Supplement to the paper 'Positive Unlabeled Classification Methods with Logistic Regression Revisited: An Evaluation of Optimization Techniques. '

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1 Supplementary figures and tables

The following metrics of our study are presented: the area under the curve (AUC), precision, recall, precision, and F1 score. These metrics are the averages of the values obtained from the metrics in a subset of tests after 100 repetitions. The average values of all metrics considered are given in Fig.1- Fig.4. The method that obtained the best result for particular values of the parameter c is marked with a specific symbol in the figures. Figure 5 demonstrates the executing time of the considered optimization algorithms.

In Tables 1-12, all our numerical results are given depending on the optimization method used and the label parameter c. In addition, the values of the naive method are provided for comparison. The average values from 100 repetitions and the standard deviation are given in parentheses. The best results for particular values of the parameter c are in bold in the tables.

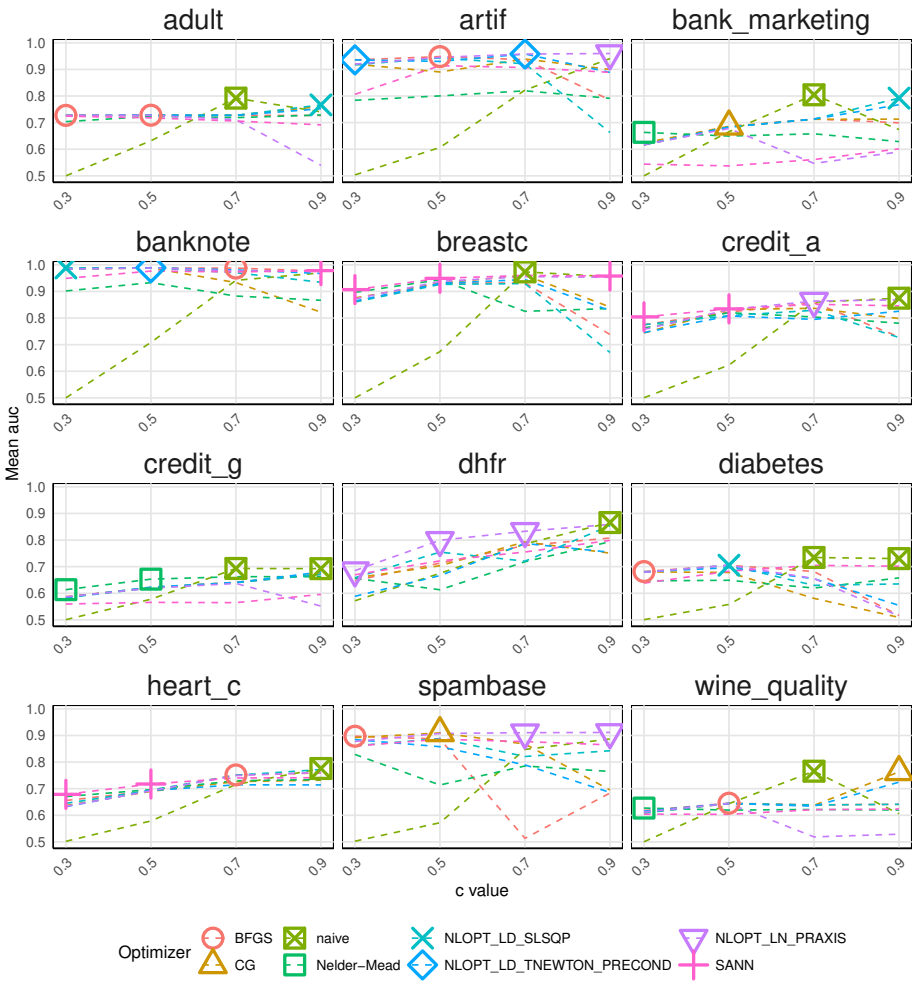

Fig. 1. Mean AUC for each optimizer

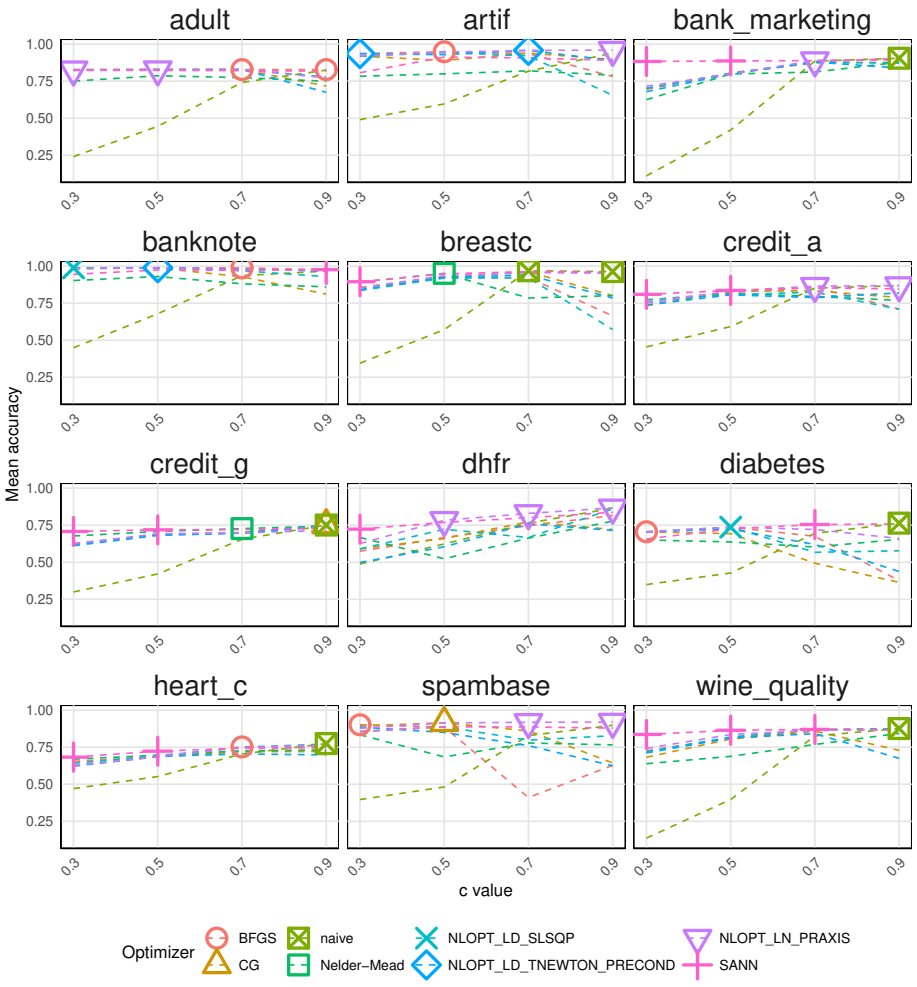

Fig. 2. Mean Accuracy for each optimizer

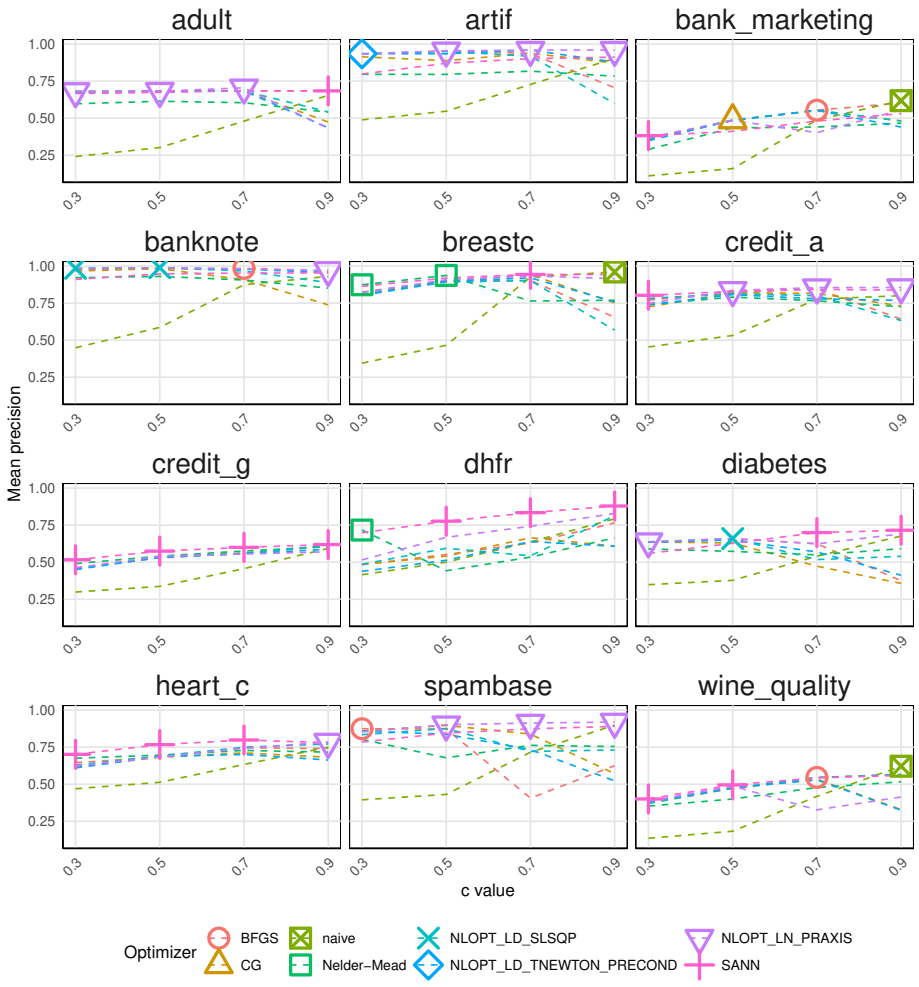

Fig. 3. Mean Precision for each optimizer

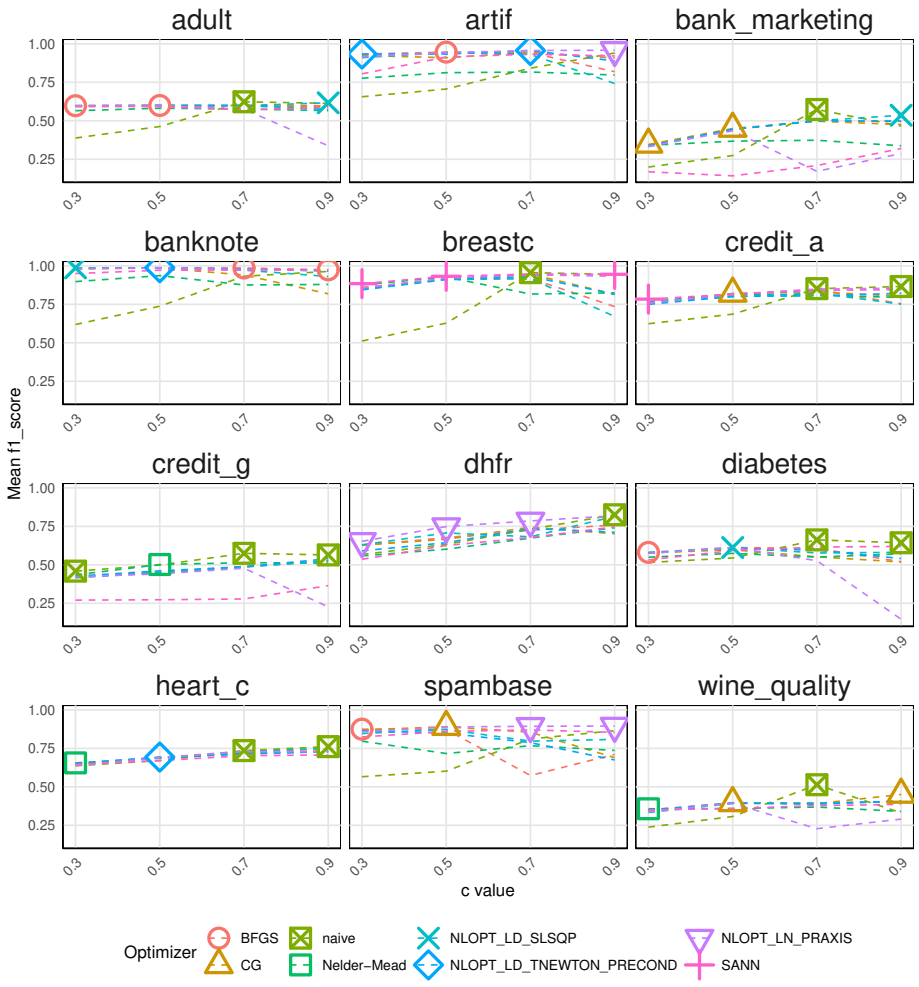

Fig. 4. Mean F1 Score for each optimizer

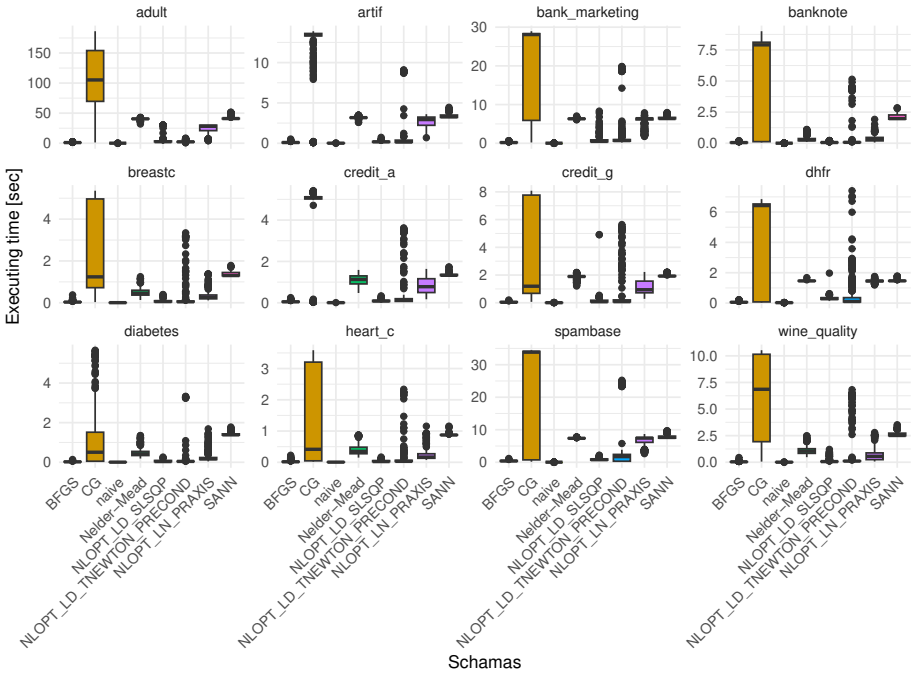

Fig. 5. Executing time for each optimizer

Table 1. Summary Statistics for dset = adult

optims	c	mean accuracy	mean precision	mean recall	mean f1 score	mean auc
BFGS	0.3	**0.827 (0.005)**	**0.680 (0.016)**	0.535 (0.024)	**0.598 (0.014)**	**0.727 (0.010)**
BFGS	0.5	**0.828 (0.004)**	**0.682 (0.015)**	0.535 (0.017)	**0.599 (0.011)**	**0.728 (0.007)**
BFGS	0.7	**0.828 (0.004)**	0.683 (0.013)	0.533 (0.015)	0.599 (0.011)	0.727 (0.007)
BFGS	0.9	**0.828 (0.004)**	0.683 (0.012)	0.532 (0.013)	0.598 (0.010)	0.727 (0.006)
CG	0.3	**0.827 (0.005)**	**0.680 (0.016)**	0.535 (0.024)	**0.598 (0.014)**	**0.727 (0.010)**
CG	0.5	**0.828 (0.004)**	0.681 (0.015)	0.535 (0.017)	**0.599 (0.011)**	**0.728 (0.007)**
CG	0.7	**0.828 (0.004)**	0.683 (0.013)	0.533 (0.015)	0.599 (0.011)	0.727 (0.007)
CG	0.9	0.717 (0.054)	0.474 (0.084)	0.847 (0.131)	0.592 (0.018)	0.761 (0.017)
NLOPT-LD-SLSQP	0.3	**0.827 (0.005)**	**0.680 (0.016)**	0.535 (0.024)	**0.598 (0.014)**	**0.727 (0.010)**
NLOPT-LD-SLSQP	0.5	**0.828 (0.004)**	**0.682 (0.015)**	0.535 (0.017)	**0.599 (0.011)**	**0.728 (0.007)**
NLOPT-LD-SLSQP	0.7	**0.828 (0.004)**	0.683 (0.013)	0.533 (0.015)	0.599 (0.011)	0.727 (0.007)
NLOPT-LD-SLSQP	0.9	0.778 (0.026)	0.542 (0.067)	0.745 (0.102)	**0.617 (0.016)**	**0.767 (0.021)**
NLOPT-LD-TNEWTON-PRECOND	0.3	0.823 (0.044)	0.676 (0.043)	0.539 (0.052)	0.596 (0.021)	0.726 (0.016)
NLOPT-LD-TNEWTON-PRECOND	0.5	**0.828 (0.004)**	**0.682 (0.015)**	0.535 (0.017)	**0.599 (0.011)**	**0.728 (0.007)**
NLOPT-LD-TNEWTON-PRECOND	0.7	**0.828 (0.004)**	0.683 (0.013)	0.533 (0.015)	0.599 (0.011)	0.727 (0.007)
NLOPT-LD-TNEWTON-PRECOND	0.9	0.675 (0.058)	0.436 (0.082)	**0.902 (0.117)**	0.574 (0.023)	0.752 (0.017)
NLOPT-LN-PRAXIS	0.3	**0.827 (0.005)**	**0.680 (0.016)**	0.534 (0.024)	**0.598 (0.014)**	0.727 (0.009)
NLOPT-LN-PRAXIS	0.5	**0.828 (0.004)**	**0.682 (0.015)**	0.534 (0.018)	**0.599 (0.011)**	0.727 (0.007)
NLOPT-LN-PRAXIS	0.7	0.827 (0.005)	**0.705 (0.017)**	0.487 (0.032)	0.575 (0.020)	0.711 (0.013)
NLOPT-LN-PRAXIS	0.9	0.772 (0.026)	0.431 (0.374)	0.091 (0.175)	0.338 (0.250)	0.540 (0.077)
Nelder-Mead	0.3	0.750 (0.164)	0.597 (0.142)	0.614 (0.178)	0.566 (0.058)	0.704 (0.057)
Nelder-Mead	0.5	0.786 (0.086)	0.614 (0.106)	0.602 (0.156)	0.582 (0.030)	0.724 (0.023)
Nelder-Mead	0.7	0.774 (0.111)	0.604 (0.120)	0.613 (0.171)	0.576 (0.037)	0.719 (0.035)
Nelder-Mead	0.9	0.750 (0.066)	0.540 (0.113)	0.689 (0.212)	0.566 (0.022)	0.729 (0.031)
SANN	0.3	0.823 (0.005)	0.666 (0.024)	0.534 (0.039)	0.592 (0.018)	0.724 (0.013)
SANN	0.5	0.823 (0.013)	0.674 (0.019)	0.515 (0.096)	0.593 (0.016)	0.718 (0.040)
SANN	0.7	0.821 (0.018)	0.685 (0.042)	0.484 (0.137)	0.571 (0.102)	0.706 (0.058)
SANN	0.9	0.817 (0.023)	**0.684 (0.017)**	0.449 (0.176)	0.588 (0.017)	0.692 (0.075)
naive	0.3	0.241 (0.004)	0.241 (0.004)	**1.000 (0.000)**	0.388 (0.006)	0.500 (0.000)
naive	0.5	0.445 (0.017)	0.302 (0.008)	**0.992 (0.003)**	0.463 (0.009)	0.632 (0.011)
naive	0.7	0.741 (0.007)	0.480 (0.010)	**0.890 (0.011)**	**0.624 (0.008)**	**0.792 (0.005)**
naive	0.9	0.825 (0.004)	0.654 (0.013)	0.578 (0.013)	0.613 (0.009)	0.740 (0.006)

Table 2. Summary Statistics for dset = artif

optims	c	mean accuracy	mean precision	mean recall	mean f1 score	mean auc
BFGS	0.3	**0.936 (0.016)**	**0.935 (0.026)**	0.934 (0.023)	**0.934 (0.016)**	**0.936 (0.016)**
BFGS	0.5	**0.948 (0.013)**	**0.954 (0.020)**	0.940 (0.027)	**0.946 (0.014)**	**0.948 (0.013)**
BFGS	0.7	0.936 (0.099)	0.937 (0.102)	0.958 (0.019)	0.943 (0.065)	0.937 (0.097)
BFGS	0.9	0.781 (0.081)	0.705 (0.093)	0.987 (0.014)	0.819 (0.056)	0.785 (0.083)
CG	0.3	0.919 (0.088)	0.914 (0.090)	0.942 (0.025)	0.924 (0.056)	0.920 (0.087)
CG	0.5	0.889 (0.154)	0.888 (0.158)	0.955 (0.028)	0.910 (0.099)	0.890 (0.151)
CG	0.7	0.939 (0.085)	0.938 (0.092)	0.957 (0.019)	0.944 (0.057)	0.939 (0.086)
CG	0.9	0.896 (0.105)	0.871 (0.141)	0.965 (0.021)	0.908 (0.082)	0.900 (0.098)
NLOPT-LD-SLSQP	0.3	0.918 (0.048)	0.934 (0.027)	0.896 (0.105)	0.910 (0.063)	0.917 (0.049)
NLOPT-LD-SLSQP	0.5	0.943 (0.046)	0.950 (0.049)	0.938 (0.029)	0.943 (0.031)	0.943 (0.047)
NLOPT-LD-SLSQP	0.7	0.920 (0.115)	0.918 (0.128)	0.958 (0.022)	0.931 (0.078)	0.921 (0.113)
NLOPT-LD-SLSQP	0.9	0.654 (0.100)	0.599 (0.110)	**0.996 (0.011)**	0.742 (0.069)	0.663 (0.096)
NLOPT-LD-TNEWTON-PRECOND	0.3	**0.936 (0.016)**	0.935 (0.025)	0.934 (0.025)	**0.934 (0.016)**	**0.936 (0.016)**
NLOPT-LD-TNEWTON-PRECOND	0.5	0.929 (0.096)	0.935 (0.098)	0.942 (0.030)	0.934 (0.063)	0.930 (0.089)
NLOPT-LD-TNEWTON-PRECOND	0.7	**0.958 (0.011)**	**0.959 (0.015)**	0.954 (0.018)	**0.957 (0.012)**	**0.958 (0.012)**
NLOPT-LD-TNEWTON-PRECOND	0.9	0.888 (0.073)	0.878 (0.100)	0.920 (0.116)	0.889 (0.071)	0.889 (0.074)
NLOPT-LN-PRAXIS	0.3	0.920 (0.029)	0.933 (0.030)	0.902 (0.050)	0.916 (0.033)	0.920 (0.030)
NLOPT-LN-PRAXIS	0.5	0.946 (0.015)	0.954 (0.019)	0.933 (0.031)	0.943 (0.016)	0.945 (0.015)
NLOPT-LN-PRAXIS	0.7	**0.958 (0.011)**	**0.959 (0.015)**	0.954 (0.018)	**0.957 (0.012)**	0.958 (0.011)
NLOPT-LN-PRAXIS	0.9	**0.960 (0.012)**	**0.959 (0.015)**	0.958 (0.017)	**0.959 (0.013)**	**0.960 (0.012)**
Nelder-Mead	0.3	0.783 (0.074)	0.796 (0.087)	0.779 (0.117)	0.777 (0.068)	0.784 (0.069)
Nelder-Mead	0.5	0.799 (0.109)	0.795 (0.118)	0.854 (0.084)	0.813 (0.065)	0.800 (0.105)
Nelder-Mead	0.7	0.820 (0.058)	0.817 (0.067)	0.825 (0.077)	0.817 (0.051)	0.820 (0.058)
Nelder-Mead	0.9	0.790 (0.085)	0.783 (0.094)	0.827 (0.068)	0.798 (0.050)	0.791 (0.081)
SANN	0.3	0.807 (0.138)	0.798 (0.138)	0.775 (0.359)	0.805 (0.227)	0.806 (0.143)
SANN	0.5	0.913 (0.018)	0.870 (0.031)	0.965 (0.019)	0.915 (0.018)	0.914 (0.018)
SANN	0.7	0.907 (0.101)	0.901 (0.024)	0.909 (0.231)	0.933 (0.014)	0.907 (0.104)
SANN	0.9	0.890 (0.125)	0.912 (0.024)	0.858 (0.288)	0.921 (0.097)	0.889 (0.131)
naive	0.3	0.490 (0.022)	0.488 (0.022)	**1.000 (0.000)**	0.656 (0.020)	0.503 (0.004)
naive	0.5	0.596 (0.029)	0.547 (0.027)	**1.000 (0.000)**	0.707 (0.022)	0.607 (0.021)
naive	0.7	0.817 (0.022)	0.727 (0.030)	**1.000 (0.001)**	0.842 (0.020)	0.822 (0.019)
naive	0.9	0.940 (0.011)	0.903 (0.020)	0.982 (0.012)	0.940 (0.012)	0.941 (0.011)

Table 3. Summary Statistics for dset = bank-marketing

optims	c	mean accuracy	mean precision	mean recall	mean f1 score	mean auc
BFGS	0.3	0.695 (0.321)	0.352 (0.152)	0.513 (0.309)	0.331 (0.110)	0.616 (0.085)
BFGS	0.5	0.805 (0.235)	0.486 (0.162)	0.529 (0.230)	0.444 (0.114)	0.684 (0.081)
BFGS	0.7	0.879 (0.114)	0.554 (0.104)	0.501 (0.154)	0.500 (0.072)	0.714 (0.058)
BFGS	0.9	0.904 (0.014)	0.602 (0.075)	0.437 (0.082)	0.499 (0.050)	0.699 (0.035)
CG	0.3	0.701 (0.320)	0.362 (0.153)	0.523 (0.294)	**0.346 (0.110)**	0.624 (0.086)
CG	0.5	0.803 (0.241)	**0.487 (0.164)**	0.536 (0.224)	**0.450 (0.114)**	**0.686 (0.082)**
CG	0.7	0.873 (0.126)	0.550 (0.112)	0.506 (0.162)	0.497 (0.076)	0.712 (0.058)
CG	0.9	0.876 (0.064)	0.482 (0.075)	0.503 (0.144)	0.476 (0.065)	0.713 (0.055)
NLOPT-LD-SLSQP	0.3	0.702 (0.320)	0.363 (0.153)	0.507 (0.305)	0.336 (0.108)	0.617 (0.085)
NLOPT-LD-SLSQP	0.5	0.802 (0.241)	0.485 (0.162)	0.530 (0.229)	0.444 (0.115)	0.683 (0.083)
NLOPT-LD-SLSQP	0.7	0.879 (0.116)	**0.554 (0.105)**	0.501 (0.154)	0.500 (0.072)	0.713 (0.058)
NLOPT-LD-SLSQP	0.9	0.872 (0.025)	0.481 (0.101)	**0.689 (0.179)**	**0.536 (0.061)**	**0.792 (0.069)**
NLOPT-LD-TNEWTON-PRECOND	0.3	0.679 (0.332)	0.348 (0.156)	0.538 (0.307)	0.337 (0.113)	0.617 (0.088)
NLOPT-LD-TNEWTON-PRECOND	0.5	0.799 (0.243)	0.485 (0.165)	0.534 (0.229)	0.445 (0.113)	0.683 (0.081)
NLOPT-LD-TNEWTON-PRECOND	0.7	0.879 (0.116)	**0.554 (0.105)**	0.501 (0.154)	0.500 (0.072)	0.713 (0.058)
NLOPT-LD-TNEWTON-PRECOND	0.9	0.839 (0.100)	0.440 (0.117)	0.675 (0.198)	0.497 (0.067)	0.767 (0.066)
NLOPT-LN-PRAXIS	0.3	0.716 (0.310)	0.370 (0.157)	0.489 (0.305)	0.333 (0.109)	0.617 (0.085)
NLOPT-LN-PRAXIS	0.5	0.799 (0.244)	0.484 (0.166)	0.522 (0.243)	0.435 (0.119)	0.678 (0.085)
NLOPT-LN-PRAXIS	0.7	**0.889 (0.012)**	0.402 (0.213)	0.107 (0.113)	0.171 (0.141)	0.547 (0.054)
NLOPT-LN-PRAXIS	0.9	0.897 (0.012)	0.555 (0.170)	0.196 (0.122)	0.287 (0.145)	0.590 (0.058)
Nelder-Mead	0.3	0.625 (0.262)	0.289 (0.152)	0.712 (0.271)	0.341 (0.095)	**0.663 (0.078)**
Nelder-Mead	0.5	0.798 (0.203)	0.435 (0.154)	0.458 (0.271)	0.367 (0.095)	0.650 (0.068)
Nelder-Mead	0.7	0.812 (0.181)	0.440 (0.140)	0.461 (0.266)	0.373 (0.093)	0.658 (0.075)
Nelder-Mead	0.9	0.878 (0.029)	0.466 (0.096)	0.309 (0.171)	0.338 (0.098)	0.629 (0.065)
SANN	0.3	**0.883 (0.011)**	**0.382 (0.122)**	0.109 (0.060)	0.169 (0.076)	0.544 (0.027)
SANN	0.5	**0.886 (0.010)**	0.411 (0.154)	0.089 (0.074)	0.142 (0.093)	0.537 (0.033)
SANN	0.7	0.889 (0.011)	0.481 (0.151)	0.141 (0.099)	0.209 (0.116)	0.561 (0.045)
SANN	0.9	0.894 (0.011)	0.531 (0.134)	0.225 (0.115)	0.320 (0.116)	0.601 (0.053)
naive	0.3	0.111 (0.009)	0.111 (0.009)	**1.000 (0.001)**	0.199 (0.015)	0.500 (0.001)
naive	0.5	0.420 (0.063)	0.160 (0.020)	**0.982 (0.016)**	0.274 (0.030)	0.666 (0.035)
naive	0.7	0.885 (0.012)	0.488 (0.044)	**0.701 (0.054)**	**0.574 (0.037)**	**0.805 (0.026)**
naive	0.9	**0.905 (0.010)**	**0.618 (0.069)**	0.377 (0.048)	0.466 (0.045)	0.674 (0.023)

Table 4. Summary Statistics for dset = banknote

optims	c	mean accuracy	mean precision	mean recall	mean f1 score	mean auc
BFGS	0.3	0.986 (0.009)	0.977 (0.018)	0.992 (0.010)	0.984 (0.010)	0.986 (0.008)
BFGS	0.5	0.987 (0.007)	0.982 (0.014)	0.991 (0.009)	0.986 (0.008)	0.988 (0.006)
BFGS	0.7	**0.988 (0.006)**	**0.984 (0.012)**	0.988 (0.013)	**0.986 (0.007)**	**0.988 (0.006)**
BFGS	0.9	**0.976 (0.040)**	0.965 (0.061)	0.986 (0.019)	0.974 (0.038)	0.976 (0.037)
CG	0.3	0.982 (0.009)	0.966 (0.020)	0.996 (0.006)	0.981 (0.010)	0.984 (0.008)
CG	0.5	0.988 (0.006)	0.983 (0.013)	0.990 (0.009)	0.986 (0.007)	0.988 (0.006)
CG	0.7	0.928 (0.136)	0.908 (0.158)	0.995 (0.008)	0.941 (0.103)	0.933 (0.126)
CG	0.9	0.810 (0.089)	0.738 (0.120)	0.928 (0.043)	0.818 (0.081)	0.822 (0.081)
NLOPT-LD-SLSQP	0.3	**0.988 (0.008)**	**0.985 (0.017)**	0.989 (0.011)	**0.987 (0.009)**	**0.988 (0.008)**
NLOPT-LD-SLSQP	0.5	**0.989 (0.007)**	**0.989 (0.014)**	0.986 (0.012)	**0.988 (0.008)**	**0.989 (0.007)**
NLOPT-LD-SLSQP	0.7	0.969 (0.084)	0.967 (0.105)	0.985 (0.015)	0.972 (0.066)	0.970 (0.076)
NLOPT-LD-SLSQP	0.9	0.929 (0.076)	0.889 (0.126)	0.989 (0.012)	0.931 (0.071)	0.934 (0.068)
NLOPT-LD-TNEWTON-PRECOND	0.3	0.985 (0.023)	0.983 (0.018)	0.983 (0.046)	0.982 (0.028)	0.985 (0.024)
NLOPT-LD-TNEWTON-PRECOND	0.5	**0.989 (0.007)**	0.988 (0.014)	0.988 (0.012)	**0.988 (0.008)**	**0.989 (0.007)**
NLOPT-LD-TNEWTON-PRECOND	0.7	0.980 (0.058)	0.979 (0.075)	0.986 (0.013)	0.981 (0.047)	0.981 (0.051)
NLOPT-LD-TNEWTON-PRECOND	0.9	0.966 (0.056)	0.956 (0.083)	0.979 (0.029)	0.966 (0.054)	0.968 (0.052)
NLOPT-LN-PRAXIS	0.3	0.985 (0.015)	0.984 (0.016)	0.982 (0.029)	0.983 (0.018)	0.984 (0.016)
NLOPT-LN-PRAXIS	0.5	0.988 (0.007)	0.988 (0.014)	0.986 (0.013)	0.987 (0.008)	0.988 (0.007)
NLOPT-LN-PRAXIS	0.7	0.976 (0.073)	0.981 (0.078)	0.978 (0.039)	0.977 (0.057)	0.977 (0.062)
NLOPT-LN-PRAXIS	0.9	0.975 (0.044)	**0.971 (0.060)**	0.978 (0.035)	**0.974 (0.045)**	0.976 (0.042)
Nelder-Mead	0.3	0.903 (0.127)	0.921 (0.127)	0.901 (0.135)	0.898 (0.111)	0.902 (0.121)
Nelder-Mead	0.5	0.930 (0.134)	0.930 (0.139)	0.959 (0.048)	0.937 (0.095)	0.933 (0.119)
Nelder-Mead	0.7	0.881 (0.154)	0.906 (0.154)	0.887 (0.161)	0.876 (0.141)	0.883 (0.142)
Nelder-Mead	0.9	0.860 (0.175)	0.851 (0.180)	0.941 (0.066)	0.879 (0.120)	0.867 (0.160)
SANN	0.3	0.944 (0.086)	0.910 (0.076)	0.988 (0.100)	0.950 (0.051)	0.949 (0.080)
SANN	0.5	0.974 (0.010)	0.947 (0.021)	0.998 (0.004)	0.972 (0.011)	0.976 (0.009)
SANN	0.7	0.972 (0.043)	0.953 (0.018)	0.986 (0.100)	0.974 (0.010)	0.973 (0.048)
SANN	0.9	0.976 (0.010)	0.954 (0.020)	0.995 (0.008)	0.974 (0.011)	**0.978 (0.009)**
naive	0.3	0.449 (0.029)	0.449 (0.029)	**1.000 (0.000)**	0.619 (0.028)	0.500 (0.001)
naive	0.5	0.679 (0.067)	0.586 (0.056)	**1.000 (0.000)**	0.738 (0.044)	0.708 (0.060)
naive	0.7	0.936 (0.016)	0.874 (0.032)	**1.000 (0.000)**	0.933 (0.018)	0.942 (0.014)
naive	0.9	0.967 (0.009)	0.931 (0.020)	**1.000 (0.000)**	0.964 (0.011)	0.970 (0.008)

Table 5. Summary Statistics for dset = breastc

optims	c	mean accuracy	mean precision	mean recall	mean f1 score	mean auc
BFGS	0.3	0.838 (0.227)	0.804 (0.216)	0.947 (0.048)	0.847 (0.154)	0.862 (0.171)
BFGS	0.5	0.925 (0.137)	0.898 (0.137)	0.950 (0.038)	0.915 (0.098)	0.931 (0.101)
BFGS	0.7	0.924 (0.152)	0.903 (0.155)	0.957 (0.035)	0.919 (0.113)	0.932 (0.112)
BFGS	0.9	0.664 (0.312)	0.655 (0.307)	0.973 (0.036)	0.735 (0.222)	0.738 (0.231)
CG	0.3	0.856 (0.208)	0.822 (0.201)	0.944 (0.047)	0.859 (0.142)	0.876 (0.158)
CG	0.5	0.925 (0.136)	0.898 (0.137)	0.951 (0.037)	0.915 (0.098)	0.932 (0.101)
CG	0.7	0.963 (0.017)	0.940 (0.038)	0.954 (0.035)	0.946 (0.024)	0.961 (0.019)
CG	0.9	0.801 (0.226)	0.752 (0.258)	0.969 (0.036)	0.816 (0.179)	0.842 (0.165)
NLOPT-LD-SLSQP	0.3	0.836 (0.224)	0.802 (0.217)	0.945 (0.047)	0.844 (0.153)	0.860 (0.169)
NLOPT-LD-SLSQP	0.5	0.919 (0.146)	0.893 (0.146)	0.950 (0.039)	0.911 (0.104)	0.926 (0.110)
NLOPT-LD-SLSQP	0.7	0.920 (0.162)	0.902 (0.159)	0.957 (0.035)	0.917 (0.117)	0.930 (0.119)
NLOPT-LD-SLSQP	0.9	0.572 (0.304)	0.568 (0.299)	**0.981 (0.034)**	0.671 (0.217)	0.671 (0.224)
NLOPT-LD-TNEWTON-PRECOND	0.3	0.842 (0.219)	0.808 (0.210)	0.941 (0.050)	0.848 (0.149)	0.864 (0.165)
NLOPT-LD-TNEWTON-PRECOND	0.5	0.924 (0.136)	0.898 (0.138)	0.949 (0.039)	0.914 (0.098)	0.930 (0.101)
NLOPT-LD-TNEWTON-PRECOND	0.7	0.941 (0.120)	0.920 (0.122)	0.956 (0.034)	0.931 (0.089)	0.945 (0.088)
NLOPT-LD-TNEWTON-PRECOND	0.9	0.784 (0.269)	0.759 (0.273)	0.967 (0.037)	0.815 (0.195)	0.828 (0.200)
NLOPT-LN-PRAXIS	0.3	0.854 (0.208)	0.824 (0.201)	0.936 (0.052)	0.856 (0.141)	0.872 (0.157)
NLOPT-LN-PRAXIS	0.5	0.935 (0.107)	0.908 (0.111)	0.945 (0.042)	0.921 (0.079)	0.938 (0.080)
NLOPT-LN-PRAXIS	0.7	0.956 (0.068)	0.933 (0.073)	0.954 (0.033)	0.941 (0.054)	0.956 (0.051)
NLOPT-LN-PRAXIS	0.9	0.953 (0.026)	0.915 (0.063)	0.955 (0.035)	0.933 (0.034)	0.953 (0.022)
Nelder-Mead	0.3	0.892 (0.159)	**0.874 (0.170)**	0.912 (0.076)	0.876 (0.117)	0.897 (0.116)
Nelder-Mead	0.5	**0.951 (0.021)**	**0.937 (0.036)**	0.922 (0.054)	0.928 (0.033)	0.944 (0.027)
Nelder-Mead	0.7	0.785 (0.274)	0.765 (0.264)	0.960 (0.041)	0.817 (0.191)	0.825 (0.204)
Nelder-Mead	0.9	0.801 (0.251)	0.770 (0.250)	0.961 (0.042)	0.825 (0.176)	0.836 (0.189)
SANN	0.3	**0.895 (0.177)**	0.864 (0.176)	0.946 (0.101)	**0.884 (0.151)**	**0.907 (0.138)**
SANN	0.5	0.948 (0.074)	0.920 (0.089)	0.953 (0.036)	**0.932 (0.059)**	**0.949 (0.056)**
SANN	0.7	0.963 (0.015)	**0.944 (0.035)**	0.951 (0.032)	0.947 (0.022)	0.960 (0.017)
SANN	0.9	0.959 (0.067)	0.942 (0.070)	0.953 (0.033)	**0.945 (0.052)**	**0.958 (0.049)**
naive	0.3	0.345 (0.035)	0.345 (0.035)	**1.000 (0.000)**	0.512 (0.039)	0.500 (0.000)
naive	0.5	0.571 (0.162)	0.466 (0.114)	**1.000 (0.000)**	0.628 (0.102)	0.674 (0.121)
naive	0.7	**0.969 (0.014)**	0.925 (0.035)	**0.989 (0.015)**	**0.956 (0.020)**	**0.974 (0.013)**
naive	0.9	**0.963 (0.016)**	**0.960 (0.024)**	0.931 (0.040)	0.945 (0.025)	0.955 (0.021)

Table 6. Summary Statistics for dset = credit-a

optims	c	mean accuracy	mean precision	mean recall	mean f1 score	mean auc
BFGS	0.3	0.770 (0.123)	0.771 (0.137)	0.797 (0.118)	0.766 (0.079)	0.775 (0.105)
BFGS	0.5	0.821 (0.095)	0.820 (0.109)	0.822 (0.083)	0.811 (0.062)	0.822 (0.083)
BFGS	0.7	0.858 (0.056)	0.847 (0.074)	0.851 (0.055)	0.845 (0.045)	0.858 (0.050)
BFGS	0.9	0.710 (0.110)	0.643 (0.126)	0.942 (0.054)	0.754 (0.073)	0.729 (0.096)
CG	0.3	0.732 (0.160)	0.725 (0.167)	0.844 (0.118)	0.756 (0.090)	0.744 (0.136)
CG	0.5	0.831 (0.084)	0.820 (0.094)	0.836 (0.077)	**0.821 (0.058)**	0.832 (0.075)
CG	0.7	0.833 (0.102)	0.816 (0.114)	0.867 (0.061)	0.832 (0.065)	0.837 (0.091)
CG	0.9	0.788 (0.095)	0.731 (0.125)	0.912 (0.056)	0.802 (0.068)	0.798 (0.085)
NLOPT-LD-SLSQP	0.3	0.773 (0.112)	0.782 (0.130)	0.778 (0.125)	0.762 (0.074)	0.775 (0.098)
NLOPT-LD-SLSQP	0.5	0.807 (0.110)	0.813 (0.127)	0.814 (0.095)	0.800 (0.069)	0.809 (0.095)
NLOPT-LD-SLSQP	0.7	0.825 (0.086)	0.800 (0.120)	0.870 (0.072)	0.823 (0.060)	0.829 (0.075)
NLOPT-LD-SLSQP	0.9	0.709 (0.088)	0.632 (0.103)	**0.947 (0.049)**	0.751 (0.057)	0.727 (0.080)
NLOPT-LD-TNEWTON-PRECOND	0.3	0.738 (0.147)	0.738 (0.158)	0.814 (0.131)	0.750 (0.085)	0.745 (0.128)
NLOPT-LD-TNEWTON-PRECOND	0.5	0.806 (0.115)	0.808 (0.126)	0.822 (0.089)	0.802 (0.069)	0.808 (0.102)
NLOPT-LD-TNEWTON-PRECOND	0.7	0.788 (0.157)	0.779 (0.164)	0.872 (0.076)	0.805 (0.093)	0.795 (0.140)
NLOPT-LD-TNEWTON-PRECOND	0.9	0.819 (0.068)	0.769 (0.104)	0.900 (0.060)	0.822 (0.051)	0.826 (0.061)
NLOPT-LN-PRAXIS	0.3	0.751 (0.137)	0.748 (0.150)	0.812 (0.124)	0.757 (0.081)	0.757 (0.119)
NLOPT-LN-PRAXIS	0.5	0.833 (0.066)	**0.836 (0.083)**	0.808 (0.077)	0.816 (0.051)	0.832 (0.058)
NLOPT-LN-PRAXIS	0.7	**0.865 (0.031)**	**0.855 (0.053)**	0.848 (0.053)	0.849 (0.037)	**0.864 (0.030)**
NLOPT-LN-PRAXIS	0.9	**0.869 (0.028)**	**0.855 (0.047)**	0.858 (0.046)	0.855 (0.033)	0.868 (0.029)
Nelder-Mead	0.3	0.755 (0.136)	0.741 (0.148)	0.839 (0.119)	0.766 (0.082)	0.763 (0.119)
Nelder-Mead	0.5	0.816 (0.109)	0.791 (0.118)	0.867 (0.074)	0.817 (0.069)	0.820 (0.099)
Nelder-Mead	0.7	0.795 (0.142)	0.766 (0.141)	0.889 (0.068)	0.810 (0.087)	0.804 (0.123)
Nelder-Mead	0.9	0.769 (0.145)	0.725 (0.145)	0.912 (0.064)	0.795 (0.089)	0.781 (0.129)
SANN	0.3	**0.809 (0.067)**	**0.803 (0.113)**	0.760 (0.175)	**0.784 (0.107)**	**0.804 (0.077)**
SANN	0.5	**0.836 (0.059)**	0.829 (0.070)	0.804 (0.136)	0.816 (0.086)	**0.835 (0.062)**
SANN	0.7	0.854 (0.038)	0.843 (0.045)	0.833 (0.099)	0.841 (0.033)	0.852 (0.044)
SANN	0.9	0.846 (0.074)	0.837 (0.048)	0.825 (0.178)	0.846 (0.036)	0.846 (0.076)
naive	0.3	0.455 (0.039)	0.455 (0.039)	**1.000 (0.002)**	0.624 (0.038)	0.500 (0.002)
naive	0.5	0.592 (0.077)	0.532 (0.060)	**0.977 (0.024)**	0.686 (0.048)	0.623 (0.070)
naive	0.7	0.852 (0.028)	0.777 (0.047)	**0.945 (0.029)**	**0.852 (0.031)**	0.860 (0.026)
naive	0.9	0.868 (0.028)	0.800 (0.045)	0.945 (0.029)	**0.866 (0.031)**	**0.875 (0.026)**

Table 7. Summary Statistics for dset = credit-g

optims	c	mean accuracy	mean precision	mean recall	mean f1 score	mean auc
BFGS	0.3	0.627 (0.152)	0.461 (0.109)	0.491 (0.277)	0.423 (0.086)	0.587 (0.057)
BFGS	0.5	0.686 (0.116)	0.529 (0.109)	0.455 (0.223)	0.448 (0.102)	0.620 (0.059)
BFGS	0.7	0.700 (0.110)	0.560 (0.115)	0.499 (0.213)	0.487 (0.091)	0.641 (0.052)
BFGS	0.9	0.748 (0.030)	0.607 (0.084)	0.478 (0.104)	0.526 (0.065)	0.671 (0.039)
CG	0.3	0.622 (0.156)	0.456 (0.112)	0.499 (0.278)	0.424 (0.088)	0.585 (0.057)
CG	0.5	0.689 (0.115)	0.535 (0.104)	0.455 (0.219)	0.452 (0.096)	0.622 (0.057)
CG	0.7	0.697 (0.114)	0.562 (0.117)	0.505 (0.215)	0.489 (0.086)	0.641 (0.051)
CG	0.9	0.751 (0.028)	0.613 (0.080)	0.474 (0.099)	0.527 (0.065)	0.672 (0.039)
NLOPT-LD-SLSQP	0.3	0.621 (0.157)	0.457 (0.108)	0.493 (0.291)	0.416 (0.095)	0.583 (0.058)
NLOPT-LD-SLSQP	0.5	0.687 (0.116)	0.532 (0.106)	0.455 (0.223)	0.449 (0.100)	0.620 (0.058)
NLOPT-LD-SLSQP	0.7	0.696 (0.115)	0.559 (0.119)	0.503 (0.218)	0.486 (0.091)	0.640 (0.052)
NLOPT-LD-SLSQP	0.9	**0.751 (0.029)**	0.612 (0.081)	0.472 (0.097)	0.525 (0.065)	0.671 (0.039)
NLOPT-LD-TNEWTON-PRECOND	0.3	0.612 (0.162)	0.450 (0.108)	0.519 (0.288)	0.426 (0.088)	0.584 (0.058)
NLOPT-LD-TNEWTON-PRECOND	0.5	0.681 (0.128)	0.534 (0.113)	0.481 (0.229)	0.461 (0.091)	0.623 (0.059)
NLOPT-LD-TNEWTON-PRECOND	0.7	0.697 (0.113)	0.557 (0.116)	0.504 (0.216)	0.487 (0.088)	0.641 (0.051)
NLOPT-LD-TNEWTON-PRECOND	0.9	0.740 (0.033)	0.587 (0.087)	0.526 (0.133)	0.539 (0.064)	0.680 (0.040)
NLOPT-LN-PRAXIS	0.3	0.623 (0.158)	0.462 (0.108)	0.498 (0.285)	0.422 (0.089)	0.586 (0.056)
NLOPT-LN-PRAXIS	0.5	0.692 (0.111)	0.540 (0.110)	0.437 (0.222)	0.441 (0.106)	0.619 (0.059)
NLOPT-LN-PRAXIS	0.7	0.698 (0.111)	0.555 (0.113)	0.489 (0.220)	0.478 (0.099)	0.637 (0.055)
NLOPT-LN-PRAXIS	0.9	0.715 (0.032)	0.570 (0.225)	0.147 (0.156)	0.227 (0.159)	0.552 (0.057)
Nelder-Mead	0.3	0.677 (0.077)	0.490 (0.091)	0.456 (0.223)	0.434 (0.113)	**0.614 (0.054)**
Nelder-Mead	0.5	0.708 (0.062)	0.541 (0.093)	0.516 (0.175)	**0.502 (0.077)**	**0.653 (0.042)**
Nelder-Mead	0.7	**0.727 (0.057)**	0.576 (0.090)	0.502 (0.161)	0.514 (0.074)	0.662 (0.040)
Nelder-Mead	0.9	0.744 (0.040)	0.605 (0.082)	0.459 (0.111)	0.511 (0.065)	0.662 (0.038)
SANN	0.3	**0.708 (0.031)**	**0.516 (0.174)**	0.194 (0.134)	0.271 (0.135)	0.560 (0.047)
SANN	0.5	**0.719 (0.035)**	**0.575 (0.175)**	0.186 (0.130)	0.273 (0.146)	0.566 (0.050)
SANN	0.7	0.720 (0.033)	**0.600 (0.198)**	0.181 (0.138)	0.278 (0.152)	0.565 (0.052)
SANN	0.9	0.733 (0.032)	**0.619 (0.159)**	0.258 (0.143)	0.365 (0.144)	0.596 (0.056)
naive	0.3	0.299 (0.030)	0.299 (0.030)	**1.000 (0.000)**	**0.459 (0.036)**	0.501 (0.003)
naive	0.5	0.421 (0.051)	0.337 (0.036)	**0.966 (0.029)**	0.498 (0.040)	0.578 (0.031)
naive	0.7	0.655 (0.036)	0.457 (0.049)	**0.786 (0.057)**	**0.575 (0.039)**	**0.693 (0.029)**
naive	0.9	0.751 (0.026)	0.593 (0.071)	**0.546 (0.064)**	**0.564 (0.048)**	**0.693 (0.030)**

Table 8. Summary Statistics for dset = dhfr

optims	c	mean accuracy	mean precision	mean recall	mean f1 score	mean auc
BFGS	0.3	0.574 (0.137)	0.483 (0.111)	0.932 (0.068)	0.626 (0.090)	0.648 (0.098)
BFGS	0.5	0.666 (0.124)	0.552 (0.113)	0.909 (0.084)	0.677 (0.083)	0.713 (0.095)
BFGS	0.7	0.747 (0.087)	0.630 (0.123)	0.896 (0.120)	0.725 (0.084)	0.780 (0.066)
BFGS	0.9	0.815 (0.082)	0.765 (0.129)	0.787 (0.145)	0.759 (0.095)	0.808 (0.074)
CG	0.3	0.591 (0.114)	0.486 (0.092)	0.918 (0.078)	0.629 (0.080)	0.657 (0.083)
CG	0.5	0.660 (0.114)	0.541 (0.097)	0.890 (0.083)	0.666 (0.077)	0.704 (0.088)
CG	0.7	0.772 (0.103)	0.665 (0.121)	0.869 (0.075)	0.745 (0.086)	0.793 (0.077)
CG	0.9	0.721 (0.092)	0.608 (0.133)	0.866 (0.091)	0.702 (0.079)	0.751 (0.071)
NLOPT-LD-SLSQP	0.3	0.589 (0.117)	0.486 (0.097)	0.926 (0.073)	0.630 (0.083)	0.659 (0.085)
NLOPT-LD-SLSQP	0.5	0.722 (0.091)	0.594 (0.097)	0.890 (0.078)	0.707 (0.079)	0.755 (0.077)
NLOPT-LD-SLSQP	0.7	0.667 (0.105)	0.543 (0.098)	**0.940 (0.051)**	0.682 (0.074)	0.721 (0.081)
NLOPT-LD-SLSQP	0.9	0.860 (0.067)	0.813 (0.112)	0.831 (0.096)	0.815 (0.086)	0.854 (0.063)
NLOPT-LD-TNEWTON-PRECOND	0.3	0.498 (0.139)	0.438 (0.101)	**0.951 (0.073)**	0.591 (0.082)	0.589 (0.101)
NLOPT-LD-TNEWTON-PRECOND	0.5	0.604 (0.153)	0.513 (0.128)	0.919 (0.091)	0.644 (0.094)	0.666 (0.111)
NLOPT-LD-TNEWTON-PRECOND	0.7	0.759 (0.086)	0.640 (0.111)	0.893 (0.081)	0.736 (0.077)	0.787 (0.065)
NLOPT-LD-TNEWTON-PRECOND	0.9	0.715 (0.120)	0.607 (0.141)	**0.907 (0.096)**	0.711 (0.086)	0.754 (0.088)
NLOPT-LN-PRAXIS	0.3	0.626 (0.125)	0.516 (0.100)	0.919 (0.067)	**0.653 (0.081)**	**0.685 (0.095)**
NLOPT-LN-PRAXIS	0.5	**0.783 (0.066)**	0.668 (0.095)	0.865 (0.076)	**0.749 (0.068)**	**0.799 (0.059)**
NLOPT-LN-PRAXIS	0.7	**0.829 (0.052)**	0.742 (0.095)	0.844 (0.079)	**0.785 (0.064)**	**0.833 (0.050)**
NLOPT-LN-PRAXIS	0.9	**0.867 (0.041)**	0.829 (0.077)	0.821 (0.095)	0.819 (0.055)	0.859 (0.046)
Nelder-Mead	0.3	0.667 (0.152)	**0.717 (0.235)**	0.595 (0.278)	0.558 (0.125)	0.656 (0.091)
Nelder-Mead	0.5	0.523 (0.090)	0.442 (0.074)	**0.964 (0.043)**	0.602 (0.067)	0.613 (0.060)
Nelder-Mead	0.7	0.663 (0.084)	0.535 (0.093)	0.931 (0.056)	0.674 (0.075)	0.718 (0.063)
Nelder-Mead	0.9	0.777 (0.069)	0.664 (0.107)	0.856 (0.088)	0.741 (0.075)	0.794 (0.061)
SANN	0.3	**0.723 (0.088)**	0.699 (0.207)	0.453 (0.263)	0.536 (0.210)	0.670 (0.113)
SANN	0.5	0.769 (0.093)	**0.777 (0.179)**	0.539 (0.279)	0.626 (0.207)	0.722 (0.123)
SANN	0.7	0.800 (0.091)	**0.834 (0.141)**	0.575 (0.280)	0.678 (0.218)	0.755 (0.128)
SANN	0.9	0.837 (0.091)	**0.879 (0.129)**	0.646 (0.250)	0.747 (0.186)	0.799 (0.118)
naive	0.3	0.488 (0.064)	0.416 (0.061)	0.905 (0.062)	0.567 (0.062)	0.572 (0.049)
naive	0.5	0.623 (0.072)	0.500 (0.078)	0.876 (0.075)	0.633 (0.070)	0.675 (0.060)
naive	0.7	0.764 (0.057)	0.637 (0.087)	0.870 (0.071)	0.731 (0.068)	0.785 (0.052)
naive	0.9	0.865 (0.040)	0.793 (0.078)	0.868 (0.072)	**0.825 (0.053)**	**0.866 (0.041)**

Table 9. Summary Statistics for dset = diabetes

optims	c	mean accuracy	mean precision	mean recall	mean f1 score	mean auc
BFGS	0.3	**0.706 (0.107)**	0.635 (0.130)	0.599 (0.192)	**0.581 (0.081)**	**0.682 (0.067)**
BFGS	0.5	0.736 (0.074)	0.659 (0.105)	0.608 (0.150)	**0.612 (0.069)**	**0.705 (0.054)**
BFGS	0.7	0.675 (0.175)	0.625 (0.170)	0.680 (0.187)	0.607 (0.081)	0.682 (0.091)
BFGS	0.9	0.376 (0.113)	0.374 (0.115)	0.967 (0.122)	0.520 (0.057)	0.516 (0.057)
CG	0.3	0.705 (0.107)	0.636 (0.132)	0.595 (0.197)	0.578 (0.085)	0.680 (0.068)
CG	0.5	0.693 (0.145)	0.630 (0.141)	0.640 (0.190)	0.598 (0.071)	0.678 (0.084)
CG	0.7	0.494 (0.203)	0.473 (0.185)	0.849 (0.211)	0.552 (0.079)	0.581 (0.107)
CG	0.9	0.364 (0.069)	0.357 (0.059)	**0.988 (0.080)**	0.518 (0.046)	0.509 (0.025)
NLOPT-LD-SLSQP	0.3	0.704 (0.107)	0.636 (0.133)	0.592 (0.200)	0.575 (0.089)	0.679 (0.069)
NLOPT-LD-SLSQP	0.5	**0.737 (0.074)**	0.659 (0.105)	0.608 (0.150)	0.612 (0.068)	0.705 (0.053)
NLOPT-LD-SLSQP	0.7	0.567 (0.178)	0.518 (0.185)	0.812 (0.212)	0.577 (0.074)	0.630 (0.091)
NLOPT-LD-SLSQP	0.9	0.577 (0.213)	0.540 (0.196)	0.782 (0.204)	0.581 (0.091)	0.635 (0.116)
NLOPT-LD-TNEWTON-PRECOND	0.3	0.705 (0.107)	0.635 (0.131)	0.596 (0.194)	0.579 (0.082)	0.681 (0.067)
NLOPT-LD-TNEWTON-PRECOND	0.5	0.724 (0.101)	0.650 (0.116)	0.616 (0.164)	0.608 (0.067)	0.696 (0.067)
NLOPT-LD-TNEWTON-PRECOND	0.7	0.620 (0.187)	0.569 (0.184)	0.757 (0.208)	0.596 (0.080)	0.655 (0.098)
NLOPT-LD-TNEWTON-PRECOND	0.9	0.437 (0.147)	0.412 (0.137)	0.933 (0.158)	0.541 (0.061)	0.555 (0.077)
NLOPT-LN-PRAXIS	0.3	0.705 (0.106)	**0.639 (0.130)**	0.591 (0.202)	0.575 (0.089)	0.679 (0.068)
NLOPT-LN-PRAXIS	0.5	**0.737 (0.074)**	**0.659 (0.106)**	0.608 (0.150)	0.612 (0.068)	**0.705 (0.054)**
NLOPT-LN-PRAXIS	0.7	0.721 (0.070)	0.624 (0.206)	0.430 (0.294)	0.527 (0.217)	0.656 (0.108)
NLOPT-LN-PRAXIS	0.9	0.660 (0.045)	0.691 (0.321)	0.035 (0.084)	0.147 (0.138)	0.514 (0.035)
Nelder-Mead	0.3	0.650 (0.150)	0.590 (0.158)	0.632 (0.255)	0.550 (0.100)	0.647 (0.080)
Nelder-Mead	0.5	0.637 (0.170)	0.573 (0.160)	0.687 (0.224)	0.574 (0.079)	0.649 (0.092)
Nelder-Mead	0.7	0.603 (0.182)	0.549 (0.164)	0.692 (0.262)	0.550 (0.081)	0.620 (0.094)
Nelder-Mead	0.9	0.655 (0.153)	0.591 (0.158)	0.658 (0.226)	0.572 (0.078)	0.658 (0.080)
SANN	0.3	0.657 (0.124)	0.559 (0.145)	0.576 (0.299)	0.532 (0.151)	0.638 (0.091)
SANN	0.5	0.725 (0.066)	0.627 (0.157)	0.541 (0.245)	0.593 (0.126)	0.683 (0.083)
SANN	0.7	**0.755 (0.050)**	**0.700 (0.123)**	0.538 (0.191)	0.615 (0.106)	0.705 (0.073)
SANN	0.9	0.758 (0.049)	**0.716 (0.082)**	0.514 (0.175)	0.620 (0.085)	0.702 (0.073)
naive	0.3	0.349 (0.041)	0.348 (0.040)	**1.000 (0.002)**	0.515 (0.044)	0.501 (0.003)
naive	0.5	0.427 (0.058)	0.378 (0.048)	**0.986 (0.016)**	0.544 (0.050)	0.558 (0.031)
naive	0.7	0.695 (0.043)	0.540 (0.063)	**0.865 (0.056)**	**0.662 (0.049)**	**0.735 (0.033)**
naive	0.9	**0.764 (0.036)**	0.676 (0.074)	0.619 (0.070)	**0.643 (0.058)**	**0.730 (0.040)**

Table 10. Summary Statistics for dset = heart-c

optims	c	mean accuracy	mean precision	mean recall	mean f1 score	mean auc
BFGS	0.3	0.654 (0.095)	0.645 (0.122)	0.705 (0.202)	0.648 (0.098)	0.656 (0.091)
BFGS	0.5	0.686 (0.112)	0.684 (0.134)	0.752 (0.172)	0.690 (0.082)	0.692 (0.096)
BFGS	0.7	**0.752 (0.063)**	0.745 (0.101)	0.742 (0.128)	0.732 (0.075)	**0.752 (0.060)**
BFGS	0.9	0.755 (0.066)	0.741 (0.115)	0.776 (0.116)	0.745 (0.067)	0.759 (0.057)
CG	0.3	0.627 (0.114)	0.616 (0.134)	0.763 (0.208)	0.651 (0.093)	0.636 (0.101)
CG	0.5	0.684 (0.114)	0.682 (0.135)	0.758 (0.169)	0.691 (0.078)	0.690 (0.098)
CG	0.7	0.720 (0.097)	0.711 (0.134)	0.776 (0.154)	0.720 (0.079)	0.727 (0.080)
CG	0.9	0.721 (0.074)	0.682 (0.124)	0.833 (0.122)	0.734 (0.068)	0.732 (0.061)
NLOPT-LD-SLSQP	0.3	0.642 (0.100)	0.629 (0.120)	0.718 (0.212)	0.642 (0.101)	0.645 (0.093)
NLOPT-LD-SLSQP	0.5	0.690 (0.108)	0.690 (0.133)	0.742 (0.175)	0.688 (0.085)	0.694 (0.092)
NLOPT-LD-SLSQP	0.7	0.751 (0.063)	0.750 (0.103)	0.732 (0.131)	0.728 (0.076)	0.751 (0.060)
NLOPT-LD-SLSQP	0.9	0.770 (0.064)	0.772 (0.105)	0.750 (0.105)	0.751 (0.068)	0.772 (0.057)
NLOPT-LD-TNEWTON-PRECOND	0.3	0.622 (0.116)	0.610 (0.130)	0.773 (0.206)	0.651 (0.090)	0.632 (0.101)
NLOPT-LD-TNEWTON-PRECOND	0.5	0.688 (0.114)	0.688 (0.135)	0.755 (0.166)	**0.694 (0.075)**	0.693 (0.097)
NLOPT-LD-TNEWTON-PRECOND	0.7	0.704 (0.117)	0.701 (0.146)	0.785 (0.155)	0.715 (0.081)	0.714 (0.094)
NLOPT-LD-TNEWTON-PRECOND	0.9	0.698 (0.101)	0.663 (0.142)	**0.860 (0.132)**	0.728 (0.075)	0.714 (0.080)
NLOPT-LN-PRAXIS	0.3	0.626 (0.112)	0.623 (0.140)	0.731 (0.221)	0.638 (0.097)	0.634 (0.097)
NLOPT-LN-PRAXIS	0.5	0.687 (0.111)	0.684 (0.133)	0.749 (0.173)	0.689 (0.085)	0.692 (0.096)
NLOPT-LN-PRAXIS	0.7	0.749 (0.066)	0.743 (0.103)	0.740 (0.131)	0.729 (0.079)	0.749 (0.062)
NLOPT-LN-PRAXIS	0.9	0.764 (0.053)	**0.785 (0.094)**	0.696 (0.120)	0.728 (0.076)	0.761 (0.055)
Nelder-Mead	0.3	0.669 (0.094)	0.675 (0.136)	0.701 (0.205)	**0.656 (0.093)**	0.670 (0.085)
Nelder-Mead	0.5	0.696 (0.095)	0.697 (0.133)	0.733 (0.189)	0.686 (0.094)	0.697 (0.088)
Nelder-Mead	0.7	0.726 (0.087)	0.728 (0.131)	0.747 (0.162)	0.715 (0.082)	0.730 (0.078)
Nelder-Mead	0.9	0.731 (0.086)	0.717 (0.125)	0.783 (0.139)	0.730 (0.070)	0.734 (0.078)
SANN	0.3	**0.683 (0.090)**	**0.702 (0.167)**	0.598 (0.243)	0.646 (0.123)	**0.679 (0.087)**
SANN	0.5	**0.723 (0.069)**	**0.767 (0.115)**	0.620 (0.168)	0.671 (0.103)	**0.718 (0.067)**
SANN	0.7	0.743 (0.075)	**0.798 (0.109)**	0.631 (0.173)	0.703 (0.086)	0.740 (0.069)
SANN	0.9	0.746 (0.081)	0.781 (0.126)	0.630 (0.184)	0.707 (0.102)	0.741 (0.081)
naive	0.3	0.471 (0.061)	0.469 (0.061)	**1.000 (0.003)**	0.637 (0.057)	0.502 (0.009)
naive	0.5	0.552 (0.075)	0.513 (0.071)	**0.983 (0.027)**	0.671 (0.061)	0.579 (0.046)
naive	0.7	0.705 (0.055)	0.633 (0.076)	**0.890 (0.072)**	**0.736 (0.055)**	0.716 (0.051)
naive	0.9	**0.774 (0.048)**	0.750 (0.083)	0.783 (0.084)	**0.761 (0.061)**	**0.776 (0.049)**

Table 11. Summary Statistics for dset = spambase

optims	c	mean accuracy	mean precision	mean recall	mean f1 score	mean auc
BFGS	0.3	**0.901 (0.013)**	**0.874 (0.026)**	0.876 (0.028)	**0.875 (0.018)**	**0.897 (0.014)**
BFGS	0.5	0.886 (0.120)	0.872 (0.122)	0.889 (0.034)	0.873 (0.078)	0.887 (0.093)
BFGS	0.7	0.410 (0.075)	0.407 (0.075)	**0.998 (0.017)**	0.574 (0.048)	0.513 (0.058)
BFGS	0.9	0.627 (0.261)	0.625 (0.263)	0.945 (0.064)	0.711 (0.165)	0.684 (0.204)
CG	0.3	0.894 (0.054)	0.860 (0.057)	0.883 (0.030)	0.870 (0.037)	0.892 (0.042)
CG	0.5	**0.915 (0.010)**	0.897 (0.019)	0.886 (0.020)	**0.891 (0.013)**	**0.910 (0.011)**
CG	0.7	0.860 (0.140)	0.838 (0.164)	0.903 (0.043)	0.855 (0.099)	0.868 (0.109)
CG	0.9	0.644 (0.157)	0.571 (0.150)	0.933 (0.075)	0.690 (0.090)	0.695 (0.117)
NLOPT-LD-SLSQP	0.3	0.856 (0.147)	0.834 (0.143)	0.884 (0.045)	0.846 (0.092)	0.861 (0.114)
NLOPT-LD-SLSQP	0.5	0.889 (0.111)	0.876 (0.118)	0.886 (0.034)	0.874 (0.074)	0.889 (0.085)
NLOPT-LD-SLSQP	0.7	0.798 (0.125)	0.721 (0.161)	0.928 (0.045)	0.797 (0.090)	0.821 (0.095)
NLOPT-LD-SLSQP	0.9	0.828 (0.043)	0.731 (0.076)	0.912 (0.023)	0.808 (0.038)	0.842 (0.032)
NLOPT-LD-TNEWTON-PRECOND	0.3	0.885 (0.089)	0.859 (0.088)	0.880 (0.034)	0.865 (0.057)	0.885 (0.069)
NLOPT-LD-TNEWTON-PRECOND	0.5	0.850 (0.171)	0.837 (0.170)	0.897 (0.044)	0.850 (0.108)	0.858 (0.135)
NLOPT-LD-TNEWTON-PRECOND	0.7	0.761 (0.211)	0.734 (0.227)	0.921 (0.058)	0.787 (0.139)	0.789 (0.164)
NLOPT-LD-TNEWTON-PRECOND	0.9	0.625 (0.082)	0.523 (0.085)	**0.971 (0.026)**	0.675 (0.053)	0.686 (0.062)
NLOPT-LN-PRAXIS	0.3	0.878 (0.099)	0.854 (0.097)	0.874 (0.039)	0.858 (0.061)	0.877 (0.078)
NLOPT-LN-PRAXIS	0.5	0.914 (0.010)	**0.901 (0.019)**	0.878 (0.020)	0.889 (0.013)	0.908 (0.011)
NLOPT-LN-PRAXIS	0.7	**0.918 (0.010)**	**0.913 (0.016)**	0.875 (0.021)	**0.894 (0.013)**	**0.911 (0.011)**
NLOPT-LN-PRAXIS	0.9	**0.920 (0.008)**	**0.920 (0.014)**	0.872 (0.018)	**0.895 (0.012)**	**0.911 (0.010)**
Nelder-Mead	0.3	0.834 (0.080)	0.803 (0.084)	0.803 (0.062)	0.797 (0.050)	0.829 (0.062)
Nelder-Mead	0.5	0.684 (0.223)	0.678 (0.220)	0.856 (0.118)	0.717 (0.120)	0.714 (0.166)
Nelder-Mead	0.7	0.779 (0.169)	0.762 (0.169)	0.819 (0.094)	0.768 (0.096)	0.785 (0.127)
Nelder-Mead	0.9	0.766 (0.148)	0.755 (0.151)	0.762 (0.110)	0.737 (0.077)	0.765 (0.108)
SANN	0.3	0.855 (0.037)	0.784 (0.054)	0.884 (0.094)	0.824 (0.087)	0.860 (0.043)
SANN	0.5	0.888 (0.013)	0.845 (0.032)	0.878 (0.028)	0.860 (0.015)	0.886 (0.012)
SANN	0.7	0.886 (0.058)	0.873 (0.022)	0.833 (0.172)	0.870 (0.013)	0.877 (0.078)
SANN	0.9	0.879 (0.078)	0.891 (0.054)	0.799 (0.186)	0.854 (0.093)	0.865 (0.092)
naive	0.3	0.397 (0.013)	0.395 (0.013)	**1.000 (0.001)**	0.566 (0.013)	0.503 (0.003)
naive	0.5	0.482 (0.023)	0.431 (0.017)	**0.996 (0.003)**	0.602 (0.016)	0.572 (0.017)
naive	0.7	0.828 (0.019)	0.716 (0.030)	0.938 (0.015)	0.811 (0.018)	0.847 (0.015)
naive	0.9	0.898 (0.010)	0.899 (0.016)	0.835 (0.022)	0.865 (0.014)	0.887 (0.012)

Table 12. Summary Statistics for dset = wine-quality

optims	c	mean accuracy	mean precision	mean recall	mean f1 score	mean auc
BFGS	0.3	0.726 (0.270)	0.387 (0.151)	0.469 (0.287)	0.350 (0.112)	0.618 (0.080)
BFGS	0.5	0.812 (0.177)	0.472 (0.127)	0.417 (0.214)	0.395 (0.090)	**0.645 (0.065)**
BFGS	0.7	0.869 (0.024)	**0.546 (0.107)**	0.324 (0.097)	0.395 (0.072)	0.639 (0.039)
BFGS	0.9	0.874 (0.018)	0.566 (0.101)	0.322 (0.070)	0.405 (0.071)	0.641 (0.034)
CG	0.3	0.682 (0.304)	0.371 (0.159)	0.508 (0.301)	0.344 (0.108)	0.610 (0.081)
CG	0.5	0.805 (0.191)	0.472 (0.131)	0.424 (0.219)	**0.396 (0.088)**	0.644 (0.066)
CG	0.7	0.858 (0.082)	0.534 (0.116)	0.335 (0.131)	0.391 (0.072)	0.637 (0.041)
CG	0.9	0.729 (0.077)	0.328 (0.078)	**0.810 (0.146)**	**0.450 (0.064)**	**0.763 (0.044)**
NLOPT-LD-SLSQP	0.3	0.719 (0.277)	0.371 (0.154)	0.457 (0.297)	0.333 (0.119)	0.609 (0.080)
NLOPT-LD-SLSQP	0.5	0.819 (0.165)	0.474 (0.123)	0.405 (0.208)	0.392 (0.092)	0.644 (0.065)
NLOPT-LD-SLSQP	0.7	0.869 (0.024)	0.545 (0.107)	0.323 (0.097)	0.394 (0.072)	0.639 (0.038)
NLOPT-LD-SLSQP	0.9	0.874 (0.018)	0.566 (0.101)	0.322 (0.070)	0.405 (0.071)	0.641 (0.034)
NLOPT-LD-TNEWTON-PRECOND	0.3	0.711 (0.283)	0.381 (0.155)	0.482 (0.288)	0.349 (0.111)	0.615 (0.079)
NLOPT-LD-TNEWTON-PRECOND	0.5	0.812 (0.179)	0.476 (0.129)	0.415 (0.213)	0.395 (0.088)	**0.645 (0.065)**
NLOPT-LD-TNEWTON-PRECOND	0.7	0.841 (0.136)	0.529 (0.131)	0.350 (0.165)	0.387 (0.079)	0.634 (0.045)
NLOPT-LD-TNEWTON-PRECOND	0.9	0.675 (0.181)	0.325 (0.123)	0.791 (0.254)	0.408 (0.105)	0.725 (0.090)
NLOPT-LN-PRAXIS	0.3	0.742 (0.257)	0.384 (0.150)	0.435 (0.283)	0.338 (0.119)	0.613 (0.078)
NLOPT-LN-PRAXIS	0.5	0.836 (0.133)	0.488 (0.110)	0.381 (0.184)	0.393 (0.088)	0.644 (0.059)
NLOPT-LN-PRAXIS	0.7	0.865 (0.019)	0.327 (0.357)	0.045 (0.114)	0.228 (0.187)	0.519 (0.050)
NLOPT-LN-PRAXIS	0.9	0.867 (0.018)	0.414 (0.322)	0.066 (0.129)	0.290 (0.174)	0.529 (0.058)
Nelder-Mead	0.3	0.638 (0.305)	0.352 (0.162)	0.611 (0.310)	**0.358 (0.111)**	**0.627 (0.090)**
Nelder-Mead	0.5	0.688 (0.295)	0.400 (0.174)	0.527 (0.305)	0.359 (0.104)	0.619 (0.077)
Nelder-Mead	0.7	0.768 (0.245)	0.478 (0.170)	0.423 (0.268)	0.369 (0.092)	0.622 (0.064)
Nelder-Mead	0.9	0.844 (0.116)	0.517 (0.143)	0.311 (0.208)	0.340 (0.114)	0.620 (0.066)
SANN	0.3	**0.836 (0.108)**	**0.401 (0.157)**	0.287 (0.236)	0.350 (0.125)	0.604 (0.081)
SANN	0.5	**0.864 (0.034)**	**0.496 (0.162)**	0.247 (0.184)	0.360 (0.126)	0.604 (0.076)
SANN	0.7	**0.870 (0.019)**	0.543 (0.144)	0.279 (0.129)	0.378 (0.099)	0.621 (0.057)
SANN	0.9	0.866 (0.076)	0.560 (0.114)	0.291 (0.125)	0.387 (0.079)	0.624 (0.049)
naive	0.3	0.136 (0.019)	0.135 (0.018)	**1.000 (0.002)**	0.238 (0.029)	0.500 (0.002)
naive	0.5	0.397 (0.077)	0.183 (0.029)	**0.982 (0.023)**	0.307 (0.042)	0.644 (0.043)
naive	0.7	0.826 (0.027)	0.418 (0.068)	**0.683 (0.082)**	**0.514 (0.060)**	**0.766 (0.037)**
naive	0.9	**0.876 (0.018)**	**0.622 (0.115)**	0.234 (0.079)	0.331 (0.086)	0.606 (0.037)