

Table 1: Performance Results for PenaltyI\2Dn_alpha1e6Problem

Optimizer	Mean Final Value	Std Dev	Best Value	Worst Value	Mean Func Evals	Success Rate (%)	Mean Time (s)
QQN-GoldenSection	1.13	2.63×10^{-4}	1.12	1.13	853.9	0.0	0.013
QQN-Bisection-1	1.13	7.75×10^{-4}	1.12	1.13	440.3	0.0	0.011
L-BFGS-Conservative	1.13	2.17×10^{-3}	1.12	1.13	495.5	0.0	0.006
QQN-StrongWolfe	1.84	1.20	1.15	6.40	639.5	0.0	0.015
GD-WeightDecay	2.62	3.07	1.64	1.60×10^1	13.2	0.0	0.000
QQN-Bisection-2	2.68	1.34	1.28	6.62	267.6	0.0	0.005
QQN-Backtracking	2.77	4.00	1.13	1.90×10^1	747.7	0.0	0.017
QQN-CubicQuadraticInterpolation	3.36	4.60	1.13	2.39×10^1	394.1	0.0	0.014
Adam-WeightDecay	3.60	6.42	1.14	2.66×10^1	203.5	0.0	0.004
GD	1.83×10^1	4.25×10^1	1.27	2.17×10^2	14.4	0.0	0.000
Adam-Fast	3.76×10^1	1.25×10^2	1.55	5.62×10^2	22.8	0.0	0.000
GD-Momentum	5.97×10^1	1.20×10^2	1.52	3.71×10^2	12.8	0.0	0.000
GD-Nesterov	1.92×10^2	4.38×10^2	1.36	1.64×10^3	13.9	0.0	0.000
Adam	9.49×10^3	1.39×10^4	1.13	5.22×10^4	453.1	0.0	0.009
Adam-AMSGrad	1.37×10^4	1.20×10^4	1.14	3.71×10^4	489.4	0.0	0.011
L-BFGS-Aggressive	1.59×10^4	6.96×10^4	1.17	3.54×10^5	633.0	0.0	0.010
QQN-MoreThuente	2.79×10^4	1.30×10^4	5.98×10^3	5.55×10^4	487.0	0.0	0.009
L-BFGS	7.77×10^4	1.27×10^5	1.55	3.08×10^5	99.8	0.0	0.001
Trust Region-Adaptive	1.31×10^5	8.28×10^4	2.33×10^4	2.95×10^5	602.0	0.0	0.004
Trust Region-Conservative	1.38×10^5	8.19×10^4	1.04×10^4	3.23×10^5	602.0	0.0	0.004
Trust Region-Standard	1.79×10^5	8.92×10^4	6.12×10^4	3.77×10^5	602.0	0.0	0.004