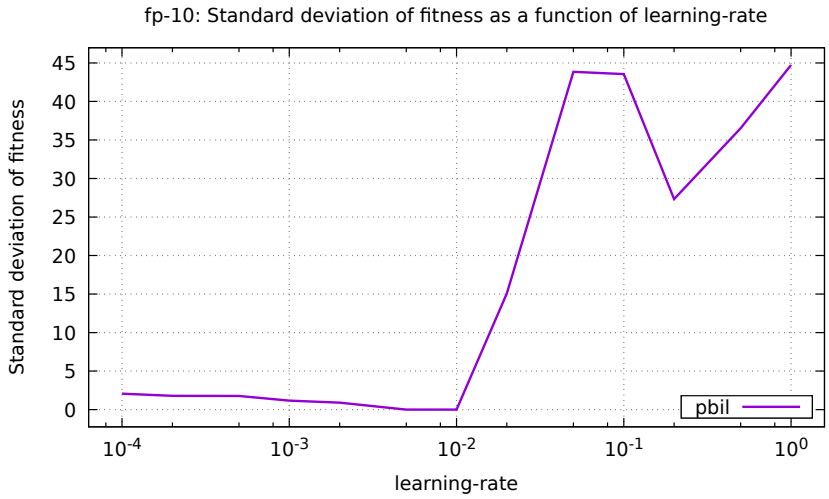


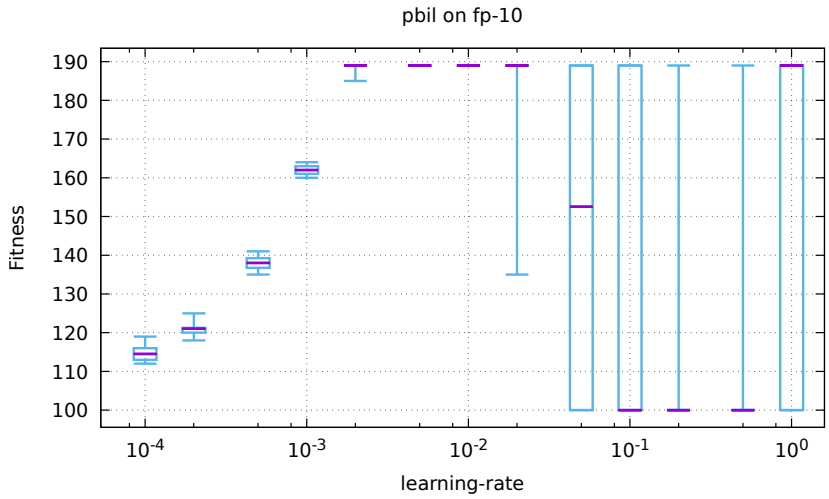


13 Function fp-10

algorithm	min	Q_1	med.	Q_3	max	rk
`pbil-0.0001`	112	113	115	116	119	10
`pbil-0.0002`	118	120	121	121	125	9
`pbil-0.0005`	135	137	138	139	141	8
`pbil-0.001`	160	161	162	163	164	6
`pbil-0.002`	185	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`	135	189	189	189	189	4
`pbil-0.05`	100	100	153	189	189	7
`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	5

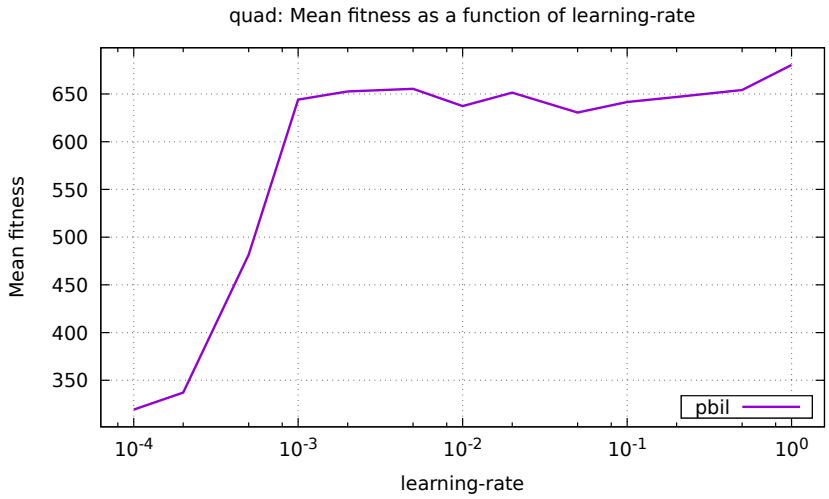


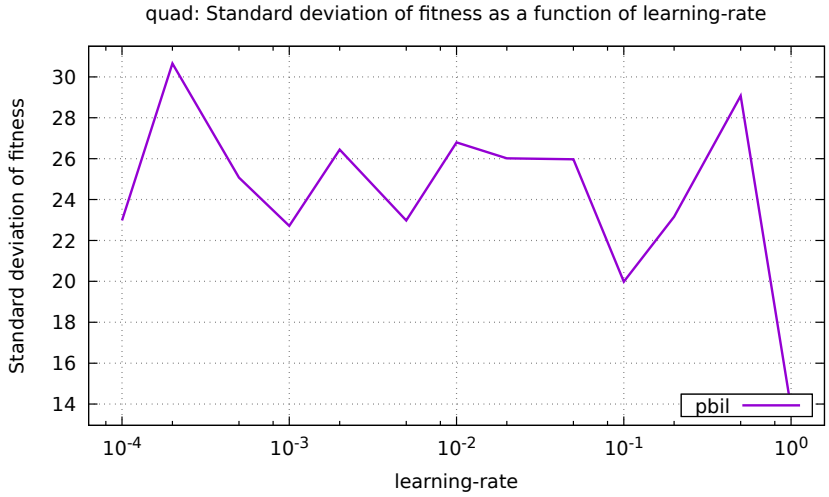


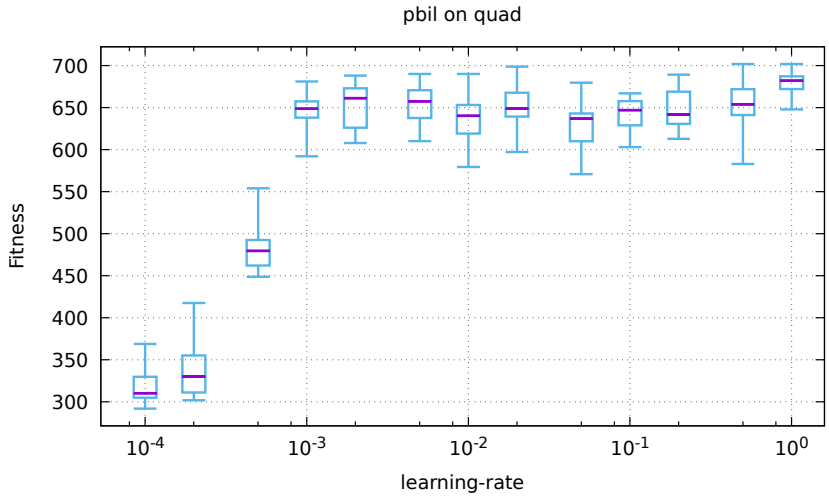


14 Function quad

algorithm	min	Q_1	med.	Q_3	max	rk
`pbil-0.0001`	291.88	304.90	310.28	329.77	368.73	13
`pbil-0.0002`	301.85	311.09	329.86	355.17	417.47	12
`pbil-0.0005`	448.69	462.13	479.51	492.37	554.00	11
`pbil-0.001`	592.01	638.04	648.51	657.42	681.01	6
`pbil-0.002`	607.82	626.01	661.15	672.85	687.95	2
`pbil-0.005`	610.02	637.59	657.46	670.67	689.91	3
`pbil-0.01`	579.33	619.02	640.10	653.15	689.91	9
`pbil-0.02`	597.07	639.26	648.63	667.65	698.66	5
`pbil-0.05`	570.71	609.95	636.72	642.91	679.64	10
`pbil-0.1`	602.94	628.83	646.90	657.67	666.83	7
`pbil-0.2`	612.73	630.55	641.61	668.93	689.12	8
`pbil-0.5`	582.86	641.16	653.99	671.84	701.81	4
`pbil-1`	647.75	672.07	681.88	687.14	701.81	1

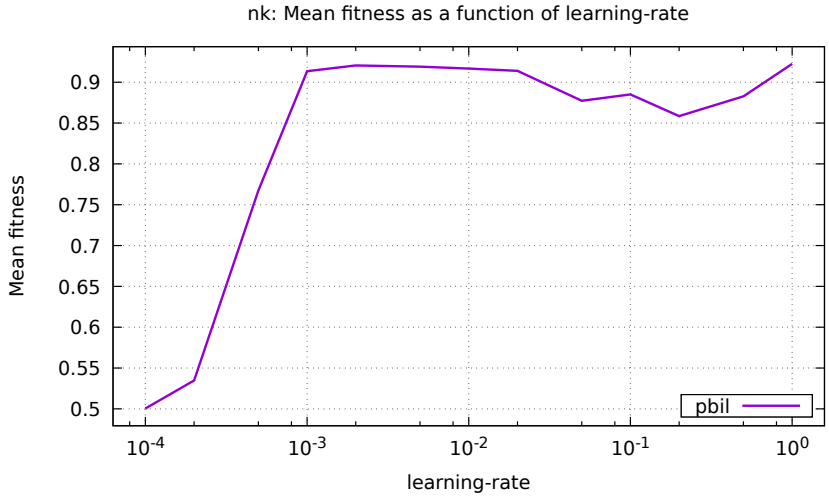

quad: Mean fitness as a function of learning-rate
Mean fitness
650
600
550
500
450
400
350
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

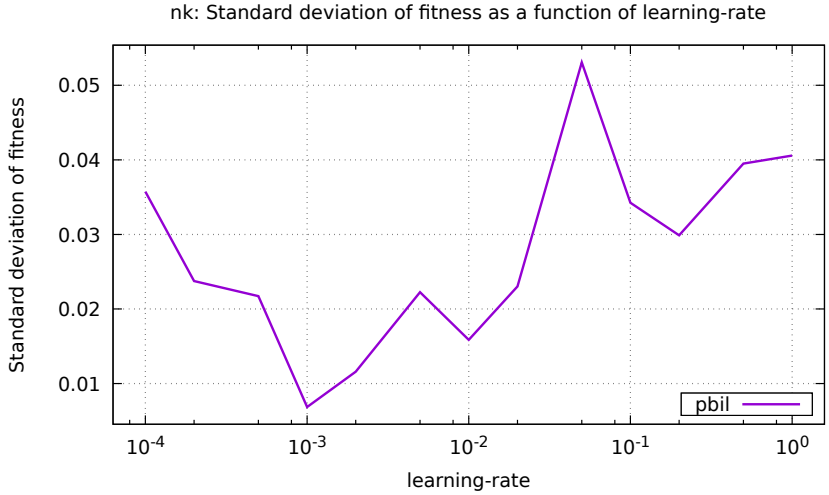

quad: Standard deviation of fitness as a function of learning-rate
Standard deviation of fitness
30
28
26
24
22
20
18
16
14
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

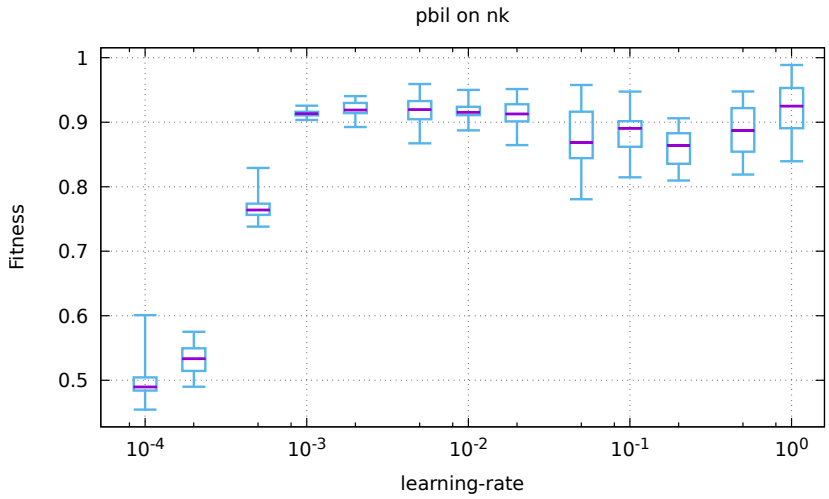

pbil on quad
Fitness
700
650
600
550
500
450
400
350
300
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate

15 Function nk

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	0.45	0.48	0.49	0.50	0.60	13
pbil-0.0002	0.49	0.51	0.53	0.55	0.58	12
pbil-0.0005	0.74	0.76	0.76	0.77	0.83	11
pbil-0.001	0.90	0.91	0.91	0.92	0.93	5
pbil-0.002	0.89	0.91	0.92	0.93	0.94	3
pbil-0.005	0.87	0.90	0.92	0.93	0.96	2
pbil-0.01	0.89	0.91	0.92	0.92	0.95	4
pbil-0.02	0.86	0.90	0.91	0.93	0.95	6
pbil-0.05	0.78	0.84	0.87	0.92	0.96	9
pbil-0.1	0.81	0.86	0.89	0.90	0.95	7
pbil-0.2	0.81	0.84	0.86	0.88	0.91	10
pbil-0.5	0.82	0.85	0.89	0.92	0.95	8
pbil-1	0.84	0.89	0.92	0.95	0.99	1

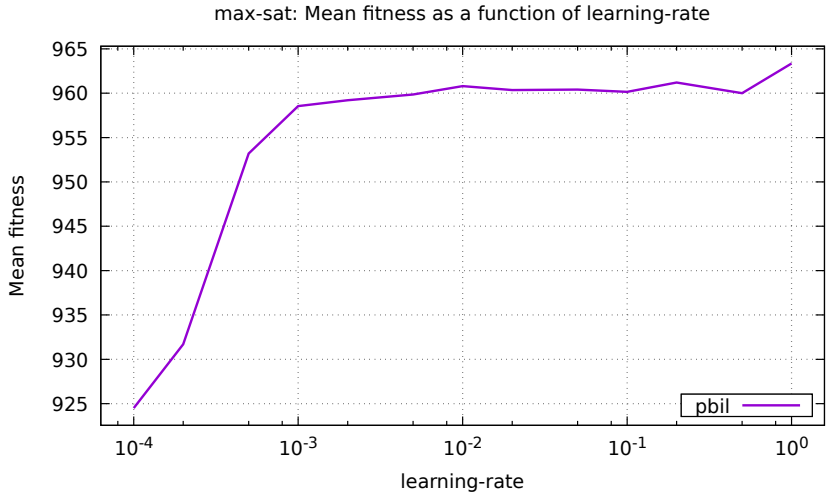


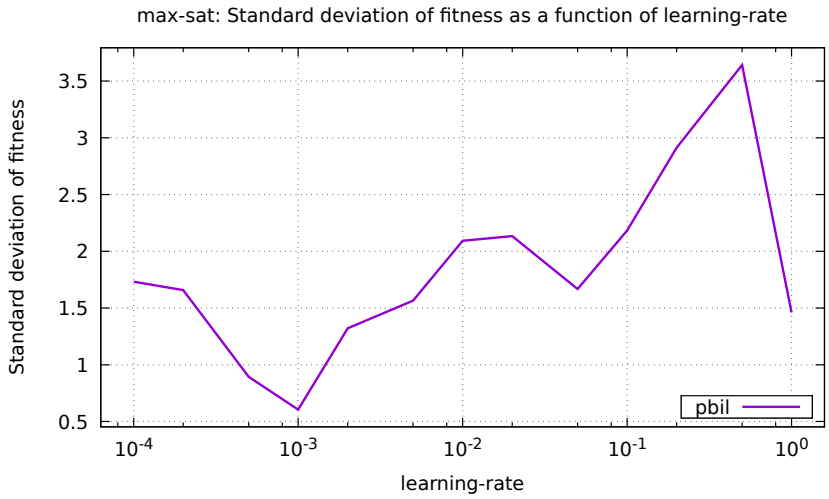


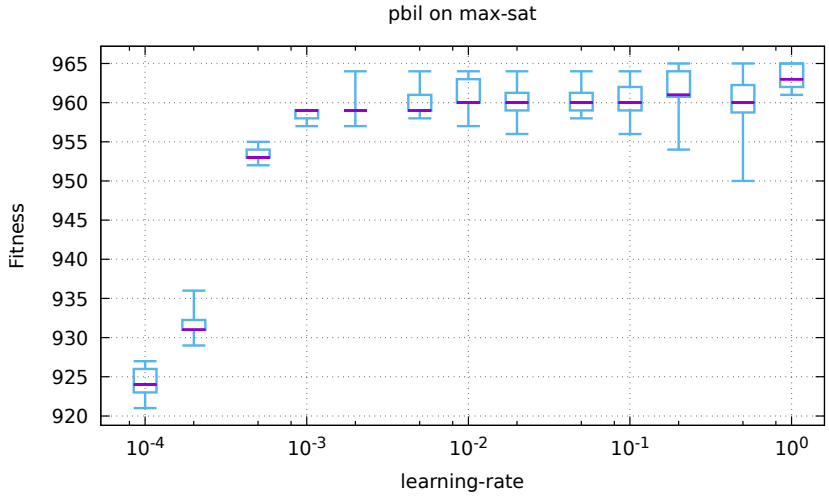


16 Function max-sat

algorithm	min	Q_1	med.	Q_3	max	rk
`pbil-0.0001`	921	923	924	926	927	13
`pbil-0.0002`	929	931	931	932	936	12
`pbil-0.0005`	952	953	953	954	955	11
`pbil-0.001`	957	958	959	959	959	10
`pbil-0.002`	957	959	959	959	964	9
`pbil-0.005`	958	959	959	961	964	8
`pbil-0.01`	957	960	960	963	964	3
`pbil-0.02`	956	959	960	961	964	6
`pbil-0.05`	958	959	960	961	964	5
`pbil-0.1`	956	959	960	962	964	4
`pbil-0.2`	954	961	961	964	965	2
`pbil-0.5`	950	959	960	962	965	7
`pbil-1`	961	962	963	965	965	1

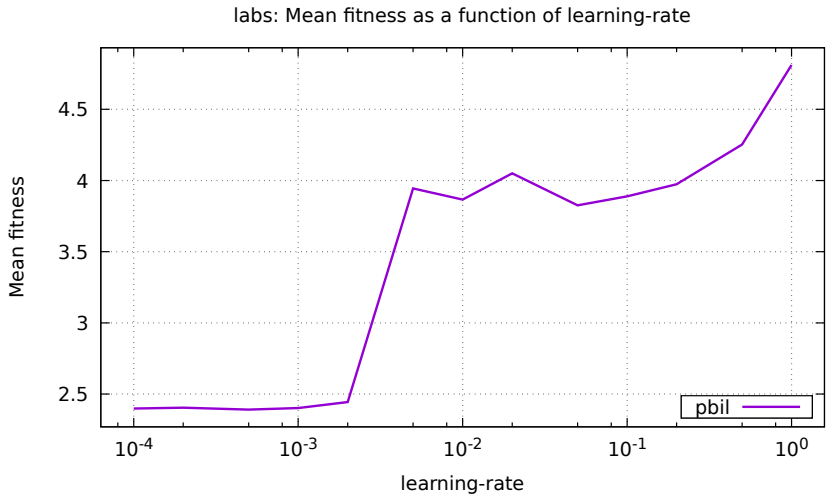


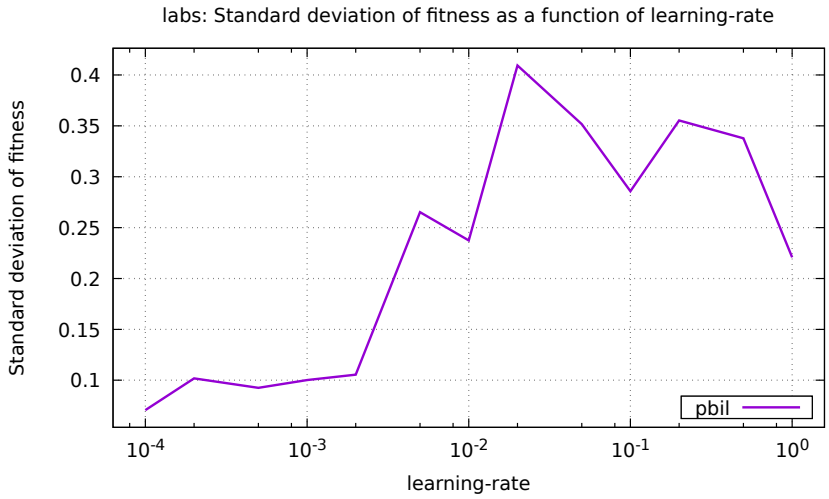


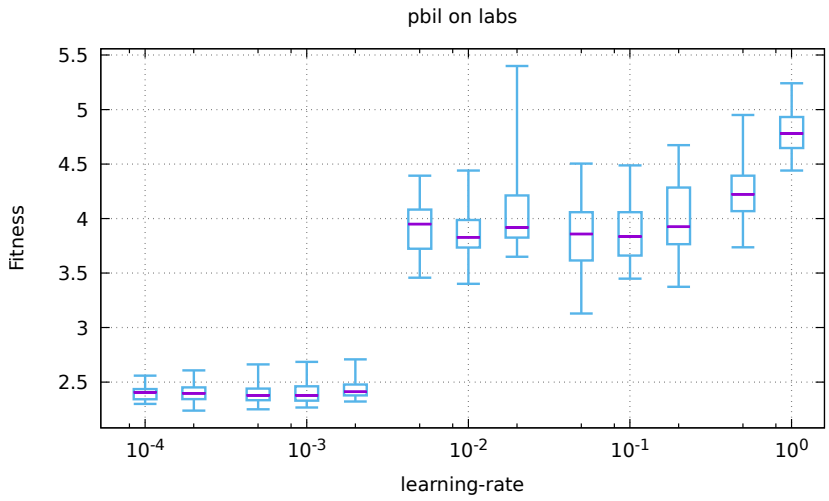


17 Function labs

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	2.30	2.34	2.41	2.44	2.56	10
pbil-0.0002	2.24	2.34	2.40	2.45	2.61	11
pbil-0.0005	2.25	2.33	2.38	2.44	2.66	12
pbil-0.001	2.27	2.33	2.38	2.46	2.69	13
pbil-0.002	2.32	2.38	2.41	2.48	2.71	9
pbil-0.005	3.46	3.72	3.95	4.08	4.39	3
pbil-0.01	3.40	3.73	3.83	3.99	4.44	8
pbil-0.02	3.65	3.83	3.92	4.21	5.40	5
pbil-0.05	3.13	3.62	3.86	4.06	4.50	6
pbil-0.1	3.45	3.66	3.83	4.06	4.49	7
pbil-0.2	3.37	3.77	3.92	4.28	4.67	4
pbil-0.5	3.74	4.07	4.22	4.39	4.95	2
pbil-1	4.44	4.65	4.78	4.93	5.24	1

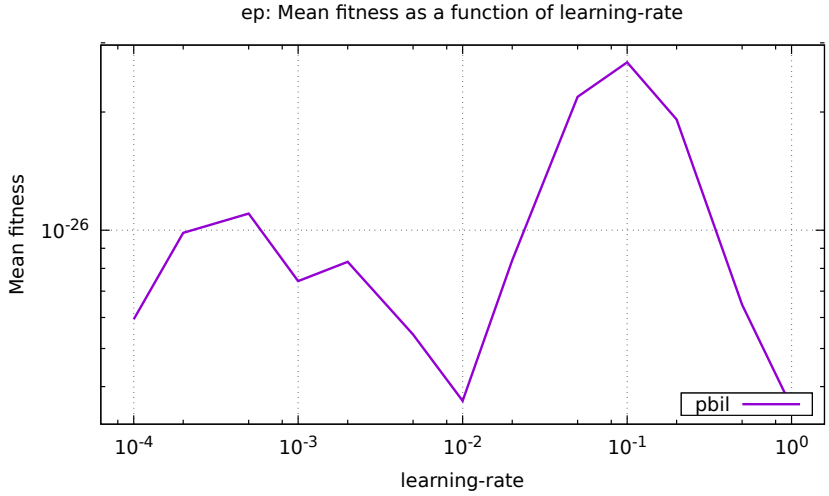

labs: Mean fitness as a function of learning-rate
Mean fitness
learning-rate
pbil
4.5
4
3.5
3
2.5
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}

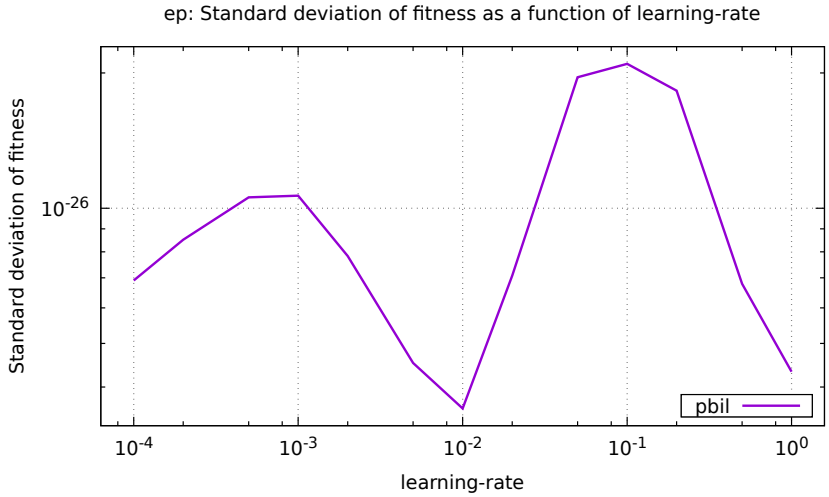

labs: Standard deviation of fitness as a function of learning-rate
Standard deviation of fitness
learning-rate
pbil
0.4
0.35
0.3
0.25
0.2
0.15
0.1
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}

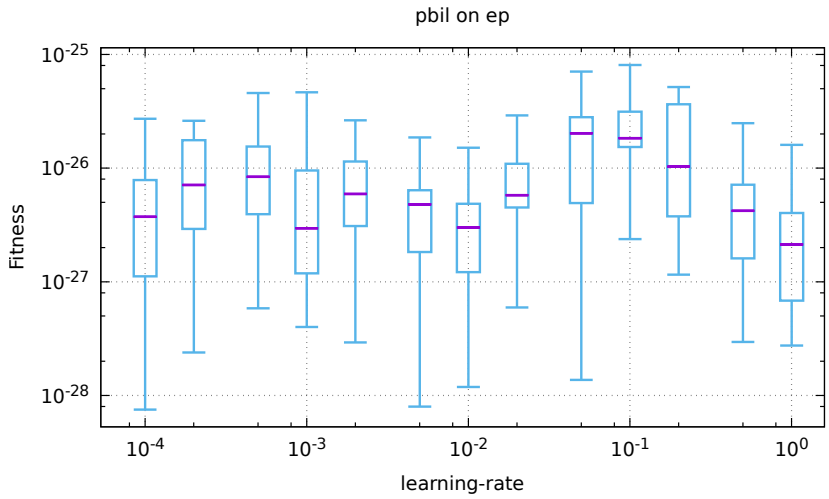

pbil on labs
Fitness
learning-rate
5.5
5
4.5
4
3.5
3
2.5
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}

18 Function ep

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	7.50×10^{-29}	1.12×10^{-27}	3.73×10^{-27}	7.86×10^{-27}	2.72×10^{-26}	4
pbil-0.0002	2.39×10^{-28}	2.92×10^{-27}	7.12×10^{-27}	1.76×10^{-26}	2.61×10^{-26}	9
pbil-0.0005	5.84×10^{-28}	3.93×10^{-27}	8.38×10^{-27}	1.55×10^{-26}	4.58×10^{-26}	10
pbil-0.001	4.00×10^{-28}	1.19×10^{-27}	2.96×10^{-27}	9.54×10^{-27}	4.65×10^{-26}	2
pbil-0.002	2.93×10^{-28}	3.09×10^{-27}	5.93×10^{-27}	1.14×10^{-26}	2.64×10^{-26}	8
pbil-0.005	7.98×10^{-29}	1.83×10^{-27}	4.80×10^{-27}	6.40×10^{-27}	1.86×10^{-26}	6
pbil-0.01	1.19×10^{-28}	1.21×10^{-27}	3.01×10^{-27}	4.85×10^{-27}	1.51×10^{-26}	3
pbil-0.02	5.94×10^{-28}	4.51×10^{-27}	5.78×10^{-27}	1.09×10^{-26}	2.91×10^{-26}	7
pbil-0.05	1.37×10^{-28}	4.93×10^{-27}	2.03×10^{-26}	2.81×10^{-26}	7.07×10^{-26}	13
pbil-0.1	2.38×10^{-27}	1.53×10^{-26}	1.83×10^{-26}	3.14×10^{-26}	8.09×10^{-26}	12
pbil-0.2	1.16×10^{-27}	3.77×10^{-27}	1.03×10^{-26}	3.65×10^{-26}	5.18×10^{-26}	11
pbil-0.5	2.95×10^{-28}	1.61×10^{-27}	4.21×10^{-27}	7.15×10^{-27}	2.49×10^{-26}	5
pbil-1	2.75×10^{-28}	6.83×10^{-28}	2.13×10^{-27}	4.03×10^{-27}	1.60×10^{-26}	1

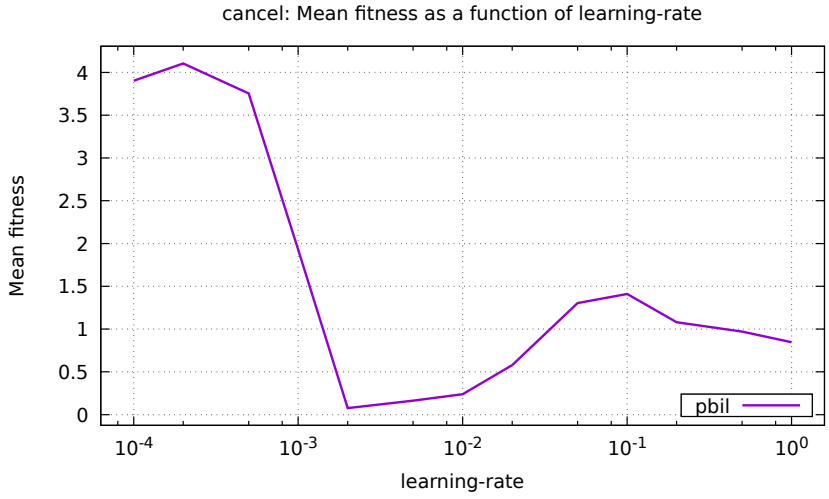


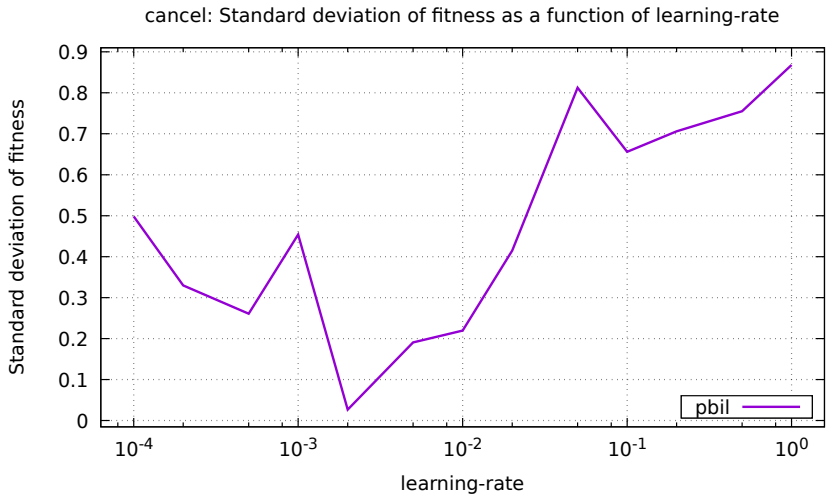


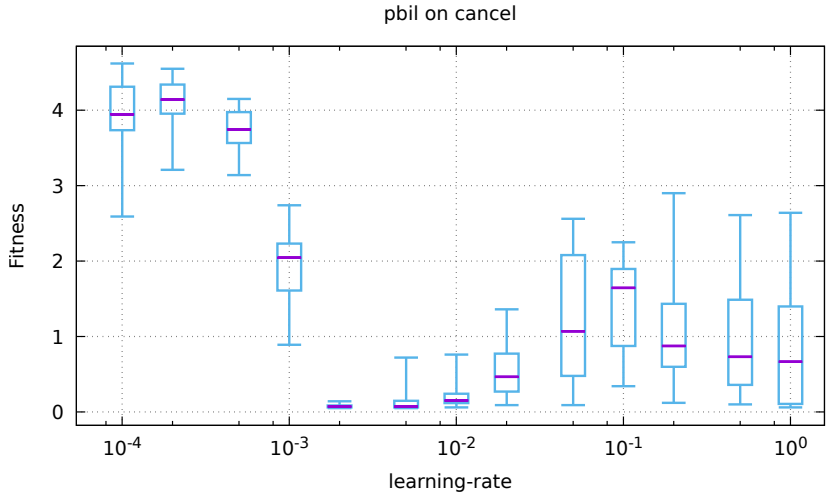


19 Function cancel

algorithm	min	Q_1	med.	Q_3	max	rk
`pbil-0.0001`	2.59	3.74	3.95	4.31	4.62	12
`pbil-0.0002`	3.21	3.96	4.14	4.34	4.55	13
`pbil-0.0005`	3.14	3.57	3.75	3.98	4.15	11
`pbil-0.001`	0.89	1.61	2.05	2.23	2.74	10
`pbil-0.002`	0.05	0.06	0.07	0.09	0.14	1
`pbil-0.005`	0.05	0.06	0.07	0.15	0.72	2
`pbil-0.01`	0.06	0.12	0.15	0.24	0.76	3
`pbil-0.02`	0.09	0.27	0.47	0.77	1.36	4
`pbil-0.05`	0.09	0.48	1.07	2.08	2.56	8
`pbil-0.1`	0.34	0.88	1.65	1.90	2.25	9
`pbil-0.2`	0.12	0.60	0.88	1.43	2.90	7
`pbil-0.5`	0.10	0.36	0.73	1.49	2.61	6
`pbil-1`	0.06	0.11	0.67	1.40	2.64	5

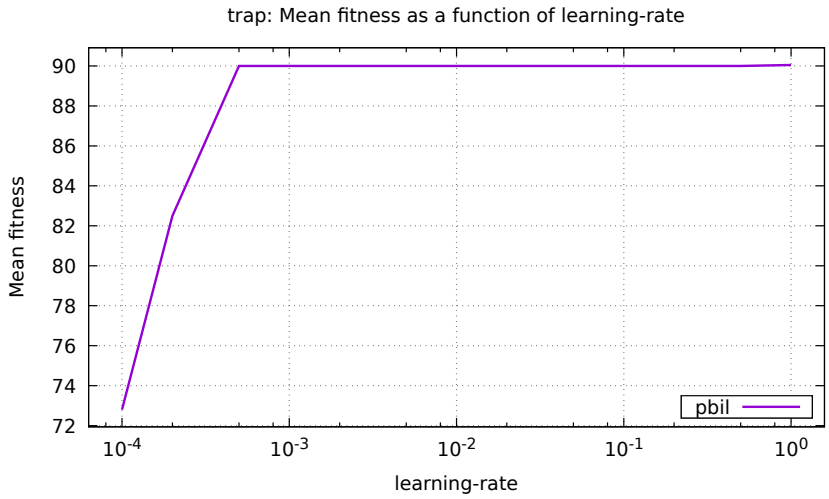


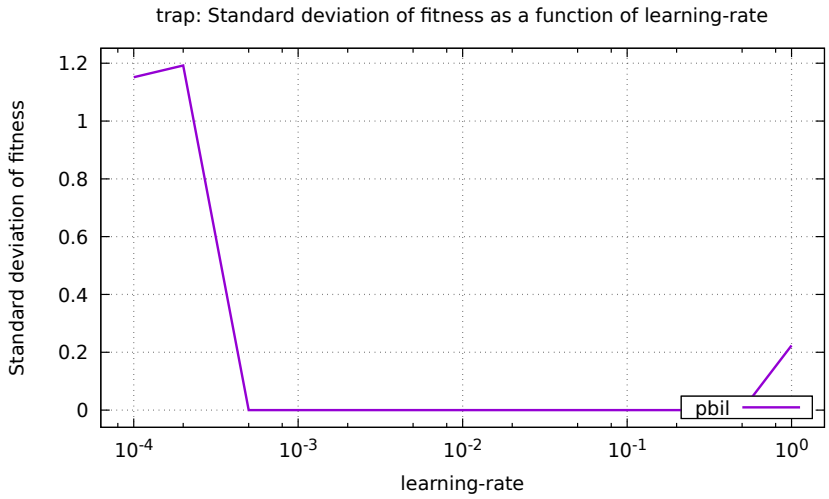


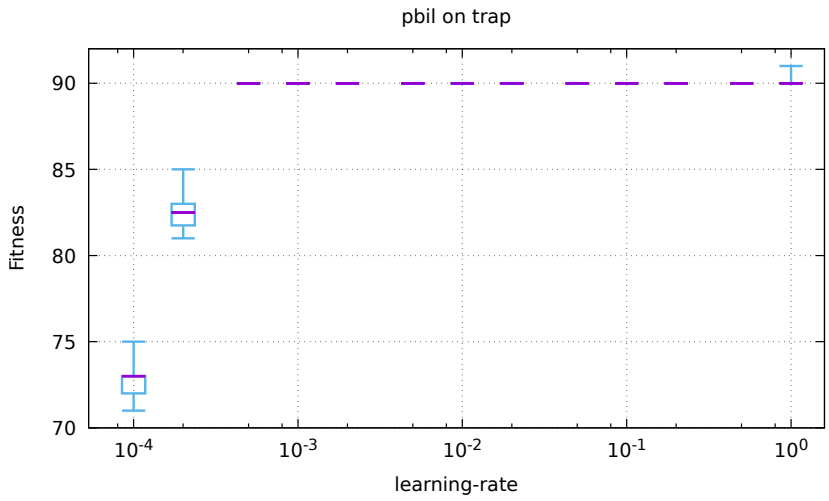


20 Function trap

algorithm	min	Q_1	med.	Q_3	max	rk
`pbil-0.0001`	71	72	73	73	75	13
`pbil-0.0002`	81	82	83	83	85	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

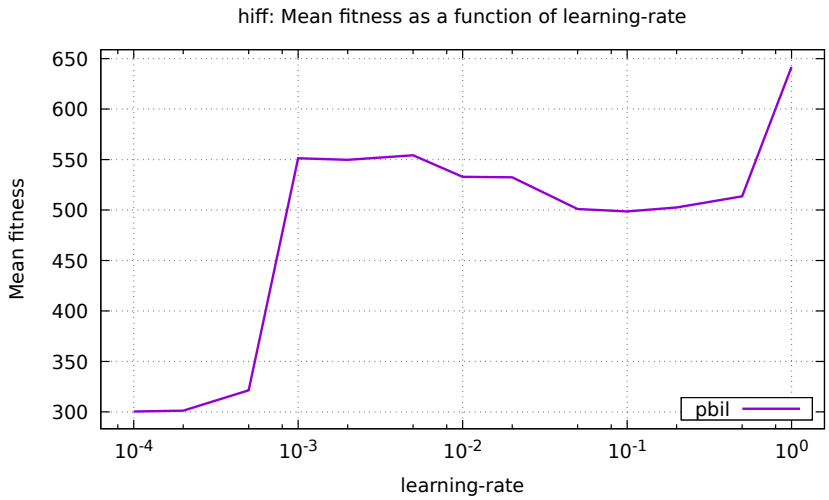

trap: Mean fitness as a function of learning-rate
Mean fitness
learning-rate
pbil

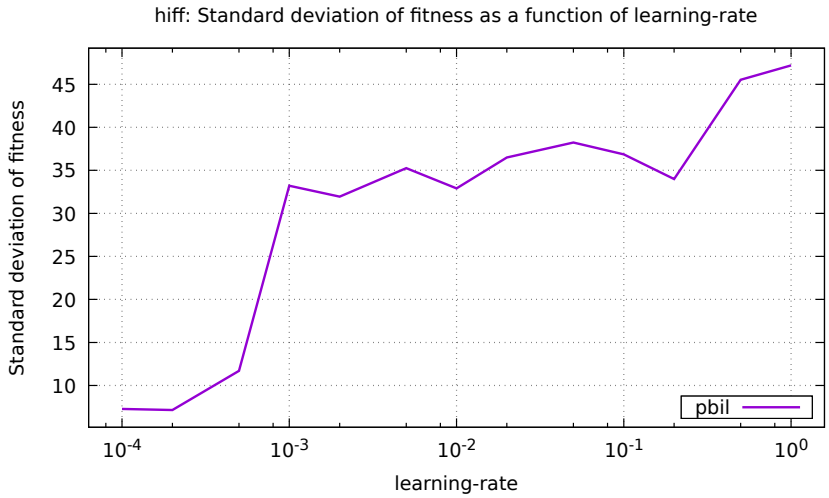

trap: Standard deviation of fitness as a function of learning-rate
Standard deviation of fitness
learning-rate
pbil

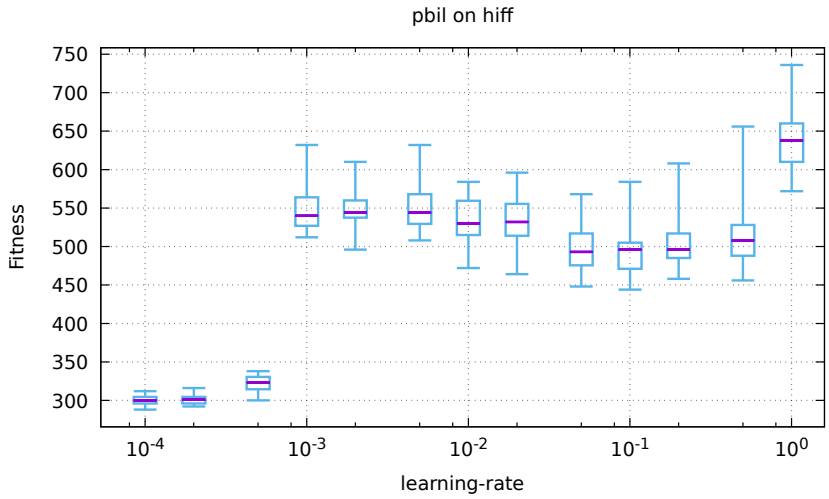

pbil on trap
Fitness
learning-rate

21 Function hiff

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	288	296	300	305	312	13
pbil-0.0002	292	296	301	305	316	12
pbil-0.0005	300	315	323	331	338	11
pbil-0.001	512	527	540	564	632	4
pbil-0.002	496	538	544	560	610	2
pbil-0.005	508	530	544	568	632	3
pbil-0.01	472	515	530	560	584	6
pbil-0.02	464	514	532	556	596	5
pbil-0.05	448	476	493	517	568	10
pbil-0.1	444	471	496	505	584	9
pbil-0.2	458	485	496	517	608	8
pbil-0.5	456	488	508	528	656	7
pbil-1	572	610	638	660	736	1

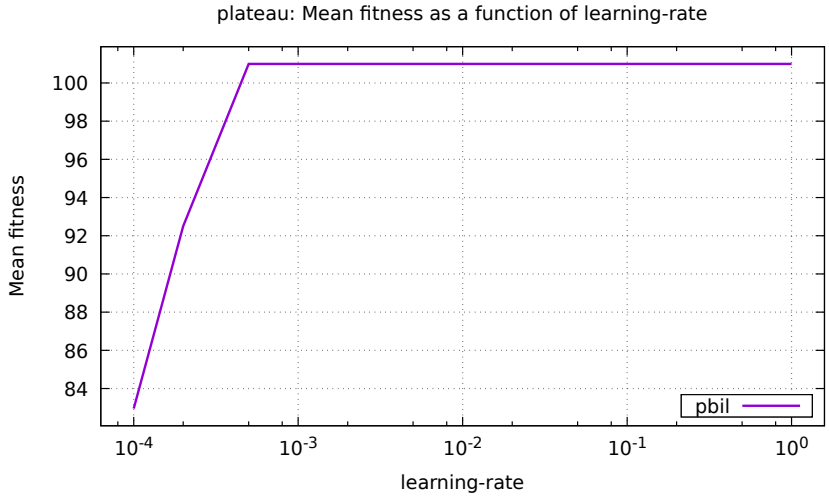


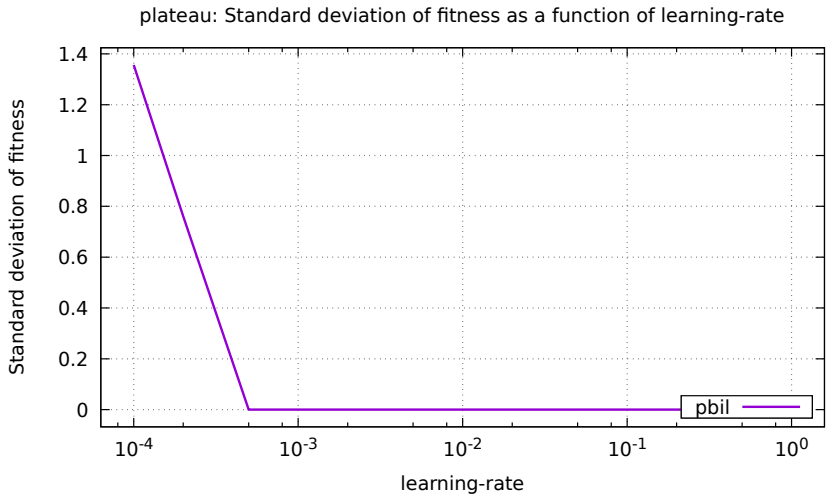


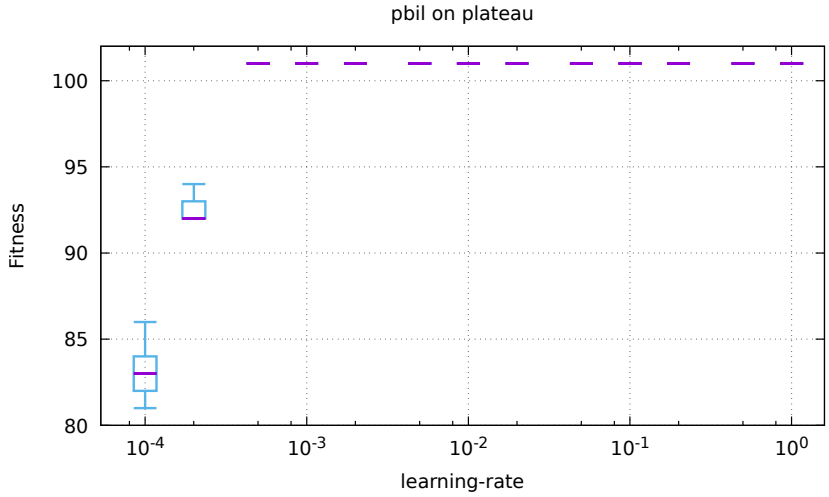


22 Function plateau

algorithm	min	Q_1	med.	Q_3	max	rk
pbil-0.0001	81	82	83	84	86	13
pbil-0.0002	92	92	92	93	94	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




plateau: Standard deviation of fitness as a function of learning-rate
Standard deviation of fitness
1.4
1.2
1
0.8
0.6
0.4
0.2
0
pbil
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate


pbil on plateau
Fitness
100
95
90
85
80
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
learning-rate