附 录

A 论文完整实验结果

A.1 表 4.8 的完整结果

表 A.1 为第四章中 4.2.7 节处表 4.8 的完整结果。主要记录了第四章提出的 MNESG-EL 算法与现有经典集成学习算法在 ACC、AUC、F-M 和 G-M 四个评价指标的对比结果。

表 4.8 与经典集成学习算法比较

Table 4.8 Comparison with classical ensemble learning algorithms

数据集	Glass1				Wisconsin			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.7526 ±0.0872	0.7400 ±0.0747	0.6727 ±0.0763	0.7364 ±0.0728	0.9648 ±0.0095	0.9611 ±0.0138	0.9501 ±0.0138	0.9609 ±0.0139
UBAG	0.7430 ±0.0882	0.7549 ±0.0817	0.6903 ±0.0807	0.7508 ±0.0826	0.9582 ±0.0119	0.9609 ±0.0112	0.9445 ±0.0137	0.9607 ±0.0114
SBO	0.8354 ±0.0596	0.7839 ±0.0652	0.7232 ±0.0830	0.7767 ±0.0659	0.9648 ±0.0141	0.9652 ±0.0145	0.9506 ±0.0196	0.9651 ±0.0145
RBO	0.7663 ±0.0717	0.7724 ±0.0864	0.7043 ±0.0911	0.7702 ±0.0838	0.9736 ±0.0083	0.9739 ±0.0111	0.9627 ±0.0120	0.9738 ±0.0113
EBO	0.7860 ±0.0812	0.8013 ±0.0695	0.7440 ±0.0683	0.7979 ±0.0745	0.9546 ±0.0141	0.9526 ±0.0154	0.9358 ±0.0194	0.9522 ±0.0157
BAC	0.7055 ±0.0693	0.7274 ±0.0738	0.6599 ±0.0703	0.7218 ±0.0741	0.9657 ±0.0095	0.9473 ±0.0132	0.9658 ±0.0095	0.9619 ±0.0095
Easy	0.6903 ±0.0926	0.7127 ±0.0962	0.6468 ±0.0963	0.7079 ±0.0957	0.9619 ±0.0119	0.9610 ±0.0117	0.9463 ±0.0166	0.9610 ±0.0117
MNESG-EL(default)	0.7614 ±0.0835	0.7757 ±0.0403	0.7130 ±0.0393	0.7543 ±0.0615	0.9780 ±0.0052	0.9812 ±0.0048	0.9694 ±0.0070	0.9811 ±0.0048
MNESG-EL	**0.9721 ±0.0104**	**0.9662 ±0.0011**	**0.9599 ±0.0125**	**0.9656 ±0.0011**	**0.9898 ±0.0083**	**0.9921 ±0.0064**	**0.9857 ±0.0115**	**0.9921 ±0.0065**
数据集	Pima				Iris0			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.7590 ±0.0158	0.7274 ±0.0155	0.6434 ±0.0212	0.7196 ±0.0165	0.9866 ±0.0182	0.9800 ±0.0273	0.9789 ±0.0288	0.9794 ±0.0281

表 4.8 与经典集成学习算法比较（续）

Table 4.8 Comparison with classical ensemble learning algorithms (continued)

数据集	Pima				Iris0			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
UBAG	0.7214 ±0.0408	0.7383 ±0.0352	0.6666 ±0.0356	0.7355 ±0.0363	0.9866 ±0.0182	0.9800 ±0.0273	0.9789 ±0.0288	0.9794 ±0.0281
SBO	0.7408 ±0.0356	0.7291 ±0.0529	0.6469 ±0.0697	0.7257 ±0.0575	0.9933 ±0.0149	0.9900 ±0.0223	0.9894 ±0.0235	0.9897 ±0.0229
RBO	0.7356 ±0.0309	0.7293 ±0.0337	0.6511 ±0.0414	0.7278 ±0.0342	0.9933 ±0.0149	0.9900 ±0.0223	0.9894 ±0.0235	0.9897 ±0.0229
EBO	0.7792 ±0.0480	0.7566 ±0.0392	0.6852 ±0.0437	0.7541 ±0.0379	0.9933 ±0.0149	0.9900 ±0.0223	0.9894 ±0.0235	0.9897 ±0.0229
BAC	0.6901 ±0.0307	0.7020 ±0.0256	0.6252 ±0.0277	0.6982 ±0.0258	**1±0**	**1±0**	**1±0**	**1±0**
Easy	0.7143 ±0.0306	0.7124 ±0.0423	0.6344 ±0.0512	0.7114 ±0.0423	0.9933 ±0.0149	0.9900 ±0.0223	0.9894 ±0.0235	0.9897 ±0.0229
MNESG-EL(default)	0.7435 ±0.0349	0.7220 ±0.0475	0.6223 ±0.1029	0.6945 ±0.0933	**1±0**	**1±0**	**1±0**	**1±0**
MNESG-EL	**0.8243 ±0.0302**	**0.7954 ±0.0343**	**0.7327 ±0.0494**	**0.7823 ±0.0460**	**1±0**	**1±0**	**1±0**	**1±0**
数据集	Yeast1				Haberman			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.7030 ±0.0246	0.6924 ±0.0239	0.5621 ±0.0347	0.6855 ±0.0331	0.6532 ±0.0654	0.6304 ±0.0521	0.4698 ±0.0637	0.6208 ±0.0463
UBAG	0.7263 ±0.0239	0.7210 ±0.0347	0.5989 ±0.0418	0.7204 ±0.0351	0.6598 ±0.0565	0.6422 ±0.0476	0.4861 ±0.0640	0.6188 ±0.0802
SBO	0.7183 ±0.0336	0.6946 ±0.0280	0.5648 ±0.0401	0.6865 ±0.0366	0.6370 ±0.0473	0.6145 ±0.0540	0.4517 ±0.0698	0.6096 ±0.0572
RBO	0.7398 ±0.0253	0.7104 ±0.0400	0.5864 ±0.0522	0.7066 ±0.0434	0.6575 ±0.0641	0.6639 ±0.0376	0.5076 ±0.0488	0.6575 ±0.0382
EBO	0.6913 ±0.0551	0.7081 ±0.0307	0.5857 ±0.0394	0.7032 ±0.0304	0.7018 ±0.0427	0.6548 ±0.0647	0.4901 ±0.0849	0.6375 ±0.0719
BAC	0.6440 ±0.0433	0.6794 ±0.0080	0.5885 ±0.0456	0.6696 ±0.0192	0.6172 ±0.0830	0.6210 ±0.0920	0.6581 ±0.1180	0.6189 ±0.0919

表 4.8 与经典集成学习算法比较（续）

Table 4.8 Comparison with classical ensemble learning algorithms (continued)

数据集	Yeast1				Haberman			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
Easy	0.6543 ±0.0207	0.6752 ±0.0144	0.5481 ±0.0146	0.6728 ±0.0156	0.6843 ±0.0758	0.6008 ±0.1185	0.3728 ±0.2543	0.5165 ±0.2490
MNESG-EL(default)	0.6914 ±0.0558	0.7028 ±0.0194	0.5788 ±0.0222	0.6957 ±0.0227	0.7284 ±0.1128	0.6819 ±0.0402	0.5259 ±0.0744	0.6333 ±0.0653
MNESG-EL	**0.7399 ±0.0516**	**0.7397 ±0.0239**	**0.6246 ±0.0357**	**0.7366 ±0.0211**	**0.9905 ±0.0130**	**0.9947 ±0.0072**	**0.9556 ±0.0609**	**0.9947 ±0.0073**
数据集	Vehicle2				Vehicle3			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9621 ±0.0130	0.9525 ±0.0245	0.9270 ±0.0261	0.9532 ±0.0244	0.7677 ±0.0092	0.7618 ±0.0170	0.6190 ±0.0195	0.7613 ±0.0177
UBAG	0.9566 ±0.0179	0.9536 ±0.0082	0.9235 ±0.0320	0.9599 ±0.0175	0.7411 ±0.0234	0.7768 ±0.0235	0.6213 ±0.0265	0.7720 ±0.0219
SBO	0.9657 ±0.0188	0.9661 ±0.0140	0.9328 ±0.0375	0.9660 ±0.0140	0.7718 ±0.0287	0.7441 ±0.0348	0.6015 ±0.0423	0.7402 ±0.0386
RBO	0.9621 ±0.0184	0.9671 ±0.0206	0.9304 ±0.0340	0.9669 ±0.0206	0.7564 ±0.0295	0.7493 ±0.0545	0.5993 ±0.0643	0.7464 ±0.0584
EBO	**0.9704 ±0.0200**	**0.9681 ±0.0210**	**0.9442 ±0.0373**	**0.9680 ±0.0212**	0.7494 ±0.0343	**0.7902 ±0.0315**	0.6364 ±0.0377	**0.7854 ±0.0312**
BAC	0.9515 ±0.0153	0.9539 ±0.0050	0.9114 ±0.0241	0.9536 ±0.0051	0.7055 ±0.0446	0.7360 ±0.0400	0.5765 ±0.0459	0.7314 ±0.0391
Easy	0.9455 ±0.0211	0.9559 ±0.0176	0.9031 ±0.0352	0.9555 ±0.0178	0.7257 ±0.0351	0.7386 ±0.0360	0.5830 ±0.0420	0.7377 ±0.0362
MNESG-EL(default)	0.9468 ±0.0120	0.9447 ±0.0146	0.9011 ±0.0218	0.9446 ±0.0146	0.7448 ±0.0397	0.7555 ±0.0376	0.6034 ±0.0442	0.7503 ±0.0401
MNESG-EL	0.9503 ±0.0456	0.9606 ±0.0313	0.9148 ±0.0694	0.9599 ±0.0325	**0.8120 ±0.0383**	0.7870 ±0.0509	**0.6601 ±0.0586**	0.7785 ±0.0612
数据集	Glass-0-1-2-3_vs_4-5-6				Vehicle0			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9203 ±0.0487	0.9198 ±0.0466	0.8509 ±0.0872	0.9183 ±0.0465	0.9337 ±0.0215	0.9359 ±0.0308	0.8703 ±0.0416	0.9355 ±0.0311

表 4.8 与经典集成学习算法比较（续）

Table 4.8 Comparison with classical ensemble learning algorithms (continued)

数据集	Glass-0-1-2-3_vs_4-5-6				Vehicle0			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
UBAG	0.8831 ±0.0520	0.8885 ±0.0503	0.7903 ±0.0863	0.8862 ±0.0491	0.9349 ±0.0131	0.9523 ±0.0189	0.8769 ±0.0251	0.9516 ±0.0187
SBO	0.9392 ±0.0390	0.9185 ±0.0514	0.8730 ±0.0807	0.9171 ±0.0524	0.9396 ±0.0252	0.9311 ±0.0385	0.8768 ±0.0519	0.9305 ±0.0389
RBO	0.9203 ±0.0428	0.9269 ±0.0324	0.8529 ±0.0740	0.9258 ±0.0322	0.9550 ±0.0106	0.9618 ±0.0138	0.9108 ±0.0206	0.9617 ±0.0137
EBO	0.9161 ±0.0533	0.9101 ±0.0514	0.8414 ±0.0880	0.9078 ±0.0522	0.9397 ±0.0234	0.9466 ±0.0279	0.8827 ±0.0440	0.9465 ±0.0278
BAC	0.9157 ±0.0359	0.8892 ±0.0517	0.8255 ±0.0715	0.9054 ±0.0435	0.9255 ±0.0239	0.9356 ±0.0223	0.8588 ±0.0393	0.9353 ±0.0225
Easy	0.9219 ±0.0268	0.9171 ±0.0313	0.8536 ±0.0521	0.9159 ±0.0319	0.9302 ±0.0224	0.9370 ±0.0312	0.8652 ±0.0418	0.9365 ±0.0315
MNESG-EL(default)	0.9628 ±0.0202	0.9548 ±0.0185	0.9254 ±0.0332	0.9539 ±0.0188	0.8208 ±0.0199	0.9007 ±0.0545	0.8336 ±0.0542	0.8966 ±0.0618
MNESG-EL	**0.9953 ±0.0104**	**0.9970 ±0.0068**	**0.9905 ±0.0213**	**0.9969 ±0.0068**	**0.9657 ±0.0190**	**0.9655 ±0.0118**	**0.9311 ±0.0349**	**0.9652 ±0.0119**
数据集	Ecoli1				Ecoli2			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.8814 ±0.0376	0.8998 ±0.0196	0.7865 ±0.0489	0.8975 ±0.0187	0.9168 ±0.0379	0.8926 ±0.0721	0.7606 ±0.1042	0.8870 ±0.0744
UBAG	0.8721 ±0.0540	0.8990 ±0.0501	0.7777 ±0.0761	0.8961 ±0.0510	0.8929 ±0.0408	0.8899 ±0.0353	0.7247 ±0.0834	0.8897 ±0.0353
SBO	0.8840 ±0.0436	0.8474 ±0.0587	0.7562 ±0.0916	0.8436 ±0.0621	0.9346 ±0.0301	0.9090 ±0.0786	0.8023 ±0.0962	0.9054 ±0.0842
RBO	0.8839 ±0.0266	0.9068 ±0.0290	0.7908 ±0.0348	0.9042 ±0.0289	0.9046 ±0.0252	0.8905 ±0.0332	0.7408 ±0.0364	0.8878 ±0.0356
EBO	0.8750 ±0.0734	0.8918 ±0.0578	0.7820 ±0.0953	0.8878 ±0.0616	0.8990 ±0.0570	0.8862 ±0.0639	0.7357 ±0.1204	0.8857 ±0.0645
BAC	0.8600 ±0.0584	0.8637 ±0.0439	0.7475 ±0.0773	0.8616 ±0.0434	0.8539 ±0.0376	0.8670 ±0.0341	0.6552 ±0.0653	0.8653 ±0.0332

表 4.8 与经典集成学习算法比较（续）

Table 4.8 Comparison with classical ensemble learning algorithms (continued)

数据集	Ecoli1				Ecoli2			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
Easy	0.8481 ±0.0611	0.8698 ±0.0564	0.7383 ±0.0855	0.8666 ±0.0570	0.8212 ±0.0427	0.8485 ±0.0298	0.6095 ±0.0525	0.8459 ±0.0284
MNESG-EL(default)	0.9139 ±0.0504	0.9070 ±0.0425	0.8331 ±0.0843	0.9046 ±0.0453	0.9316 ±0.0266	0.9202 ±0.0526	0.8035 ±0.0748	0.9191 ±0.0534
MNESG-EL	**0.9910 ±0.0082**	**0.9800 ±0.0183**	**0.9793 ±0.0189**	**0.9797 ±0.0186**	**0.9761 ±0.0257**	**0.9538 ±0.0291**	**0.9242 ±0.0787**	**0.9532 ±0.0293**
数据集	Glass6				Yeast3			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9346 ±0.0191	0.8923 ±0.0965	0.7657 ±0.1005	0.8836 ±0.1123	0.9413 ±0.0218	0.9401 ±0.0197	0.7822 ±0.0661	0.9401 ±0.0197
UBAG	0.8972 ±0.0421	0.9159 ±0.0576	0.7159 ±0.0953	0.9115 ±0.0553	0.9279 ±0.0258	0.9353 ±0.0155	0.7472 ±0.0673	0.9350 ±0.0156
SBO	0.9345 ±0.0106	0.8504 ±0.0815	0.7447 ±0.0615	0.8353 ±0.0970	0.9386 ±0.0086	0.8795 ±0.0148	0.7427 ±0.0290	0.8761 ±0.0157
RBO	0.9108 ±0.0518	0.9227 ±0.0342	0.7507 ±0.1082	0.9182 ±0.0340	0.9225 ±0.0263	0.9188 ±0.0240	0.7260 ±0.0698	0.9188 ±0.0240
EBO	0.8877 ±0.0894	0.8932 ±0.0700	0.7121 ±0.1598	0.8912 ±0.0701	0.9198 ±0.0252	0.9281 ±0.0166	0.7244 ±0.0597	0.9277 ±0.0168
BAC	0.8875 ±0.0395	0.8932 ±0.0359	0.6893 ±0.0791	0.8913 ±0.0352	0.9076 ±0.0257	0.9079 ±0.0316	0.6871 ±0.0697	0.9079 ±0.0316
Easy	0.8550 ±0.0387	0.8463 ±0.0935	0.6050 ±0.1065	0.8390 ±0.1036	0.9130 ±0.0222	0.9109 ±0.0274	0.6989 ±0.0580	0.9108 ±0.0274
MNESG-EL(default)	0.9673 ±0.0126	0.9359 ±0.0408	0.8823 ±0.0369	0.9333 ±0.0429	0.9373 ±0.0182	0.8819 ±0.0776	0.7349 ±0.0974	0.8753 ±0.0897
MNESG-EL	**0.9766 ±0.0233**	**0.9586 ±0.0709**	**0.9132 ±0.0881**	**0.9551 ±0.0783**	**0.9905 ±0.0130**	**0.9947 ±0.0072**	**0.9556 ±0.0609**	**0.9947 ±0.0073**
数据集	Ecoli3				Yeast-2-vs-4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.8898 ±0.0227	0.8754 ±0.0467	0.6197 ±0.0525	0.8736 ±0.0481	0.9163 ±0.0108	0.8910 ±0.0753	0.6664 ±0.0600	0.8861 ±0.0830

表 4.8 与经典集成学习算法比较（续）

Table 4.8 Comparison with classical ensemble learning algorithms (continued)

数据集	Ecoli3				Yeast-2-vs-4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
UBAG	0.8424 ±0.0520	0.8994 ±0.0386	0.5710 ±0.0843	0.8955 ±0.0396	0.9124 ±0.0305	0.9335 ±0.0229	0.6914 ±0.0662	0.9324 ±0.0229
SBO	0.9107 ±0.0179	0.8744 ±0.0735	0.6563 ±0.0814	0.8693 ±0.0823	0.9435 ±0.0187	0.8893 ±0.0455	0.7428 ±0.0829	0.9058 ±0.0581
RBO	0.8720 ±0.0522	0.8402 ±0.0332	0.5778 ±0.0686	0.8346 ±0.0337	0.9299 ±0.0371	0.9263 ±0.0296	0.7342 ±0.0819	0.9247 ±0.0309
EBO	0.8621 ±0.0174	0.8605 ±0.0746	0.5621 ±0.0549	0.8552 ±0.0810	0.9144 ±0.0510	0.9267 ±0.0196	0.7024 ±0.1029	0.9253 ±0.0209
BAC	0.8090 ±0.1216	0.8112 ±0.0749	0.4820 ±0.1089	0.7996 ±0.0831	0.9066 ±0.0520	0.8866 ±0.0358	0.6632 ±0.0875	0.8827 ±0.0396
Easy	0.8451 ±0.0822	0.8504 ±0.0463	0.5544 ±0.0845	0.8439 ±0.0493	0.9046 ±0.0221	0.9212 ±0.0433	0.6642 ±0.0618	0.9199 ±0.0435
MNESG-EL(default)	0.8958 ±0.0153	0.9166 ±0.0357	0.6539 ±0.0376	0.9154 ±0.0350	0.9590 ±0.0273	0.9068 ±0.0702	0.8080 ±0.1153	0.9006 ±0.0796
MNESG-EL	**0.9628 ±0.0584**	**0.9442 ±0.0516**	**0.8806 ±0.1533**	**0.9413 ±0.0544**	**0.9845 ±0.0128**	**0.9833 ±0.0251**	**0.9286 ±0.0532**	**0.9832 ±0.0253**
数据集	Yeast-0-5-6-7-9-vs-4				Glass-0-1-6_vs_2			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.8541 ±0.0340	0.8217 ±0.0822	0.5089 ±0.1030	0.8165 ±0.0885	0.8331 ±0.0475	0.6676 ±0.1698	0.4020 ±0.1666	0.5605 ±0.3434
UBAG	0.7916 ±0.0179	0.7969 ±0.0385	0.4271 ±0.0403	0.7963 ±0.0386	0.6667 ±0.0261	0.7035 ±0.1160	0.2771 ±0.0862	0.6863 ±0.1213
SBO	0.8900 ±0.0321	0.7727 ±0.0907	0.5235 ±0.1359	0.7523 ±0.1114	0.8491 ±0.0423	0.6014 ±0.1304	0.3234 ±0.1658	0.4569 ±0.2871
RBO	0.8351 ±0.0295	0.7862 ±0.0899	0.4581 ±0.0987	0.7788 ±0.0982	0.7809 ±0.0607	0.6999 ±0.1416	0.3196 ±0.1500	0.6692 ±0.1733
EBO	0.8180 ±0.0324	0.8206 ±0.0471	0.4692 ±0.0679	0.8197 ±0.0473	0.7182 ±0.0896	0.7930 ±0.1055	0.3669 ±0.1032	0.7851 ±0.1015
BAC	0.7557 ±0.0313	0.7511 ±0.0658	0.3686 ±0.0432	0.7456 ±0.0636	0.6300 ±0.1074	0.6254 ±0.1762	0.2199 ±0.0984	0.5965 ±0.1821

表 4.8 与经典集成学习算法比较（续）

Table 4.8 Comparison with classical ensemble learning algorithms (continued)

数据集	Yeast-0-5-6-7-9-vs-4				Glass-0-1-6_vs_2			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
Easy	0.8047 ±0.0516	0.7801 ±0.0640	0.4298 ±0.0675	0.7757 ±0.0693	0.6345 ±0.1013	0.7390 ±0.1278	0.3066 ±0.1166	0.7259 ±0.1226
MNESG-EL(default)	0.8146 ±0.0478	0.8176 ±0.0934	0.4618 ±0.0965	0.8112 ±0.1015	0.8961 ±0.0019	0.6244 ±0.0194	0.3333 ±0.0006	0.5267 ±0.0479
MNESG-EL	**0.9263 ±0.0039**	**0.9235 ±0.0779**	**0.6977 ±0.0370**	**0.9184 ±0.0873**	**0.9795 ±0.0115**	**0.9000 ±0.0559**	**0.8857 ±0.0639**	**0.8928 ±0.0599**
数据集	Glass2				Yeast-1-vs-7			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.8174 ±0.0518	0.7019 ±0.1399	0.3847 ±0.1180	0.6077 ±0.3421	0.8237 ±0.0556	0.7208 ±0.0367	0.3174 ±0.0480	0.7074 ±0.0455
UBAG	0.5888 ±0.0579	0.7766 ±0.0316	0.2796 ±0.0375	0.7428 ±0.0422	0.7363 ±0.0262	0.6883 ±0.0798	0.2361 ±0.0525	0.6778 ±0.0981
SBO	0.8594 ±0.0585	0.7330 ±0.0945	0.4141 ±0.1420	0.7114 ±0.1150	0.8065 ±0.0742	0.7259 ±0.0319	0.3142 ±0.0662	0.7170 ±0.0356
RBO	0.7662 ±0.1562	0.6375 ±0.1506	0.3190 ±0.2350	0.6110 ±0.1610	**0.8257 ±0.0558**	0.7827 ±0.0943	0.3601 ±0.0813	0.7749 ±0.1005
EBO	0.7053 ±0.0626	0.7646 ±0.0711	0.3129 ±0.0714	0.7569 ±0.0638	0.7996 ±0.0336	0.7222 ±0.1005	0.2946 ±0.0899	0.7105 ±0.1192
BAC	0.5750 ±0.1166	0.6174 ±0.1515	0.2064 ±0.0854	0.6134 ±0.1478	0.6404 ±0.0785	0.6526 ±0.1016	0.1974 ±0.0634	0.6425 ±0.1109
Easy	0.5933 ±0.1077	0.7795 ±0.0565	0.2903 ±0.0845	0.7445 ±0.0766	0.6817 ±0.0821	0.7212 ±0.0346	0.2425 ±0.0201	0.7113 ±0.0416
MNESG-EL(default)	0.6957 ±0.1946	0.7595 ±0.0043	0.3018 ±0.0874	0.7378 ±0.0187	0.6455 ±0.1230	0.8023 ±0.0658	0.2690 ±0.0662	0.7753 ±0.0848
MNESG-EL	**0.9814 ±0.0104**	**0.8607 ±0.0745**	**0.8400 ±0.0894**	**0.8532 ±0.0821**	0.8110 ±0.0531	**0.8214 ±0.0294**	**0.3732 ±0.0614**	**0.8210 ±0.0291**
数据集	Glass4				Ecoli4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9060 ±0.0610	0.9025 ±0.0885	0.5733 ±0.1382	0.8921 ±0.1066	0.9524 ±0.0193	0.8810 ±0.0497	0.7463 ±0.1452	0.8753 ±0.0523

表 4.8 与经典集成学习算法比较（续）

Table 4.8 Comparison with classical ensemble learning algorithms (continued)

数据集	Glass4				Ecoli4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
UBAG	0.8773 ±0.0577	0.8593 ±0.1031	0.4666 ±0.1027	0.8487 ±0.1153	0.8363 ±0.0802	0.8427 ±0.0773	0.4118 ±0.1298	0.8394 ±0.0756
SBO	0.9343 ±0.0355	0.8866 ±0.1011	0.6189 ±0.1166	0.8749 ±0.1178	0.9582 ±0.0164	0.8373 ±0.0964	0.6666 ±0.1020	0.8177 ±0.1151
RBO	0.9018 ±0.0665	0.9004 ±0.1392	0.5563 ±0.2347	0.8962 ±0.1469	0.8927 ±0.0867	0.8961 ±0.0714	0.5680 ±0.2540	0.8920 ±0.0737
EBO	0.8975 ±0.1390	0.8666 ±0.1520	0.6187 ±0.2352	0.8578 ±0.1610	0.8600 ±0.1016	0.9021 ±0.1029	0.5121 ±0.2370	0.9005 ±0.1026
BAC	0.8036 ±0.0881	0.8480 ±0.1249	0.3915 ±0.2176	0.8393 ±0.1301	0.8539 ±0.0492	0.8989 ±0.0593	0.4491 ±0.1020	0.8956 ±0.0596
Easy	0.8693 ±0.0706	0.8208 ±0.1130	0.4389 ±0.1094	0.8108 ±0.1214	0.8869 ±0.0248	0.8930 ±0.0531	0.4888 ±0.0248	0.8897 ±0.0541
MNESG-EL(default)	0.9765 ±0.0001	0.9104 ±0.1090	0.8000 ±0.0001	0.9020 ±0.1209	0.9045 ±0.0977	0.9258 ±0.0542	0.6436 ±0.2550	0.9214 ±0.0582
MNESG-EL	**0.9902 ±0.0134**	**0.9949 ±0.0070**	**0.9200 ±0.1095**	**0.9948 ±0.0071**	**0.9911 ±0.0081**	**0.9953 ±0.0043**	**0.9333 ±0.0609**	**0.9952 ±0.0043**
数据集	Abalone9-18				Shuttle-c2-vs-c4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.8617 ±0.0601	0.7257 ±0.1537	0.3392 ±0.1904	0.6932 ±0.1850	0.9221 ±0.0109	0.9558 ±0.0077	0.6334 ±0.0383	0.9551 ±0.0076
UBAG	0.7369 ±0.0566	0.7819 ±0.0526	0.2755 ±0.0453	0.7770 ±0.0536	0.9384 ±0.0842	0.9473 ±0.0447	0.7666 ±0.3248	0.9658 ±0.0467
SBO	0.9137 ±0.0458	0.7533 ±0.1430	0.4560 ±0.2876	0.7149 ±0.1897	0.9340 ±0.0241	0.9114 ±0.0904	0.6269 ±0.0362	0.9027 ±0.1095
RBO	0.8002 ±0.0353	0.7906 ±0.0992	0.3146 ±0.0807	0.7834 ±0.1052	0.9692 ±0.0688	0.9840 ±0.0357	0.8666 ±0.2981	0.9833 ±0.0373
EBO	0.7523 ±0.0597	0.7326 ±0.0941	0.2504 ±0.0572	0.7196 ±0.1073	**1±0**	**1±0**	**1±0**	**1±0**
BAC	0.7358 ±0.0713	0.7502 ±0.1094	0.2628 ±0.0932	0.7463 ±0.1094	**1±0**	**1±0**	**1±0**	**1±0**

表 4.8 与经典集成学习算法比较（续）

Table 4.8 Comparison with classical ensemble learning algorithms (continued)

数据集	Abalone9-18				Shuttle-c2-vs-c4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
Easy	0.6880 ±0.0665	0.7220 ±0.0595	0.2257 ±0.0444	0.7165 ±0.0586	**1±0**	**1±0**	**1±0**	**1±0**
MNESG-EL(default)	0.9110 ±0.0581	0.8057 ±0.0724	0.4882 ±0.2028	0.7968 ±0.0756	**1±0**	**1±0**	**1±0**	**1±0**
MNESG-EL	**0.9623 ±0.0048**	**0.9212 ±0.0807**	**0.7166 ±0.0151**	**0.9173 ±0.0859**	**1±0**	**1±0**	**1±0**	**1±0**
数据集	Glass5				Yeast-2-vs-8			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9488 ±0.0382	0.9256 ±0.0998	0.6619 ±0.1980	0.9164 ±0.1185	0.9584 ±0.0181	0.8109 ±0.1566	0.5473 ±0.1410	0.7697 ±0.2034
UBAG	0.9495 ±0.0310	0.5266 ±0.2712	**0.9512 ±0.0298**	0.9065 ±0.0569	0.7590 ±0.1437	0.7307 ±0.1349	0.2327 ±0.1257	0.7215 ±0.1378
SBO	0.9673 ±0.0126	0.9353 ±0.1037	0.6933 ±0.0596	0.9266 ±0.1228	0.9646 ±0.0174	0.7902 ±0.1070	0.5833 ±0.1666	0.7528 ±0.1564
RBO	0.8976 ±0.0879	0.9463 ±0.0461	0.5815 ±0.3015	0.9438 ±0.0487	0.9335 ±0.0059	0.8457 ±0.0030	0.4846 ±0.0210	0.8403 ±0.0027
EBO	0.9297 ±0.0572	0.9634 ±0.0298	0.6066 ±0.2832	0.9623 ±0.0310	0.7820 ±0.0375	0.7666 ±0.0844	0.2238 ±0.0514	0.7613 ±0.0878
BAC	0.9018 ±0.0476	0.9487 ±0.0249	0.4866 ±0.1849	0.9471 ±0.0261	0.6823 ±0.0972	0.7625 ±0.1149	0.1910 ±0.0758	0.7485 ±0.1142
Easy	0.9390 ±0.0538	0.9682 ±0.0280	0.6266 ±0.2385	0.9674 ±0.0292	0.7637 ±0.0961	0.7571 ±0.1331	0.2214 ±0.0736	0.7471 ±0.1340
MNESG-EL(default)	**0.9884 ±0.0164**	**0.9939 ±0.0086**	0.9000 ±0.1414	**0.9939 ±0.0087**	0.8961 ±0.0927	0.7066 ±0.1603	0.3026 ±0.0901	0.6246 ±0.2253
MNESG-EL	**0.9884 ±0.0164**	**0.9939 ±0.0086**	0.9000 ±0.1414	**0.9939 ±0.0087**	**0.9792 ±0.0121**	**0.8696 ±0.0978**	**0.7532 ±0.1358**	**0.8547 ±0.1152**
数据集	Yeast4				Winequality-red-4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.7978 ±0.0482	0.8339 ±0.0374	0.2345 ±0.0278	0.8307 ±0.0327	0.8930 ±0.0156	0.6523 ±0.0732	0.1970 ±0.0716	0.5921 ±0.1039

表 4.8 与经典集成学习算法比较（续）

Table 4.8 Comparison with classical ensemble learning algorithms (continued)

数据集	Yeast4				Winequality-red-4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
UBAG	0.7742 ±0.0275	0.8452 ±0.0970	0.2097 ±0.0219	0.8179 ±0.0717	0.6897 ±0.0454	0.6666 ±0.0750	0.1206 ±0.0285	0.6600 ±0.0797
SBO	0.8215 ±0.0885	0.7979 ±0.0779	0.2466 ±0.0488	0.7835 ±0.0916	0.9392 ±0.0047	0.5867 ±0.0582	0.2180 ±0.0403	0.3999 ±0.2266
RBO	0.8200 ±0.0347	0.8199 ±0.0472	0.2398 ±0.0170	0.8165 ±0.0462	0.8116 ±0.0324	0.6228 ±0.0453	0.1330 ±0.0335	0.5879 ±0.0552
EBO	0.8126 ±0.0403	0.8372 ±0.0611	0.2437 ±0.0397	0.8340 ±0.0594	0.7535 ±0.0876	0.6110 ±0.0788	0.1051 ±0.0124	0.5630 ±0.1616
BAC	0.7850 ±0.0532	0.7747 ±0.0966	0.2031 ±0.0592	0.7710 ±0.1002	0.6113 ±0.0831	0.6500 ±0.0791	0.1021 ±0.0186	0.6335 ±0.0727
Easy	0.7998 ±0.0588	0.8191 ±0.0865	0.2337 ±0.0750	0.8159 ±0.0880	0.6611 ±0.1143	0.6403 ±0.0669	0.1083 ±0.0217	0.6206 ±0.0824
MNESG-EL(default)	0.8653 **±0.0190**	**0.8579** **±0.0243**	0.2990 ±0.0123	**0.8573** **±0.0247**	0.6953 ±0.1522	**0.7326** **±0.0554**	0.1584 ±0.0331	**0.7074** **±0.0423**
MNESG-EL	**0.9097** **±0.0142**	0.8209 ±0.0693	**0.3553** **±0.0457**	0.8122 ±0.0781	**0.9677** **±0.0018**	0.6034 ±0.1003	**0.2699** **±0.1787**	0.4239 ±0.2120
数据集	Yeast-1-2-8-9-vs-7				Yeast5			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.8253 ±0.0177	0.6711 ±0.1485	0.1498 ±0.0788	0.6200 ±0.2011	0.9703 ±0.0122	**0.9618** **±0.0320**	0.6669 ±0.0925	**0.9612** **±0.0325**
UBAG	0.7285 ±0.0661	0.7147 ±0.0517	0.1423 ±0.0212	0.7089 ±0.0561	0.9393 ±0.0189	0.9458 ±0.0293	0.4917 ±0.0811	0.9451 ±0.0294
SBO	0.8171 ±0.0096	0.7299 ±0.1313	0.1851 ±0.0714	0.7065 ±0.1625	**0.9757** **±0.0087**	0.9444 ±0.0555	**0.7018** **±0.0541**	0.9418 ±0.0589
RBO	0.8456 ±0.0239	0.7389 ±0.0896	0.1992 ±0.0365	0.7191 ±0.1208	0.9440 ±0.1475	0.9604 ±0.0282	0.5158 ±0.0678	0.9600 ±0.0282
EBO	0.7696 ±0.0990	0.6714 ±0.0611	0.1440 ±0.0471	0.6537 ±0.0801	0.9602 ±0.0096	0.9458 ±0.0308	0.5849 ±0.0624	0.9452 ±0.0312
BAC	0.6472 ±0.0484	0.6727 ±0.0260	0.1122 ±0.0093	0.6702 ±0.0229	0.9333 ±0.0197	0.9534 ±0.0220	0.4736 ±0.0642	0.9526 ±0.0221

表 4.8 与经典集成学习算法比较（续）

Table 4.8 Comparison with classical ensemble learning algorithms (continued)

数据集	Yeast-1-2-8-9-vs-7				Yeast5			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
Easy	0.5957 ±0.1497	0.6783 ±0.0562	0.1130 ±0.0231	0.6591 ±0.0712	0.9198 ±0.0191	0.9479 ±0.0223	0.4253 ±0.0464	0.9470 ±0.0222
MNESG-EL(default)	0.6943 ±0.1227	0.7919 ±0.0580	0.1916 ±0.1012	0.7826 ±0.0852	0.9158 ±0.0381	0.9566 ±0.0196	0.4342 ±0.1065	0.9554 ±0.0207
MNESG-EL	**0.8468 ±0.0976**	**0.8000 ±0.0066**	**0.2628 ±0.0997**	**0.7954 ±0.0137**	0.9636 ±0.0140	0.9597 ±0.0291	0.6231 ±0.0788	0.9592 ±0.0295
数据集	Yeast6				Winequality-white-3_vs_7			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9521 ±0.0114	0.8360 ±0.1076	0.4103 ±0.0799	0.8179 ±0.1288	0.9333 ±0.0143	0.6605 ±0.0675	0.1980 ±0.0557	0.5865 ±0.1133
UBAG	0.8679 ±0.0335	0.8766 ±0.0594	0.2466 ±0.0502	0.8746 ±0.0593	0.7411 ±0.0529	0.7698 ±0.0618	0.1237 ±0.0255	0.7674 ±0.0581
SBO	**0.9676 ±0.0084**	0.7743 ±0.1489	**0.4407 ±0.1667**	0.7252 ±0.1973	0.9518 ±0.0032	0.7310 ±0.1207	0.3025 ±0.1000	0.6772 ±0.1771
RBO	0.8746 ±0.0377	0.8382 ±0.0795	0.2353 ±0.0390	0.8307 ±0.0848	0.7866 ±0.0873	0.7198 ±0.1365	0.1347 ±0.0713	0.7101 ±0.1409
EBO	0.8712 ±0.0517	0.8225 ±0.1086	0.2206 ±0.0575	0.8135 ±0.1236	0.7688 ±0.0550	0.7107 ±0.1565	0.1176 ±0.0589	0.6940 ±0.1782
BAC	0.7776 ±0.0334	0.8162 ±0.0426	0.1548 ±0.0158	0.8135 ±0.0405	0.7069± 0.0517	0.7279 ±0.1075	0.1043 ±0.0323	0.7223 ±0.1054
Easy	0.7755 ±0.0493	0.8293 ±0.0513	0.1603 ±0.0266	0.8246 ±0.0488	0.5966 ±0.1318	0.6715 ±0.0420	0.0779 ±0.0115	0.6521 ±0.0527
MNESG-EL(default)	0.8814 ±0.0237	**0.8974 ±0.0921**	0.2685 ±0.0570	**0.8921 ±0.0994**	0.8694 ±0.0904	**0.8111 ±0.0462**	0.2398 ±0.1322	**0.8082 ±0.0429**
MNESG-EL	0.9137 ±0.0173	0.8868 ±0.0170	0.3234 ±0.0472	0.8861 ±0.0175	**0.9889 ±0.0045**	0.8111 ±0.0722	**0.7113 ±0.1216**	0.7855 ±0.0916
数据集	Winequality-red-8_vs_6-7				Kr-vs-k-zero_vs_eight			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9005 ±0.0354	0.7349 ±0.0847	0.1937 ±0.0712	0.7054 ±0.1165	0.9294 ±0.0140	0.9564 ±0.0120	0.6436 ±0.0659	0.9562 ±0.0118

表 4.8 与经典集成学习算法比较（续）

Table 4.8 Comparison with classical ensemble learning algorithms (continued)

数据集	Winequality-red-8_vs_6-7				Kr-vs-k-zero_vs_eight			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
UBAG	0.6596 ±0.0886	0.7446 ±0.0555	0.0956 ±0.230	0.7323 ±0.0490	0.8376 ±0.0610	0.8779 ±0.0683	0.1802 ±0.0277	0.8704 ±0.0744
SBO	**0.9502 ±0.0139**	0.7298 ±0.1264	**0.2955 ±0.1582**	0.6764 ±0.1776	0.9374 ±0.0122	0.9177 ±0.0611	0.6434 ±0.0661	0.9151 ±0.0642
RBO	0.8070 ±0.0423	0.7139 ±0.1216	0.1151 ±0.0452	0.6886 ±0.1536	0.8945 ±0.0467	0.9462 ±0.0238	0.2836 ±0.0897	0.9444 ±0.0252
EBO	0.6830 ±0.1012	0.6750 ±0.0523	0.0813 ±0.0108	0.6610 ±0.0447	0.9095 ±0.0337	0.9539 ±0.0172	0.3081 ±0.0860	0.9526 ±0.0180
BAC	0.6783 ±0.1094	0.7625 ±0.1077	0.1043 ±0.0379	0.7467 ±0.1106	0.8362 ±0.0679	0.9165 ±0.0347	0.1970 ±0.0545	0.9128 ±0.0391
Easy	0.6549 ±0.0726	0.6933 ±0.1589	0.0819 ±0.0382	0.6748 ±0.1727	0.8602 ±0.0333	0.8732 ±0.0909	0.1979 ±0.0683	0.8693 ±0.0940
MNESG-EL(default)	0.6932 ±0.1517	0.6599 ±0.0788	0.1222 ±0.0629	0.5730 ±0.1182	0.9534 ±0.0093	0.9436 ±0.0745	0.4269 ±0.0647	0.9408 ±0.0801
MNESG-EL	0.8302 ±0.1735	**0.9136 ±0.0082**	0.2679 ±0.2273	**0.9069 ±0.0974**	**0.9932 ±0.0080**	**0.9965 ±0.0041**	**0.8684 ±0.0239**	**0.9965 ±0.0041**

数据集	Shuttle-2_vs_5				Kddcup-buffer_overflow_vs_back			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	**1±0**	**1±0**	**1±0**	**1±0**	0.9996 ±0.0010	0.9833 ±0.0373	0.9818 ±0.0407	0.9826 ±0.0390
UBAG	**1±0**	**1±0**	**1±0**	**1±0**	0.9861 ±0.0168	0.9929 ±0.0085	0.7471 ±0.2704	0.9929 ±0.0086
SBO	**1±0**	**1±0**	**1±0**	**1±0**	0.9986 ±0.0020	0.9828 ±0.0370	0.9532 ±0.0666	0.9821 ±0.0387
RBO	0.9834 ±0.0371	0.9915 ±0.0188	0.8533 ±0.3279	0.9913 ±0.0192	0.9605 ±0.0232	0.9800 ±0.0117	0.4848 ±0.2898	0.9797 ±0.0119
EBO	**1±0**	**1±0**	**1±0**	**1±0**	0.9852 ±0.0201	0.9760 ±0.0345	0.7387 ±0.2556	0.9752 ±0.0361
BAC	**1±0**	**1±0**	**1±0**	**1±0**	0.9771 ±0.0223	0.9884 ±0.0113	0.6533 ±0.3207	0.9882 ±0.0114

表 4.8 与经典集成学习算法比较（续）

Table 4.8 Comparison with classical ensemble learning algorithms (continued)

数据集	Shuttle-2_vs_5				Kddcup-buffer_overflow_vs_back			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
Easy	**1±0**	**1±0**	**1±0**	**1±0**	0.9520 ±0.0078	0.9757 ±0.0039	0.3622 ±0.0357	0.9754 ±0.0041
MNESG-EL(default)	0.9970 ±0.0024	0.9262 ±0.0631	0.8895 ±0.0890	0.9212 ±0.0697	**1±0**	**1±0**	**1±0**	**1±0**
MNESG-EL	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**
数据集	Kr-vs-k-zero_vs_fifteen				Rootkit_imapvsback			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9694 ±0.0142	0.9570 ±0.0492	0.7258 ±0.0399	0.9553 ±0.0523	0.9854 ±0.0644	0.9543 ±0.0621	0.8769 ±0.1315	0.9525 ±0.0644
UBAG	0.9334 ±0.0196	0.9662 ±0.0099	0.2830 ±0.0757	0.9656 ±0.0102	0.9825 ±0.0279	0.9115 ±0.0506	0.8420 ±0.1243	0.9073 ±0.0528
SBO	0.9660 ±0.0153	0.9462 ±0.0542	0.7178 ±0.0448	0.9439 ±0.0577	0.9858 ±0.0290	0.9545 ±0.0623	0.8987 ±0.1244	0.9528 ±0.0646
RBO	0.9402 ±0.0347	0.9697 ±0.0176	0.3391 ±0.1441	0.9691 ±0.0181	0.9818 ±0.0283	0.9327 ±0.0620	0.8057 ±0.2371	0.9300 ±0.0643
EBO	0.9544 ±0.0340	0.9769 ±0.0172	0.4431 ±0.2470	0.9765 ±0.0176	0.9829 ±0.0282	0.9315 ±0.0631	0.8642 ±0.1432	0.9285 ±0.0658
BAC	0.9366 ±0.0292	0.9679 ±0.0148	0.3257 ±0.1712	0.9672 ±0.0151	0.9863 ±0.0292	0.9547 ±0.0625	0.9169 ±0.1327	0.9530 ±0.0648
Easy	0.9357 ±0.0235	0.9674 ±0.0119	0.2950 ±0.0914	0.9668 ±0.0122	0.9784 ±0.0266	0.9094 ±0.0514	0.7531 ±0.2110	0.9055 ±0.0535
MNESG-EL(default)	0.9973 ±0.0019	0.9788 ±0.0441	0.9005 ±0.0651	0.9777 ±0.0466	0.9991 ±0.0012	0.9550 ±0.0622	0.9492 ±0.0705	0.9521 ±0.0664
MNESG-EL	**0.9995 ±0.0010**	**0.9833 ±0.0622**	**0.9818 ±0.0407**	**0.9826 ±0.0390**	**0.9996 ±0.0010**	**0.9998 ±0.0001**	**0.9778 ±0.0497**	**0.9998 ±0.0001**

A.2 表 4.11 的完整结果

表 A.2 为第四章中 4.2.7 节处表 4.11 的完整结果。主要记录了第四章提出的 MNESG-EL 算法与最先进的集成算法在 ACC、AUC、F-M 和 G-M 四个评价指标的对比结果。

表 4.11 SOTA 算法和本节提出算法之间的比较结果

Table 4.11 Comparison results between SOTA and proposed algorithm

数据集	Glass1				Wisconsin			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.7756 ±0.0801	0.7687 ±0.0901	0.7008 ±0.1109	0.7668 ±0.0911	0.9326 ±0.0224	0.9337 ±0.0234	0.9072 ±0.0303	0.9335 ±0.0234
SPE	0.7754 ±0.0646	0.7546 ±0.0679	0.6845 ±0.0901	0.7509 ±0.0694	0.9238 ±0.0149	0.9154 ±0.0055	0.8915 ±0.0150	0.9140 ±0.0057
HUE	0.7942 ±0.0351	0.7872 ±0.0430	0.7238 ±0.0462	0.7848 ±0.0426	0.9253 ±0.0202	0.9262 ±0.0182	0.8975 ±0.0255	0.9259 ±0.0183
ECUBoost	0.7620 ±0.0776	0.7543 ±0.0821	0.6849 ±0.0934	0.7511 ±0.0816	0.9385 ±0.0228	0.9401 ±0.0218	0.9154 ±0.0308	0.9399 ±0.0218
MNESG-EL(default)	0.7614 ±0.0835	0.7757 ±0.0403	0.7130 ±0.0393	0.7543 ±0.0615	0.9780 ±0.0052	0.9812 ±0.0048	0.9694 ±0.0070	0.9811 ±0.0048
MNESG-EL	**0.9721 ±0.0104**	**0.9662 ±0.0011**	**0.9599 ±0.0125**	**0.9656 ±0.0011**	**0.9898 ±0.0083**	**0.9921 ±0.0064**	**0.9857 ±0.0115**	**0.9921 ±0.0065**
数据集	Pima				Iris0			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.6523 ±0.0306	0.6474 ±0.0297	0.5590 ±0.0319	0.6466 ±0.0297	**1±0**	**1±0**	**1±0**	**1±0**
SPE	0.6470 ±0.0277	0.6335 ±0.0344	0.5372 ±0.0446	0.6311 ±0.0359	**1±0**	**1±0**	**1±0**	**1±0**
HUE	0.6588 ±0.0338	0.6419 ±0.0339	0.5455 ±0.0387	0.6392 ±0.0339	**1±0**	**1±0**	**1±0**	**1±0**
ECUBoost	0.6745 ±0.0314	0.6437 ±0.0312	0.5357 ±0.0431	0.6326 ±0.0367	**1±0**	**1±0**	**1±0**	**1±0**
MNESG-EL(default)	0.7435 ±0.0349	0.7220 ±0.0475	0.6223 ±0.1029	0.6945 ±0.0933	**1±0**	**1±0**	**1±0**	**1±0**
MNESG-EL	**0.8243 ±0.0302**	**0.7954 ±0.0343**	**0.7327 ±0.0494**	**0.7823 ±0.0460**	**1±0**	**1±0**	**1±0**	**1±0**

表 4.11 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.11 Comparison results between SOTA and proposed algorithm (continued)

数据集	Yeast1				Haberman			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.7358 ±0.0238	0.7256 ±0.0244	0.6054 ±0.0311	0.7241 ±0.0248	0.6312 ±0.0802	0.5877 ±0.0779	0.4199 ±0.0827	0.5792 ±0.0792
SPE	0.7237 ±0.0408	0.7040 ±0.0357	0.5804 ±0.0441	0.7015 ±0.0355	0.5846 ±0.0690	0.5823 ±0.0730	0.4259 ±0.0793	0.5807 ±0.0720
HUE	0.7243 ±0.0278	0.7058 ±0.0278	0.5818 ±0.0353	0.7042 ±0.0280	0.5819 ±0.0796	0.5339 ±0.0715	0.3559 ±0.0764	0.5188 ±0.0707
ECUBoost	0.7385 ±0.0191	0.7193 ±0.0161	0.5986 ±0.0205	0.7175 ±0.0162	0.4932 ±0.0634	0.5519 ±0.0743	0.4132 ±0.0719	0.5327 ±0.0719
MNESG-EL(default)	0.6914 ±0.0558	0.7028 ±0.0194	0.5788 ±0.0222	0.6957 ±0.0227	0.7284 ±0.1128	0.6819 ±0.0402	0.5259 ±0.0744	0.6333 ±0.0653
MNESG-EL	**0.7399 ±0.0516**	**0.7397 ±0.0239**	**0.6246 ±0.0357**	**0.7366 ±0.0211**	**0.9905 ±0.0130**	**0.9947 ±0.0072**	**0.9556 ±0.0609**	**0.9947 ±0.0073**
数据集	Vehicle2				Vehicle3			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9645 ±0.0134	0.9559 ±0.0189	0.9257 ±0.0280	0.9556 ±0.0191	0.7623 ±0.0278	0.7281 ±0.0367	0.5815 ±0.0494	0.7242 ±0.0387
SPE	0.9645 ±0.0158	0.9595 ±0.0166	0.9328 ±0.0294	0.9593 ±0.0167	0.7553 ±0.0079	0.7206 ±0.0073	0.5713 ±0.0100	0.7168 ±0.0088
HUE	0.9538 ±0.0219	0.9525 ±0.0178	0.9149 ±0.0375	0.9523 ±0.0178	0.7270 ±0.0374	0.7333 ±0.0376	0.5783 ±0.0438	0.7311 ±0.0363
ECUBoost	**0.9704 ±0.0106**	**0.9636 ±0.0126**	**0.9434 ±0.0183**	**0.9632 ±0.0128**	0.7647 ±0.0285	0.6860 ±0.0193	0.5308 ±0.0293	0.6672 ±0.0172
MNESG-EL(default)	0.9468 ±0.0120	0.9447 ±0.0146	0.9011 ±0.0218	0.9446 ±0.0146	0.7623 ±0.0278	0.7281 ±0.0367	0.5815 ±0.0494	0.7242 ±0.0387
MNESG-EL	0.9503 ±0.0456	0.9606 ±0.0313	0.9148 ±0.0694	0.9599 ±0.0325	**0.8120 ±0.0383**	**0.7870 ±0.0509**	**0.6601 ±0.0586**	**0.7785 ±0.0612**
数据集	Glass-0-1-2-3_vs_4-5-6				Vehicle0			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9346 ±0.0307	0.9173 ±0.0380	0.8668 ±0.0569	0.9157 ±0.0391	0.9597 ±0.0196	0.9545 ±0.0184	0.9181 ±0.0376	0.9544 ±0.0184

表 4.11 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.11 Comparison results between SOTA and proposed algorithm (continued)

数据集	Glass-0-1-2-3_vs_4-5-6				Vehicle0			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SPE	0.8967 ±0.0448	0.8558 ±0.0552	0.7840 ±0.0720	0.8472 ±0.0607	0.9598 ±0.0137	0.9459 ±0.0160	0.9154 ±0.0267	0.9451 ±0.0168
HUE	0.7270 ±0.0374	0.7333 ±0.0376	0.5783 ±0.0438	0.7311 ±0.0363	0.9491 ±0.0087	0.9581 ±0.0087	0.9004 ±0.0162	0.9579 ±0.0086
ECUBoost	0.9345 ±0.0175	0.9172 ±0.0419	0.8640 ±0.0376	0.9133 ±0.0461	0.9539 ±0.0195	0.9542 ±0.0203	0.9084 ±0.0357	0.9535 ±0.0206
MNESG-EL(default)	0.9346 ±0.0307	0.9173 ±0.0380	0.8668 ±0.0569	0.9157 ±0.0391	0.8208 ±0.0199	0.9007 ±0.0545	0.8336 ±0.0542	0.8966 ±0.0618
MNESG-EL	**0.9953 ±0.0104**	**0.9970 ±0.0068**	**0.9905 ±0.0213**	**0.9969 ±0.0068**	**0.9657 ±0.0190**	**0.9655 ±0.0118**	**0.9311 ±0.0349**	**0.9652 ±0.0119**
数据集	Ecoli1				Ecoli2			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.8989 ±0.0314	0.8607 ±0.0500	0.7802 ±0.0693	0.8560 ±0.0536	0.9256 ±0.0523	0.8871 ±0.0689	0.7886 ±0.1235	0.8840 ±0.0704
SPE	0.8841 ±0.0349	0.8484 ±0.0653	0.7524 ±0.0802	0.8406 ±0.0732	0.9435 ±0.0303	0.8942 ±0.0525	0.8214 ±0.0922	0.8895 ±0.0569
HUE	0.8571 ±0.0545	0.8704 ±0.0412	0.7476 ±0.0791	0.8693 ±0.0418	0.8838 ±0.0176	0.8846 ±0.0208	0.7035 ±0.0223	0.8831 ±0.0203
ECUBoost	0.9136 ±0.0404	0.8569 ±0.0625	0.7981 ±0.0987	0.8488 ±0.0684	0.8746 ±0.1476	0.8575 ±0.0961	0.7371 ±0.1897	0.8454 ±0.1095
MNESG-EL(default)	0.9139 ±0.0504	0.9070 ±0.0425	0.8331 ±0.0843	0.9046 ±0.0453	0.9316 ±0.0266	0.9202 ±0.0526	0.8035 ±0.0748	0.9191 ±0.0534
MNESG-EL	**0.9910 ±0.0082**	**0.9800 ±0.0183**	**0.9793 ±0.0189**	**0.9797 ±0.0186**	**0.9761 ±0.0257**	**0.9538 ±0.0291**	**0.9242 ±0.0787**	**0.9532 ±0.0293**
数据集	Glass6				Yeast3			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9486 ±0.0092	0.9250 ±0.0623	0.8197 ±0.0512	0.9210 ±0.0676	0.9353 ±0.0062	0.8826 ±0.0331	0.7335 ±0.0327	0.8791 ±0.0354
SPE	0.9439 ±0.0347	0.8944 ±0.0963	0.7921 ±0.1383	0.8861 ±0.1090	0.9366 ±0.0157	0.8810 ±0.0263	0.7392 ±0.0576	0.8779 ±0.0281

表 4.11 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.11 Comparison results between SOTA and proposed algorithm (continued)

数据集	Glass6				Yeast3			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
HUE	0.9302 ±0.0465	0.9175 ±0.0435	0.7967 ±0.1158	0.9157 ±0.0441	0.9110 ±0.0208	0.8964 ±0.0203	0.6876 ±0.0478	0.8955 ±0.0213
ECUBoost	0.9485 ±0.0519	0.9250 ±0.0669	0.8387 ±0.1382	0.9203 ±0.0721	0.9366 ±0.0152	0.8969 ±0.0334	0.7477 ±0.0422	0.8942 ±0.0365
MNESG-EL(default)	0.9673 ±0.0126	0.9359 ±0.0408	0.8823 ±0.0369	0.9333 ±0.0429	0.9373 ±0.0182	0.8819 ±0.0776	0.7349 ±0.0974	0.8753 ±0.0897
MNESG-EL	**0.9766 ±0.0233**	**0.9586 ±0.0709**	**0.9132 ±0.0881**	**0.9551 ±0.0783**	**0.9905 ±0.0130**	**0.9947 ±0.0072**	**0.9556 ±0.0609**	**0.9947 ±0.0073**
数据集	Ecoli3				Yeast-2-vs-4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9078 ±0.0472	0.8097 ±0.1166	0.6100 ±0.1820	0.7882 ±0.1378	0.9416 ±0.0261	0.8623 ±0.0856	0.7188 ±0.1360	0.8517 ±0.0979
SPE	0.8986 ±0.0259	0.7919 ±0.0953	0.5695 ±0.1207	0.7721 ±0.1094	0.9572 ±0.0131	0.9316 ±0.0273	0.8096 ±0.0486	0.9302 ±0.0285
HUE	0.8572 ±0.0444	0.8698 ±0.0447	0.5736 ±0.0911	0.8693 ±0.0443	0.8910 ±0.0187	0.9047 ±0.0378	0.6277 ±0.0546	0.9037 ±0.0374
ECUBoost	0.9195 ±0.0336	0.8414 ±0.0921	0.6571 ±0.1281	0.8274 ±0.1096	0.9163 ±0.0265	0.8661 ±0.0434	0.6630 ±0.0430	0.8594 ±0.0508
MNESG-EL(default)	0.8958 ±0.0153	0.9166 ±0.0357	0.6539 ±0.0376	0.9154 ±0.0350	0.9590 ±0.0273	0.9068 ±0.0702	0.8080 ±0.1153	0.9006 ±0.0796
MNESG-EL	**0.9628 ±0.0584**	**0.9442 ±0.0516**	**0.8806 ±0.1533**	**0.9413 ±0.0544**	**0.9845 ±0.0128**	**0.9833 ±0.0251**	**0.9286 ±0.0532**	**0.9832 ±0.0253**
数据集	Yeast-0-5-6-7-9-vs-4				Glass-0-1-6_vs_2			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.8806 ±0.0233	0.8095 ±0.0620	0.5387 ±0.0817	0.8021 ±0.0676	0.7916 ±0.0600	0.5700 ±0.0783	0.2004 ±0.1249	0.4436 ±0.2274
SPE	0.8599 ±0.0494	0.8016 ±0.0910	0.5109 ±0.1306	0.7956 ±0.0947	0.7759 ±0.0543	0.7054 ±0.1384	0.2966 ±0.1573	0.6121 ±0.3086
HUE	0.8086 ±0.0549	0.7813 ±0.0486	0.4440 ±0.1000	0.7794 ±0.0493	0.6399 ±0.1113	0.7059 ±0.0675	0.2799 ±0.0489	0.6843 ±0.0737

表 4.11 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.11 Comparison results between SOTA and proposed algorithm (continued)

数据集	Yeast-0-5-6-7-9-vs-4				Glass-0-1-6_vs_2			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
ECUBoost	0.8977 ±0.0299	0.7840 ±0.0367	0.5538 ±0.0394	0.7672 ±0.0488	0.6197 ±0.1118	0.5061 ±0.1231	0.1207 ±0.0815	0.3878 ±0.2236
MNESG-EL(default)	0.8146 ±0.0478	0.8176 ±0.0934	0.4618 ±0.0965	0.8112 ±0.1015	0.8961 ±0.0019	0.6244 ±0.0194	0.3333 ±0.0006	0.5267 ±0.0479
MNESG-EL	**0.9263 ±0.0039**	**0.9235 ±0.0779**	**0.6977 ±0.0370**	**0.9184 ±0.0873**	**0.9795 ±0.0115**	**0.9000 ±0.0559**	**0.8857 ±0.0639**	**0.8928 ±0.0599**
数据集	Glass2				Yeast-1-vs-7			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.7944 ±0.0165	0.7202 ±0.1439	0.3147 ±0.1203	0.6918 ±0.1640	0.8323 ±0.0389	0.7088 ±0.0945	0.2996 ±0.0735	0.6767 ±0.1230
SPE	0.7849 ±0.0237	0.6842 ±0.0887	0.2911 ±0.0997	0.6617 ±0.1144	0.7581 ±0.0205	0.7001 ±0.0920	0.2519 ±0.0564	0.6888 ±0.0945
HUE	0.6966 ±0.0859	0.7596 ±0.0851	0.3145 ±0.0845	0.7518 ±0.0819	0.6950 ±0.0887	0.6663 ±0.1180	0.2188 ±0.0905	0.6430 ±0.1286
ECUBoost	0.7988 ±0.0549	0.7003 ±0.0758	0.3233 ±0.0975	0.6831 ±0.0928	**0.8583 ±0.0308**	0.7537 ±0.0489	0.3722 ±0.0445	0.7390 ±0.0603
MNESG-EL(default)	0.6957 ±0.1946	0.7595 ±0.0043	0.3018 ±0.0874	0.7378 ±0.0187	0.6455 ±0.1230	0.8023 ±0.0658	0.2690 ±0.0662	0.7753 ±0.0848
MNESG-EL	**0.9814 ±0.0104**	**0.8607 ±0.0745**	**0.8400 ±0.0894**	**0.8532 ±0.0821**	0.8110 ±0.0531	**0.8214 ±0.0294**	**0.3732 ±0.0614**	**0.8210 ±0.0291**
数据集	Glass4				Ecoli4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9486 ±0.0270	0.8160 ±0.1426	0.5895 ±0.2248	0.7847 ±0.1711	0.9582 ±0.0274	0.8373 ±0.1251	0.6716 ±0.2234	0.8096 ±0.1669
SPE	0.9486 ±0.0227	0.8943 ±0.1058	0.6599 ±0.1688	0.8842 ±0.1187	0.9642 ±0.0223	0.8873 ±0.0871	0.7365 ±0.1263	0.8756 ±0.1012
HUE	0.8321 ±0.0919	0.8626 ±0.0873	0.4204 ±0.1110	0.8502 ±0.0989	0.8747 ±0.0515	0.8865 ±0.1137	0.4833 ±0.1598	0.8808 ±0.1211
ECUBoost	0.9627 ±0.0237	0.9492 ±0.0710	0.7690 ±0.1489	0.9466 ±0.0759	0.9612 ±0.0152	0.8623 ±0.1014	0.6978 ±0.0939	0.8436 ±0.1202

表 4.11 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.11 Comparison results between SOTA and proposed algorithm (continued)

数据集	Glass4				Ecoli4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
MNESG-EL(default)	0.9765 ±0.0001	0.9104 ±0.1090	0.8000 ±0.0001	0.9020 ±0.1209	0.9045 ±0.0977	0.9258 ±0.0542	0.6436 ±0.2550	0.9214 ±0.0582
MNESG-EL	**0.9902 ±0.0134**	**0.9949 ±0.0070**	**0.9200 ±0.1095**	**0.9948 ±0.0071**	**0.9911 ±0.0081**	**0.9953 ±0.0043**	**0.9333 ±0.0609**	**0.9952 ±0.0043**
数据集	Abalone9-18				Shuttle-c2-vs-c4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9083 ±0.0205	0.7935 ±0.0862	0.4554 ±0.1128	0.7758 ±0.1065	**1±0**	**1±0**	**1±0**	**1±0**
SPE	0.8768 ±0.0096	0.7574 ±0.0591	0.3636 ±0.0334	0.7407 ±0.0688	0.9923 ±0.0153	0.9000 ±0.2000	0.8000 ±0.4000	0.8000 ±0.4000
HUE	0.8371 ±0.0160	0.7571 ±0.0417	0.3202 ±0.0416	0.7501 ±0.0469	**1±0**	**1±0**	**1±0**	**1±0**
ECUBoost	0.8617 ±0.0470	0.7951 ±0.0890	0.3780 ±0.0694	0.7766 ±0.1180	0.9923 ±0.0153	0.9500 ±0.0999	0.9333 ±0.1333	0.9414 ±0.1171
MNESG-EL(default)	0.9110 ±0.0581	0.8057 ±0.0724	0.4882 ±0.2028	0.7968 ±0.0756	**1±0**	**1±0**	**1±0**	**1±0**
MNESG-EL	**0.9623 ±0.0048**	**0.9212 ±0.0807**	**0.7166 ±0.0151**	**0.9173 ±0.0859**	**1±0**	**1±0**	**1±0**	**1±0**
数据集	Glass5				Yeast-2-vs-8			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9812 ±0.0271	0.8926 ±0.1968	0.7142 ±0.3938	0.7925 ±0.3965	0.9169 ±0.0287	0.7653 ±0.0626	0.3915 ±0.1006	0.7433 ±0.0756
SPE	0.9812 ±0.0271	0.9902 ±0.0142	0.8476 ±0.1890	0.9900 ±0.0144	0.8609 ±0.0267	0.7600 ±0.1574	0.2637 ±0.1019	0.7180 ±0.2037
HUE	0.8788 ±0.0677	0.9365 ±0.0356	0.4504 ±0.1291	0.9336 ±0.0382	0.7923 ±0.0579	0.7959 ±0.0973	0.2517 ±0.0684	0.7895 ±0.0990
ECUBoost	0.9112 ±0.0629	0.9536 ±0.0330	0.5454 ±0.2082	0.9518 ±0.0348	0.8318 ±0.0444	0.7448 ±0.0453	0.2510 ±0.0470	0.7334 ±0.0569
MNESG-EL(default)	**0.9884 ±0.0164**	**0.9939 ±0.0086**	**0.9000 ±0.1414**	**0.9939 ±0.0087**	0.8961 ±0.0927	0.7066 ±0.1603	0.3026 ±0.0901	0.6246 ±0.2253

表 4.11 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.11 Comparison results between SOTA and proposed algorithm (continued)

数据集	Glass5				Yeast-2-vs-8			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
MNESG-EL	**0.9884 ±0.0164**	**0.9939 ±0.0086**	**0.9000 ±0.1414**	**0.9939 ±0.0087**	**0.9792 ±0.0121**	**0.8696 ±0.0978**	**0.7532 ±0.1358**	**0.8547 ±0.1152**
数据集	Yeast4				Winequality-red-4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9083 ±0.0164	0.7893 ±0.0782	0.3316 ±0.0671	0.7725 ±0.0917	0.7785 ±0.0302	0.6124 ±0.0568	0.1142 ±0.0266	0.5779 ±0.0831
SPE	0.8712 ±0.0095	0.8000 ±0.0392	0.2791 ±0.0350	0.7951 ±0.0437	0.7173 ±0.0542	0.6168 ±0.0693	0.1091 ±0.0345	0.6010 ±0.0795
HUE	0.8167 ±0.0300	0.8112 ±0.0534	0.2351 ±0.0373	0.8094 ±0.0520	0.6960 ±0.0204	0.6892 ±0.0451	0.1294 ±0.0156	0.6877 ±0.0459
ECUBoost	**0.9204 ±0.0229**	0.8176 ±0.0429	**0.3891 ±0.0734**	0.8087 ±0.0485	0.6292 ±0.1777	0.5906 ±0.0374	0.0932 ±0.0192	0.5529 ±0.0582
MNESG-EL(default)	0.8653 ±0.0190	**0.8579 ±0.0243**	0.2990 ±0.0123	**0.8573 ±0.0247**	0.6953 ±0.1522	**0.7326 ±0.0554**	0.1584 ±0.0331	**0.7074 ±0.0423**
MNESG-EL	0.9097 ±0.0142	0.8209 ±0.0693	0.3553 ±0.0457	0.8122 ±0.0781	**0.9677 ±0.0018**	0.6034 ±0.1003	**0.2699 ±0.1787**	0.4239 ±0.2120
数据集	Yeast-1-2-8-9-vs-7				Yeast5			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.7877 ±0.0520	0.6646 ±0.0267	0.1424 ±0.0266	0.6491 ±0.0288	**0.9770 ±0.0068**	0.9006 ±0.0427	**0.6854 ±0.0728**	0.8956 ±0.0481
SPE	0.6980 ±0.0373	0.6989 ±0.0447	0.1274 ±0.0117	0.6940 ±0.0469	0.9757 ±0.0107	0.8892 ±0.0673	0.6666 ±0.1285	0.8815 ±0.0777
HUE	0.6737 ±0.0439	0.6703 ±0.0719	0.1129 ±0.0223	0.6592 ±0.0845	0.9501 ±0.0100	0.9513 ±0.0299	0.5349 ±0.0514	0.9509 ±0.0300
ECUBoost	0.6737 ±0.1902	0.7025 ±0.1043	0.1559 ±0.0735	0.6843 ±0.1096	0.9770 ±0.0077	0.8885 ±0.0738	0.6720 ±0.0938	0.8794 ±0.0842
MNESG-EL(default)	0.6943 ±0.1227	0.7919 ±0.0580	0.1916 ±0.1012	0.7826 ±0.0852	0.9158 ±0.0381	0.9566 ±0.0196	0.4342 ±0.1065	0.9554 ±0.0207
MNESG-EL	**0.8468 ±0.0976**	**0.8000 ±0.0066**	**0.2628 ±0.0997**	**0.7954 ±0.0137**	0.9636 ±0.0140	**0.9597 ±0.0291**	0.6231 ±0.0788	**0.9592 ±0.0295**

表 4.11 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.11 Comparison results between SOTA and proposed algorithm (continued)

数据集	Yeast6				Winequality-white-3_vs_7			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9420 ±0.0124	0.8030 ±0.0698	0.3509 ±0.0635	0.7842 ±0.0874	0.9433 ±0.0214	0.7511 ±0.1385	0.2923 ±0.1600	0.6427 ±0.3257
SPE	0.9103 ±0.0311	0.8425 ±0.1048	0.3038 ±0.0909	0.8302 ±0.1192	0.8888 ±0.0312	0.7232 ±0.0841	0.1834 ±0.0531	0.6890 ±0.1201
HUE	0.8786 ±0.0248	0.8542 ±0.0245	0.2482 ±0.0312	0.8529 ±0.0265	0.8022 ±0.0191	0.7034 ±0.0887	0.1153 ±0.0293	0.6816 ±0.1219
ECUBoost	**0.9615 ±0.0083**	0.8130 ±0.0597	**0.4507 ±0.0919**	0.7946 ±0.0768	0.6188 ±0.1883	0.6829 ±0.0831	0.1007 ±0.0560	0.6595 ±0.0964
MNESG-EL(default)	0.8814 ±0.0237	**0.8974 ±0.0921**	0.2685 ±0.0570	**0.8921 ±0.0994**	0.8694 ±0.0904	**0.8111 ±0.0462**	0.2398 ±0.1322	**0.8082 ±0.0429**
MNESG-EL	0.9137 ±0.0173	0.8868 ±0.0170	0.3234 ±0.0472	0.8861 ±0.0175	**0.9889 ±0.0045**	0.8111 ±0.0722	**0.7113 ±0.1216**	0.7855 ±0.0916
数据集	Winequality-red-8_vs_6-7				Kr-vs-k-zero_vs_eight			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.7964 ±0.0550	0.5859 ±0.1207	0.0732 ±0.0488	0.4735 ±0.2590	0.9863 ±0.0075	0.9244 ±0.0983	0.7045 ±0.1528	0.9151 ±0.1137
SPE	0.6257 ±0.0731	0.6213 ±0.0944	0.0623 ±0.0188	0.5999 ±0.1044	0.9678 ±0.0073	0.8627 ±0.1268	0.4549 ±0.1158	0.8407 ±0.1573
HUE	0.5918 ±0.0551	0.6367 ±0.0701	0.0638 ±0.0046	0.6250 ±0.0588	0.9171 ±0.0135	0.9577 ±0.0069	0.3116 ±0.0331	0.9568 ±0.0072
ECUBoost	0.2350 ±0.1469	0.5604 ±0.0913	0.0480 ±0.0092	0.4130 ±0.1613	0.8712 ±0.0521	0.8951 ±0.0940	0.2418 ±0.1103	0.8914 ±0.0970
MNESG-EL(default)	0.6932 ±0.1517	0.6599 ±0.0788	0.1222 ±0.0629	0.5730 ±0.1182	0.9534 ±0.0093	0.9436 ±0.0745	0.4269 ±0.0647	0.9408 ±0.0801
MNESG-EL	**0.8302 ±0.1735**	**0.9136 ±0.0082**	**0.2679 ±0.2273**	**0.9069 ±0.0974**	**0.9932 ±0.0080**	**0.9965 ±0.0041**	**0.8684 ±0.0239**	**0.9965 ±0.0041**
数据集	Shuttle-2_vs_5				Kddcup-buffer_overflow_vs_back			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**
SPE	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**

表 4.11 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.11 Comparison results between SOTA and proposed algorithm (continued)

数据集	Shuttle-2_vs_5				Kddcup-buffer_overflow_vs_back			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
HUE	**1±0**	**1±0**	**1±0**	**1±0**	0.9995 ±0.0008	0.9833 ±0.0333	0.9818 ±0.0363	0.9825 ±0.0348
ECUBoost	**1±0**	**1±0**	**1±0**	**1±0**	0.9991 ±0.0010	0.9666 ±0.0408	0.9636 ±0.0445	0.9651 ±0.0426
MNESG-EL(default)	0.9970 ±0.0024	0.9262 ±0.0631	0.8895 ±0.0890	0.9212 ±0.0697	**1±0**	**1±0**	**1±0**	**1±0**
MNESG-EL	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**
数据集	Kr-vs-k-zero_vs_fifteen				Rootkit_imapvsback			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9990 ±0.0011	0.9797 ±0.0398	0.9595 ±0.0498	0.9786 ±0.0421	0.9995 ±0.0008	0.9800 ±0.0399	0.9777 ±0.0444	0.9788 ±0.0422
SPE	0.9995 ±0.0009	0.9997 ±0.0004	0.9846 ±0.0307	0.9997 ±0.0004	0.9991 ±0.0011	0.9550 ±0.0556	0.9492 ±0.0630	0.9520 ±0.0593
HUE	0.9872 ±0.0099	0.9771 ±0.0317	0.6964 ±0.1634	0.9763 ±0.0331	0.9950 ±0.0078	0.9479 ±0.0637	0.8300 ±0.2357	0.9446 ±0.0678
ECUBoost	**1±0**	**1±0**	**1±0**	**1±0**	0.9991 ±0.0017	0.9600 ±0.0799	0.9500 ±0.1000	0.9549 ±0.0901
MNESG-EL(default)	0.9973 ±0.0019	0.9788 ±0.0441	0.9005 ±0.0651	0.9777 ±0.0466	0.9991 ±0.0012	0.9550 ±0.0622	0.9492 ±0.0705	0.9521 ±0.0664
MNESG-EL	0.9995 ±0.0010	0.9833 ±0.0622	0.9818 ±0.0407	0.9826 ±0.0390	**0.9996 ±0.0010**	**0.9998 ±0.0001**	**0.9778 ±0.0497**	**0.9998 ±0.0001**

A.3 表 4.15 的完整结果

表 A.3 为第四章中 4.2.7 节处表 4.15 的完整结果。主要记录了第四章提出的 MNESG-EL 算法与基于样本生成的深度学习方法的对比结果。

表 4.15 与基于样本生成的深度学习方法的比较

Table 4.15 Comparison with sample generation based deep learning methods

数据集	算法	AUC	F-M	G-M
Ecoli1	CNN+SMOTE	0.6522±0.0381	0.4668±0.0509	0.6405±0.0399
	CNN+AE+GAN	0.8376±0.0541	0.4303±0.0690	0.8295±0.0556
	BED	0.8495±0.0251	0.7584±0.0268	0.8467±0.0269
	RVGAN-TL	0.8123±0.0510	0.7252±0.0654	0.7991±0.0583
	EAL-GAN	0.9226±0.0441	0.6968±0.0960	0.8624±0.0518
	DLE-ISMOTE	0.7663±0.0599	0.5826±0.0710	0.7463±0.0910
	MNESG-EL(default)	0.9070±0.0425	0.8331±0.0843	0.9046±0.0453
	MNESG-EL	**0.9800±0.0183**	**0.9793±0.0189**	**0.9797±0.0186**
Ecoli3	CNN+SMOTE	0.8288±0.0831	0.4810±0.0636	0.8209±0.0851
	CNN+AE+GAN	0.8325±0.0129	0.4944±0.0305	0.8321±0.0134
	BED	0.9197±0.0212	0.5941±0.0679	0.9159±0.0231
	RVGAN-TL	0.7443±0.0883	0.5621±0.1560	0.7031±0.1180
	EAL-GAN	0.9200±0.0574	0.6086±0.1530	0.8650±0.0664
	DLE-ISMOTE	0.8452±0.0183	0.5227±0.0227	0.8451±0.0185
	MNESG-EL(default)	0.9166±0.0357	0.6539±0.0376	0.9154±0.0350
	MNESG-EL	**0.9442±0.0516**	**0.8806±0.1533**	**0.9413±0.0544**
Glass-0-1-6_vs_2	CNN+SMOTE	0.6025±0.0765	0.2151±0.0601	0.5629±0.0842
	CNN+AE+GAN	0.6065±0.0932	0.2314±0.0872	0.5952±0.1070
	BED	0.7133±0.0775	0.2488±0.0416	0.6887±0.0682
	RVGAN-TL	0.5935±0.1600	0.1967±0.2410	0.3269±0.1560
	EAL-GAN	0.6389±0.1290	0.3704±0.1250	0.5992±0.0997
	DLE-ISMOTE	0.6698±0.1210	0.2269±0.0769	0.6143±0.1400
	MNESG-EL(default)	0.6244±0.0194	0.3333±0.0006	0.5267±0.0479
	MNESG-EL	**0.9000±0.0559**	**0.8857±0.0639**	**0.8928±0.0599**
Shuttle-c2-vs-c4	CNN+SMOTE	0.9957±0.0088	0.9918±0.0112	0.9957±0.0089
	CNN+AE+GAN	0.9997±0.0007	0.9959±0.0091	0.9997±0.0007

表 4.15 与基于样本生成的深度学习方法的比较（续）

Table 4.15 Comparison with sample generation based deep learning methods (continued)

数据集	算法	AUC	F-M	G-M
Shuttle-c2-vs-c4	BED	**1±0**	**1±0**	**1±0**
	RVGAN-TL	**1±0**	**1±0**	**1±0**
	EAL-GAN	0.9960±0.0120	0.9940±0.0143	0.9905±0.0234
	DLE-ISMOTE	0.9791±0.0022	0.9787±0.0054	0.9789±0.0028
	MNESG-EL(default)	**1±0**	**1±0**	**1±0**
	MNESG-EL	**1±0**	**1±0**	**1±0**
Yeast4	CNN+SMOTE	0.8279±0.0325	0.2963±0.0204	0.8250±0.0349
	CNN+AE+GAN	0.7970±0.0335	0.2983±0.0538	0.7907±0.0380
	BED	0.8573±0.0080	0.2508±0.0155	0.8562±0.0084
	RVGAN-TL	0.6352±0.0755	0.3328±0.0716	0.4948±0.0937
	EAL-GAN	**0.8764±0.0604**	0.3045±0.1130	0.4533±0.1130
	DLE-ISMOTE	0.8552±0.0179	0.2910±0.0252	0.8545±0.0181
	MNESG-EL(default)	0.8579±0.0243	0.2990±0.0123	**0.8573±0.0247**
	MNESG-EL	0.8209±0.0693	**0.3553±0.0457**	0.8122±0.0781
Yeast5	CNN+SMOTE	0.9242±0.0513	0.4922±0.1120	0.9228±0.0560
	CNN+AE+GAN	0.9183±0.0398	0.4335±0.0560	0.9168±0.0408
	BED	**0.9785±0.0016**	0.5925±0.0168	**0.9782±0.0016**
	RVGAN-TL	0.7991±0.0721	**0.6638±0.0878**	0.7685±0.0977
	EAL-GAN	0.9715±0.0391	0.5556±0.0242	0.8094±0.0264
	DLE-ISMOTE	0.9687±0.0086	0.4810±0.0707	0.9682±0.0089
	MNESG-EL(default)	0.9566±0.0196	0.4342±0.1065	0.9554±0.0207
	MNESG-EL	0.9597±0.0291	0.6231±0.0788	0.9592±0.0295
Yeast6	CNN+SMOTE	0.8739±0.0517	0.2753±0.0567	0.8724±0.0532
	CNN+AE+GAN	0.8663±0.0744	0.2485±0.0550	0.8639±0.0754
	BED	0.8829±0.0291	0.2586±0.0147	0.8823±0.0282
	RVGAN-TL	0.7098±0.0678	0.4821±0.1540	0.6415±0.1160
	EAL-GAN	0.9336±0.0355	**0.5476±0.0982**	0.7020±0.0496
	DLE-ISMOTE	**0.9345±0.0186**	0.2717±0.0261	**0.9321±0.0192**
	MNESG-EL(default)	0.8974±0.0921	0.2685±0.0570	0.8921±0.0994
	MNESG-EL	0.8868±0.0170	0.3234±0.0472	0.8861±0.0175

表 4.15 与基于样本生成的深度学习方法的比较（续）

Table 4.15 Comparison with sample generation based deep learning methods (continued)

数据集	算法	AUC	F-M	G-M
Winequality-red-8_vs_6-7	CNN+SMOTE	0.6434±0.0762	0.0896±0.0288	0.6250±0.0934
	CNN+AE+GAN	0.6026±0.0315	0.0550±0.0041	0.6002±0.0327
	BED	0.6613±0.0621	0.0801±0.0142	0.6587±0.0619
	RVGAN-TL	0.6470±0.0193	**0.3800±0.0653**	0.5447±0.0372
	EAL-GAN	0.5294±0.1690	0.0400±0.1000	0.0000±0.0000
	DLE-ISMOTE	0.5722±0.0810	0.0957±0.0791	0.5714±0.0865
	MNESG-EL(default)	0.6599±0.0788	0.1222±0.0629	0.5730±0.1182
	MNESG-EL	**0.9136±0.0082**	0.2679±0.2273	**0.9069±0.0974**
Shuttle-2_vs_5	CNN+SMOTE	0.9994±0.0008	0.9636±0.0498	0.9994±0.008
	CNN+AE+GAN	0.9989±0.0004	0.9351±0.0237	0.9989±0.004
	BED	0.9991±0.0008	0.9453±0.0471	0.9991±0.008
	RVGAN-TL	**1±0**	**1±0**	**1±0**
	EAL-GAN	**1±0**	**1±0**	**1±0**
	DLE-ISMOTE	0.9992±0.0008	0.9545±0.0455	0.9992±0.008
	MNESG-EL(default)	0.9970±0.0024	0.9262±0.0631	0.8895±0.0890
	MNESG-EL	**1±0**	**1±0**	**1±0**
Rootkit_imapvsback	CNN+SMOTE	0.9993±0.0006	0.9414±0.0541	0.9993±0.0006
	CNN+AE+GAN	0.9050±0.0102	0.8532±0.1380	0.8935±0.1210
	BED	**1±0**	**1±0**	**1±0**
	RVGAN-TL	**1±0**	**1±0**	**1±0**
	EAL-GAN	0.9538±0.0092	0.9190±0.0174	0.9298±0.0161
	DLE-ISMOTE	0.9375±0.0625	0.9286±0.0714	0.9330±0.0670
	MNESG-EL(default)	0.9550±0.0622	0.9492±0.0705	0.9521±0.0664
	MNESG-EL	0.9998±0.0001	0.9778±0.0497	0.9998±0.0001

A.4 表 4.20 的完整结果

表 A.4 为第四章中 4.3.4 节处表 4.20 的完整结果。主要记录了第四章提出的 MNESM-EL 算法与现有经典集成学习算法在 ACC、AUC、F-M 和 G-M 四个评价指标的对比结果。

表 4.20 与经典集成学习算法比较

Table 4.20 Comparison with classical ensemble learning algorithms

数据集	Glass1				Wisconsin			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.7526 ±0.0872	0.7400 ±0.0747	0.6727 ±0.0763	0.7364 ±0.0728	0.9648 ±0.0095	0.9611 ±0.0138	0.9501 ±0.0138	0.9609 ±0.0139
UBAG	0.7430 ±0.0882	0.7549 ±0.0817	0.6903 ±0.0807	0.7508 ±0.0826	0.9582 ±0.0119	0.9609 ±0.0112	0.9445 ±0.0137	0.9607 ±0.0114
SBO	0.8354 ±0.0596	0.7839 ±0.0652	0.7232 ±0.0830	0.7767 ±0.0659	0.9648 ±0.0141	0.9652 ±0.0145	0.9506 ±0.0196	0.9651 ±0.0145
RBO	0.7663 ±0.0717	0.7724 ±0.0864	0.7043 ±0.0911	0.7702 ±0.0838	0.9736 ±0.0083	0.9739 ±0.0111	0.9627 ±0.0120	0.9738 ±0.0113
EBO	0.7860 ±0.0812	0.8013 ±0.0695	0.7440 ±0.0683	0.7979 ±0.0745	0.9546 ±0.0141	0.9526 ±0.0154	0.9358 ±0.0194	0.9522 ±0.0157
BAC	0.7055 ±0.0693	0.7274 ±0.0738	0.6599 ±0.0703	0.7218 ±0.0741	0.9657 ±0.0095	0.9473 ±0.0132	0.9658 ±0.0095	0.9619 ±0.0095
Easy	0.6903 ±0.0926	0.7127 ±0.0962	0.6468 ±0.0963	0.7079 ±0.0957	0.9619 ±0.0119	0.9610 ±0.0117	0.9463 ±0.0166	0.9610 ±0.0117
MNESM-EL(default)	0.8178 ±0.0723	0.8114 ±0.0720	0.7467 ±0.1329	0.7852 ±0.1040	0.9795 ±0.0120	0.9823 ±0.0112	0.9714 ±0.0168	0.9822 ±0.0112
MNESM-EL	**0.9859 ±0.0128**	**0.9862 ±0.0141**	**0.9802 ±0.0181**	**0.9860 ±0.0143**	**0.9927 ±0.0090**	**0.9924 ±0.0091**	**0.9895 ±0.0129**	**0.9924 ±0.0091**
数据集	Pima				Iris0			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.7590 ±0.0158	0.7274 ±0.0155	0.6434 ±0.0212	0.7196 ±0.0165	0.9866 ±0.0182	0.9800 ±0.0273	0.9789 ±0.0288	0.9794 ±0.0281
UBAG	0.7214 ±0.0408	0.7383 ±0.0352	0.6666 ±0.0356	0.7355 ±0.0363	0.9866 ±0.0182	0.9800 ±0.0273	0.9789 ±0.0288	0.9794 ±0.0281
SBO	0.7408 ±0.0356	0.7291 ±0.0529	0.6469 ±0.0697	0.7257 ±0.0575	0.9933 ±0.0149	0.9900 ±0.0223	0.9894 ±0.0235	0.9897 ±0.0229

表 4.20 与经典集成学习算法比较（续）

Table 4.20 Comparison with classical ensemble learning algorithms (continued)

数据集	Pima				Iris0			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
RBO	0.7356 ±0.0309	0.7293 ±0.0337	0.6511 ±0.0414	0.7278 ±0.0342	0.9933 ±0.0149	0.9900 ±0.0223	0.9894 ±0.0235	0.9897 ±0.0229
EBO	0.7792 ±0.0480	0.7566 ±0.0392	0.6852 ±0.0437	0.7541 ±0.0379	0.9933 ±0.0149	0.9900 ±0.0223	0.9894 ±0.0235	0.9897 ±0.0229
BAC	0.6901 ±0.0307	0.7020 ±0.0256	0.6252 ±0.0277	0.6982 ±0.0258	**1±0**	**1±0**	**1±0**	**1±0**
Easy	0.7143 ±0.0306	0.7124 ±0.0423	0.6344 ±0.0512	0.7114 ±0.0423	0.9933 ±0.0149	0.9900 ±0.0223	0.9894 ±0.0235	0.9897 ±0.0229
MNESM-EL(default)	0.7616 ±0.0472	0.7683 ±0.0326	0.6969 ±0.0391	0.7574 ±0.0331	**1±0**	**1±0**	**1±0**	**1±0**
MNESM-EL	**0.8255 ±0.0299**	**0.8171 ±0.0331**	**0.7580 ±0.0414**	**0.8119 ±0.0350**	**1±0**	**1±0**	**1±0**	**1±0**
数据集	Yeast1				Haberman			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.7030 ±0.0246	0.6924 ±0.0239	0.5621 ±0.0347	0.6855 ±0.0331	0.6532 ±0.0654	0.6304 ±0.0521	0.4698 ±0.0637	0.6208 ±0.0463
UBAG	0.7263 ±0.0239	0.7210 ±0.0347	0.5989 ±0.0418	0.7204 ±0.0351	0.6598 ±0.0565	0.6422 ±0.0476	0.4861 ±0.0640	0.6188 ±0.0802
SBO	0.7183 ±0.0336	0.6946 ±0.0280	0.5648 ±0.0401	0.6865 ±0.0366	0.6370 ±0.0473	0.6145 ±0.0540	0.4517 ±0.0698	0.6096 ±0.0572
RBO	0.7398 ±0.0253	0.7104 ±0.0400	0.5864 ±0.0522	0.7066 ±0.0434	0.6575 ±0.0641	0.6639 ±0.0376	0.5076 ±0.0488	0.6575 ±0.0382
EBO	0.6913 ±0.0551	0.7081 ±0.0307	0.5857 ±0.0394	0.7032 ±0.0304	0.7018 ±0.0427	0.6548 ±0.0647	0.4901 ±0.0849	0.6375 ±0.0719
BAC	0.6440 ±0.0433	0.6794 ±0.0080	0.5885 ±0.0456	0.6696 ±0.0192	0.6172 ±0.0830	0.6210 ±0.0920	0.6581 ±0.1180	0.6189 ±0.0919
Easy	0.6543 ±0.0207	0.6752 ±0.0144	0.5481 ±0.0146	0.6728 ±0.0156	0.6843 ±0.0758	0.6008 ±0.1185	0.3728 ±0.2543	0.5165 ±0.2490
MNESM-EL(default)	0.7251 ±0.0411	0.7313 ±0.0364	0.6110 ±0.0421	0.7288 ±0.0377	0.7661 ±0.0427	0.7193 ±0.0457	0.5744 ±0.0431	0.6934 ±0.0683

表 4.20 与经典集成学习算法比较（续）

Table 4.20 Comparison with classical ensemble learning algorithms (continued)

数据集	Yeast1				Haberman			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
MNESM-EL	**0.7985 ±0.0225**	**0.7501 ±0.0458**	**0.6388 ±0.0622**	**0.7379 ±0.0674**	**0.9560 ±0.0254**	**0.9570 ±0.0112**	**0.9564 ±0.0110**	**0.9238 ±0.0387**
数据集	Vehicle2				Vehicle3			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9621 ±0.0130	0.9525 ±0.0245	0.9270 ±0.0261	0.9532 ±0.0244	0.7677 ±0.0092	0.7618 ±0.0170	0.6190 ±0.0195	0.7613 ±0.0177
UBAG	0.9566 ±0.0179	0.9536 ±0.0082	0.9235 ±0.0320	0.9599 ±0.0175	0.7411 ±0.0234	0.7768 ±0.0235	0.6213 ±0.0265	0.7720 ±0.0219
SBO	0.9657 ±0.0188	0.9661 ±0.0140	0.9328 ±0.0375	0.9660 ±0.0140	0.7718 ±0.0287	0.7441 ±0.0348	0.6015 ±0.0423	0.7402 ±0.0386
RBO	0.9621 ±0.0184	0.9671 ±0.0206	0.9304 ±0.0340	0.9669 ±0.0206	0.7564 ±0.0295	0.7493 ±0.0545	0.5993 ±0.0643	0.7464 ±0.0584
EBO	0.9704 ±0.0200	0.9681 ±0.0210	0.9442 ±0.0373	0.9680 ±0.0212	0.7494 ±0.0343	0.7902 ±0.0315	0.6364 ±0.0377	0.7854 ±0.0312
BAC	0.9515 ±0.0153	0.9539 ±0.0050	0.9114 ±0.0241	0.9536 ±0.0051	0.7055 ±0.0446	0.7360 ±0.0400	0.5765 ±0.0459	0.7314 ±0.0391
Easy	0.9455 ±0.0211	0.9559 ±0.0176	0.9031 ±0.0352	0.9555 ±0.0178	0.7257 ±0.0351	0.7386 ±0.0360	0.5830 ±0.0420	0.7377 ±0.0362
MNESM-EL(default)	0.9752 ±0.0153	0.9682 ±0.0174	0.9520 ±0.0295	0.9681 ±0.0175	0.8144 ±0.0424	0.7996 ±0.0273	0.6777 ±0.0457	0.7967 ±0.0264
MNESM-EL	**0.9834 ±0.0088**	**0.9784 ±0.0137**	**0.9679 ±0.0171**	**0.9783 ±0.0138**	**0.8475 ±0.0218**	**0.8356 ±0.0207**	**0.7279 ±0.0305**	**0.8350 ±0.0210**
数据集	Glass-0-1-2-3_vs_4-5-6				Vehicle0			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9203 ±0.0487	0.9198 ±0.0466	0.8509 ±0.0872	0.9183 ±0.0465	0.9337 ±0.0215	0.9359 ±0.0308	0.8703 ±0.0416	0.9355 ±0.0311
UBAG	0.8831 ±0.0520	0.8885 ±0.0503	0.7903 ±0.0863	0.8862 ±0.0491	0.9349 ±0.0131	0.9523 ±0.0189	0.8769 ±0.0251	0.9516 ±0.0187
SBO	0.9392 ±0.0390	0.9185 ±0.0514	0.8730 ±0.0807	0.9171 ±0.0524	0.9396 ±0.0252	0.9311 ±0.0385	0.8768 ±0.0519	0.9305 ±0.0389

表 4.20 与经典集成学习算法比较（续）

Table 4.20 Comparison with classical ensemble learning algorithms (continued)

数据集	Glass-0-1-2-3_vs_4-5-6				Vehicle0			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
RBO	0.9203 ±0.0428	0.9269 ±0.0324	0.8529 ±0.0740	0.9258 ±0.0322	0.9550 ±0.0106	0.9618 ±0.0138	0.9108 ±0.0206	0.9617 ±0.0137
EBO	0.9161 ±0.0533	0.9101 ±0.0514	0.8414 ±0.0880	0.9078 ±0.0522	0.9397 ±0.0234	0.9466 ±0.0279	0.8827 ±0.0440	0.9465 ±0.0278
BAC	0.9157 ±0.0359	0.8892 ±0.0517	0.8255 ±0.0715	0.9054 ±0.0435	0.9255 ±0.0239	0.9356 ±0.0223	0.8588 ±0.0393	0.9353 ±0.0225
Easy	0.9219 ±0.0268	0.9171 ±0.0313	0.8536 ±0.0521	0.9159 ±0.0319	0.9302 ±0.0224	0.9370 ±0.0312	0.8652 ±0.0418	0.9365 ±0.0315
MNESM-EL(default)	0.9764 ±0.0168	0.9708 ±0.0274	0.9504 ±0.0354	0.9704 ±0.0278	0.9645 ±0.0168	0.9663 ±0.0176	0.9282 ±0.0333	0.9663 ±0.0176
MNESM-EL	**1±0**	**1±0**	**1±0**	**1±0**	**0.9716 ±0.0341**	**0.9779 ±0.0247**	**0.9459 ±0.0622**	**0.9777 ±0.0250**
数据集	Ecoli1				Ecoli2			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.8814 ±0.0376	0.8998 ±0.0196	0.7865 ±0.0489	0.8975 ±0.0187	0.9168 ±0.0379	0.8926 ±0.0721	0.7606 ±0.1042	0.8870 ±0.0744
UBAG	0.8721 ±0.0540	0.8990 ±0.0501	0.7777 ±0.0761	0.8961 ±0.0510	0.8929 ±0.0408	0.8899 ±0.0353	0.7247 ±0.0834	0.8897 ±0.0353
SBO	0.8840 ±0.0436	0.8474 ±0.0587	0.7562 ±0.0916	0.8436 ±0.0621	0.9346 ±0.0301	0.9090 ±0.0786	0.8023 ±0.0962	0.9054 ±0.0842
RBO	0.8839 ±0.0266	0.9068 ±0.0290	0.7908 ±0.0348	0.9042 ±0.0289	0.9046 ±0.0252	0.8905 ±0.0332	0.7408 ±0.0364	0.8878 ±0.0356
EBO	0.8750 ±0.0734	0.8918 ±0.0578	0.7820 ±0.0953	0.8878 ±0.0616	0.8990 ±0.0570	0.8862 ±0.0639	0.7357 ±0.1204	0.8857 ±0.0645
BAC	0.8600 ±0.0584	0.8637 ±0.0439	0.7475 ±0.0773	0.8616 ±0.0434	0.8539 ±0.0376	0.8670 ±0.0341	0.6552 ±0.0653	0.8653 ±0.0332
Easy	0.8481 ±0.0611	0.8698 ±0.0564	0.7383 ±0.0855	0.8666 ±0.0570	0.8212 ±0.0427	0.8485 ±0.0298	0.6095 ±0.0525	0.8459 ±0.0284
MNESM-EL(default)	0.9345 ±0.0249	0.9438 ±0.0164	0.8721 ±0.0410	0.9432 ±0.0166	0.9613 ±0.0171	0.9533 ±0.0311	0.8828 ±0.0524	0.9530 ±0.0313

表 4.20 与经典集成学习算法比较（续）

Table 4.20 Comparison with classical ensemble learning algorithms (continued)

数据集	Ecoli1				Ecoli2			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
MNESM-EL	**0.9910 ±0.0200**	**0.9847 ±0.0341**	**0.9793 ±0.0463**	**0.9844 ±0.0349**	**0.9910 ±0.0134**	**0.9865 ±0.0218**	**0.9713 ±0.0416**	**0.9862 ±0.0223**
数据集	Glass6				Yeast3			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9346 ±0.0191	0.8923 ±0.0965	0.7657 ±0.1005	0.8836 ±0.1123	0.9413 ±0.0218	0.9401 ±0.0197	0.7822 ±0.0661	0.9401 ±0.0197
UBAG	0.8972 ±0.0421	0.9159 ±0.0576	0.7159 ±0.0953	0.9115 ±0.0553	0.9279 ±0.0258	0.9353 ±0.0155	0.7472 ±0.0673	0.9350 ±0.0156
SBO	0.9345 ±0.0106	0.8504 ±0.0815	0.7447 ±0.0615	0.8353 ±0.0970	0.9386 ±0.0086	0.8795 ±0.0148	0.7427 ±0.0290	0.8761 ±0.0157
RBO	0.9108 ±0.0518	0.9227 ±0.0342	0.7507 ±0.1082	0.9182 ±0.0340	0.9225 ±0.0263	0.9188 ±0.0240	0.7260 ±0.0698	0.9188 ±0.0240
EBO	0.8877 ±0.0894	0.8932 ±0.0700	0.7121 ±0.1598	0.8912 ±0.0701	0.9198 ±0.0252	0.9281 ±0.0166	0.7244 ±0.0597	0.9277 ±0.0168
BAC	0.8875 ±0.0395	0.8932 ±0.0359	0.6893 ±0.0791	0.8913 ±0.0352	0.9076 ±0.0257	0.9079 ±0.0316	0.6871 ±0.0697	0.9079 ±0.0316
Easy	0.8550 ±0.0387	0.8463 ±0.0935	0.6050 ±0.1065	0.8390 ±0.1036	0.9130 ±0.0222	0.9109 ±0.0274	0.6989 ±0.0580	0.9108 ±0.0274
MNESM-EL(default)	0.9812 ±0.0199	0.9892 ±0.0113	0.9359 ±0.0690	0.9891 ±0.0115	0.9535 ±0.0080	0.9175 ±0.0314	0.8040 ±0.0366	0.9159 ±0.0328
MNESM-EL	**0.9953 ±0.0104**	**0.9973 ±0.0060**	**0.9846 ±0.0344**	**0.9973 ±0.0061**	**0.9656 ±0.0168**	**0.9404 ±0.0258**	**0.8563 ±0.0595**	**0.9394 ±0.0267**
数据集	Ecoli3				Yeast-2-vs-4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.8898 ±0.0227	0.8754 ±0.0467	0.6197 ±0.0525	0.8736 ±0.0481	0.9163 ±0.0108	0.8910 ±0.0753	0.6664 ±0.0600	0.8861 ±0.0830
UBAG	0.8424 ±0.0520	0.8994 ±0.0386	0.5710 ±0.0843	0.8955 ±0.0396	0.9124 ±0.0305	0.9335 ±0.0229	0.6914 ±0.0662	0.9324 ±0.0229
SBO	0.9107 ±0.0179	0.8744 ±0.0735	0.6563 ±0.0814	0.8693 ±0.0823	0.9435 ±0.0187	0.8893 ±0.0455	0.7428 ±0.0829	0.9058 ±0.0581

表 4.20 与经典集成学习算法比较（续）

Table 4.20 Comparison with classical ensemble learning algorithms (continued)

数据集	Ecoli3				Yeast-2-vs-4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
RBO	0.8720 ±0.0522	0.8402 ±0.0332	0.5778 ±0.0686	0.8346 ±0.0337	0.9299 ±0.0371	0.9263 ±0.0296	0.7342 ±0.0819	0.9247 ±0.0309
EBO	0.8621 ±0.0174	0.8605 ±0.0746	0.5621 ±0.0549	0.8552 ±0.0810	0.9144 ±0.0510	0.9267 ±0.0196	0.7024 ±0.1029	0.9253 ±0.0209
BAC	0.8090 ±0.1216	0.8112 ±0.0749	0.4820 ±0.1089	0.7996 ±0.0831	0.9066 ±0.0520	0.8866 ±0.0358	0.6632 ±0.0875	0.8827 ±0.0396
Easy	0.8451 ±0.0822	0.8504 ±0.0463	0.5544 ±0.0845	0.8439 ±0.0493	0.9046 ±0.0221	0.9212 ±0.0433	0.6642 ±0.0618	0.9199 ±0.0435
MNESM-EL(default)	0.9166 ±0.0135	0.8776 ±0.1354	0.6499 ±0.1227	0.8553 ±0.1824	0.9669 ±0.0148	0.9371 ±0.0604	0.8404 ±0.0791	0.9344 ±0.0651
MNESM-EL	**0.9852 ±0.0148**	**0.9917 ±0.0083**	**0.9367 ±0.0625**	**0.9917 ±0.0083**	**0.9942 ±0.0053**	**0.9789 ±0.0265**	**0.9694 ±0.0280**	**0.9784 ±0.0272**
数据集	Yeast-0-5-6-7-9-vs-4				Glass-0-1-6_vs_2			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.8541 ±0.0340	0.8217 ±0.0822	0.5089 ±0.1030	0.8165 ±0.0885	0.8331 ±0.0475	0.6676 ±0.1698	0.4020 ±0.1666	0.5605 ±0.3434
UBAG	0.7916 ±0.0179	0.7969 ±0.0385	0.4271 ±0.0403	0.7963 ±0.0386	0.6667 ±0.0261	0.7035 ±0.1160	0.2771 ±0.0862	0.6863 ±0.1213
SBO	0.8900 ±0.0321	0.7727 ±0.0907	0.5235 ±0.1359	0.7523 ±0.1114	0.8491 ±0.0423	0.6014 ±0.1304	0.3234 ±0.1658	0.4569 ±0.2871
RBO	0.8351 ±0.0295	0.7862 ±0.0899	0.4581 ±0.0987	0.7788 ±0.0982	0.7809 ±0.0607	0.6999 ±0.1416	0.3196 ±0.1500	0.6692 ±0.1733
EBO	0.8180 ±0.0324	0.8206 ±0.0471	0.4692 ±0.0679	0.8197 ±0.0473	0.7182 ±0.0896	0.7930 ±0.1055	0.3669 ±0.1032	0.7851 ±0.1015
BAC	0.7557 ±0.0313	0.7511 ±0.0658	0.3686 ±0.0432	0.7456 ±0.0636	0.6300 ±0.1074	0.6254 ±0.1762	0.2199 ±0.0984	0.5965 ±0.1821
Easy	0.8047 ±0.0516	0.7801 ±0.0640	0.4298 ±0.0675	0.7757 ±0.0693	0.6345 ±0.1013	0.7390 ±0.1278	0.3066 ±0.1166	0.7259 ±0.1226
MNESM-EL(default)	0.8486 ±0.0285	**0.8813 ±0.0309**	0.5432 ±0.0482	**0.8801 ±0.0305**	0.8086 ±0.0927	0.8583 ±0.0779	0.4715 ±0.1238	0.8525 ±0.0793

表 4.20 与经典集成学习算法比较（续）

Table 4.20 Comparison with classical ensemble learning algorithms (continued)

数据集	Yeast-0-5-6-7-9-vs-4				Glass-0-1-6_vs_2			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
MNESM-EL	**0.9593 ±0.0258**	0.8705 ±0.1821	**0.7214 ±0.3026**	0.8224 ±0.2851	**0.9842 ±0.0444**	**0.9964 ±0.0071**	**0.9643 ±0.0714**	**0.9964 ±0.0072**
数据集	Glass2				Yeast1vs7			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.8174 ±0.0518	0.7019 ±0.1399	0.3847 ±0.1180	0.6077 ±0.3421	0.8237 ±0.0556	0.7208 ±0.0367	0.3174 ±0.0480	0.7074 ±0.0455
UBAG	0.5888 ±0.0579	0.7766 ±0.0316	0.2796 ±0.0375	0.7428 ±0.0422	0.7363 ±0.0262	0.6883 ±0.0798	0.2361 ±0.0525	0.6778 ±0.0981
SBO	0.8594 ±0.0585	0.7330 ±0.0945	0.4141 ±0.1420	0.7114 ±0.1150	0.8065 ±0.0742	0.7259 ±0.0319	0.3142 ±0.0662	0.7170 ±0.0356
RBO	0.7662 ±0.1562	0.6375 ±0.1506	0.3190 ±0.2350	0.6110 ±0.1610	0.8257 ±0.0558	0.7827 ±0.0943	0.3601 ±0.0813	0.7749 ±0.1005
EBO	0.7053 ±0.0626	0.7646 ±0.0711	0.3129 ±0.0714	0.7569 ±0.0638	0.7996 ±0.0336	0.7222 ±0.1005	0.2946 ±0.0899	0.7105 ±0.1192
BAC	0.5750 ±0.1166	0.6174 ±0.1515	0.2064 ±0.0854	0.6134 ±0.1478	0.6404 ±0.0785	0.6526 ±0.1016	0.1974 ±0.0634	0.6425 ±0.1109
Easy	0.5933 ±0.1077	0.7795 ±0.0565	0.2903 ±0.0845	0.7445 ±0.0766	0.6817 ±0.0821	0.7212 ±0.0346	0.2425 ±0.0201	0.7113 ±0.0416
MNESM-EL(default)	0.8543 ±0.1076	0.9199 ±0.0594	0.6005 ±0.2240	0.9149 ±0.0638	0.7525 ±0.0637	0.8159 ±0.0870	0.3228 ±0.0673	0.8072 ±0.0844
MNESM-EL	**0.9937 ±0.0073**	**0.9724 ±0.0373**	**0.9286 ±0.0825**	**0.9936 ±0.0073**	**0.9236 ±0.0303**	**0.8817 ±0.0933**	**0.5934 ±0.0311**	**0.8741 ±0.1020**
数据集	Glass4				Ecoli4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9060 ±0.0610	0.9025 ±0.0885	0.5733 ±0.1382	0.8921 ±0.1066	0.9524 ±0.0193	0.8810 ±0.0497	0.7463 ±0.1452	0.8753 ±0.0523
UBAG	0.8773 ±0.0577	0.8593 ±0.1031	0.4666 ±0.1027	0.8487 ±0.1153	0.8363 ±0.0802	0.8427 ±0.0773	0.4118 ±0.1298	0.8394 ±0.0756
SBO	0.9343 ±0.0355	0.8866 ±0.1011	0.6189 ±0.1166	0.8749 ±0.1178	0.9582 ±0.0164	0.8373 ±0.0964	0.6666 ±0.1020	0.8177 ±0.1151

表 4.20 与经典集成学习算法比较（续）

Table 4.20 Comparison with classical ensemble learning algorithms (continued)

数据集	Glass4				Ecoli4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
RBO	0.9018 ±0.0665	0.9004 ±0.1392	0.5563 ±0.2347	0.8962 ±0.1469	0.8927 ±0.0867	0.8961 ±0.0714	0.5680 ±0.2540	0.8920 ±0.0737
EBO	0.8975 ±0.1390	0.8666 ±0.1520	0.6187 ±0.2352	0.8578 ±0.1610	0.8600 ±0.1016	0.9021 ±0.1029	0.5121 ±0.2370	0.9005 ±0.1026
BAC	0.8036 ±0.0881	0.8480 ±0.1249	0.3915 ±0.2176	0.8393 ±0.1301	0.8539 ±0.0492	0.8989 ±0.0593	0.4491 ±0.1020	0.8956 ±0.0596
Easy	0.8693 ±0.0706	0.8208 ±0.1130	0.4389 ±0.1094	0.8108 ±0.1214	0.8869 ±0.0248	0.8930 ±0.0531	0.4888 ±0.0248	0.8897 ±0.0541
MNESM-EL(default)	0.9847 ±0.0133	0.9403 ±0.0928	0.8857 ±0.1030	0.9346 ±0.1025	0.9653 ±0.0087	0.9035 ±0.0700	0.7389 ±0.0674	0.8985 ±0.0742
MNESM-EL	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**
数据集	Abalone9-18				Shuttle-c2-vs-c4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.8617 ±0.0601	0.7257 ±0.1537	0.3392 ±0.1904	0.6932 ±0.1850	0.9221 ±0.0109	0.9558 ±0.0077	0.6334 ±0.0383	0.9551 ±0.0076
UBAG	0.7369 ±0.0566	0.7819 ±0.0526	0.2755 ±0.0453	0.7770 ±0.0536	0.9384 ±0.0842	0.9473 ±0.0447	0.7666 ±0.3248	0.9658 ±0.0467
SBO	0.9137 ±0.0458	0.7533 ±0.1430	0.4560 ±0.2876	0.7149 ±0.1897	0.9340 ±0.0241	0.9114 ±0.0904	0.6269 ±0.0362	0.9027 ±0.1095
RBO	0.8002 ±0.0353	0.7906 ±0.0992	0.3146 ±0.0807	0.7834 ±0.1052	0.9692 ±0.0688	0.9840 ±0.0357	0.8666 ±0.2981	0.9833 ±0.0373
EBO	0.7523 ±0.0597	0.7326 ±0.0941	0.2504 ±0.0572	0.7196 ±0.1073	**1±0**	**1±0**	**1±0**	**1±0**
BAC	0.7358 ±0.0713	0.7502 ±0.1094	0.2628 ±0.0932	0.7463 ±0.1094	**1±0**	**1±0**	**1±0**	**1±0**
Easy	0.6880 ±0.0665	0.7220 ±0.0595	0.2257 ±0.0444	0.7165 ±0.0586	**1±0**	**1±0**	**1±0**	**1±0**
MNESM-EL(default)	0.9429 ±0.0141	0.7631 ±0.0830	0.5238 ±0.0412	0.7276 ±0.1167	**1±0**	**1±0**	**1±0**	**1±0**

表 4.20 与经典集成学习算法比较（续）

Table 4.20 Comparison with classical ensemble learning algorithms (continued)

数据集	Abalone9-18				Shuttle-c2-vs-c4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
MNESM-EL	**0.9829 ±0.0048**	**0.9026 ±0.0442**	**0.8375 ±0.0530**	**0.8975 ±0.0489**	**1±0**	**1±0**	**1±0**	**1±0**
数据集	Glass5				Yeast2vs8			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9488 ±0.0382	0.9256 ±0.0998	0.6619 ±0.1980	0.9164 ±0.1185	0.9584 ±0.0181	0.8109 ±0.1566	0.5473 ±0.1410	0.7697 ±0.2034
UBAG	0.9495 ±0.0310	0.5266 ±0.2712	0.9512 ±0.0298	0.9065 ±0.0569	0.7590 ±0.1437	0.7307 ±0.1349	0.2327 ±0.1257	0.7215 ±0.1378
SBO	0.9673 ±0.0126	0.9353 ±0.1037	0.6933 ±0.0596	0.9266 ±0.1228	0.9646 ±0.0174	0.7902 ±0.1070	0.5833 ±0.1666	0.7528 ±0.1564
RBO	0.8976 ±0.0879	0.9463 ±0.0461	0.5815 ±0.3015	0.9438 ±0.0487	0.9335 ±0.0059	0.8457 ±0.0030	0.4846 ±0.0210	0.8403 ±0.0027
EBO	0.9297 ±0.0572	0.9634 ±0.0298	0.6066 ±0.2832	0.9623 ±0.0310	0.7820 ±0.0375	0.7666 ±0.0844	0.2238 ±0.0514	0.7613 ±0.0878
BAC	0.9018 ±0.0476	0.9487 ±0.0249	0.4866 ±0.1849	0.9471 ±0.0261	0.6823 ±0.0972	0.7625 ±0.1149	0.1910 ±0.0758	0.7485 ±0.1142
Easy	0.9390 ±0.0538	0.9682 ±0.0280	0.6266 ±0.2385	0.9674 ±0.0292	0.7637 ±0.0961	0.7571 ±0.1331	0.2214 ±0.0736	0.7471 ±0.1340
MNESM-EL(default)	0.9845 ±0.0134	0.9126 ±0.1409	0.8222 ±0.1678	0.8983 ±0.1657	0.8824 ±0.0627	0.8988 ±0.0418	0.4218 ±0.1143	0.8878 ±0.0438
MNESM-EL	**1±0**	**1±0**	**1±0**	**1±0**	**0.9917 ±0.0087**	**0.9000 ±0.1046**	**0.8762 ±0.1372**	**0.8944 ±0.1212**
数据集	Yeast4				Winequality-red-4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.7978 ±0.0482	0.8339 ±0.0374	0.2345 ±0.0278	0.8307 ±0.0327	0.8930 ±0.0156	0.6523 ±0.0732	0.1970 ±0.0716	0.5921 ±0.1039
UBAG	0.7742 ±0.0275	0.8452 ±0.0970	0.2097 ±0.0219	0.8179 ±0.0717	0.6897 ±0.0454	0.6666 ±0.0750	0.1206 ±0.0285	0.6600 ±0.0797
SBO	0.8215 ±0.0885	0.7979 ±0.0779	0.2466 ±0.0488	0.7835 ±0.0916	0.9392 ±0.0047	0.5867 ±0.0582	0.2180 ±0.0403	0.3999 ±0.2266

表 4.20 与经典集成学习算法比较（续）

Table 4.20 Comparison with classical ensemble learning algorithms (continued)

数据集	Yeast4				Winequality-red-4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
RBO	0.8200 ±0.0347	0.8199 ±0.0472	0.2398 ±0.0170	0.8165 ±0.0462	0.8116 ±0.0324	0.6228 ±0.0453	0.1330 ±0.0335	0.5879 ±0.0552
EBO	0.8126 ±0.0403	0.8372 ±0.0611	0.2437 ±0.0397	0.8340 ±0.0594	0.7535 ±0.0876	0.6110 ±0.0788	0.1051 ±0.0124	0.5630 ±0.1616
BAC	0.7850 ±0.0532	0.7747 ±0.0966	0.2031 ±0.0592	0.7710 ±0.1002	0.6113 ±0.0831	0.6500 ±0.0791	0.1021 ±0.0186	0.6335 ±0.0727
Easy	0.7998 ±0.0588	0.8191 ±0.0865	0.2337 ±0.0750	0.8159 ±0.0880	0.6611 ±0.1143	0.6403 ±0.0669	0.1083 ±0.0217	0.6206 ±0.0824
MNESM-EL(default)	0.8719 ±0.0671	**0.9337 ±0.0347**	0.3693 ±0.1069	**0.9308 ±0.0377**	0.6232 ±0.0569	0.6880 ±0.0603	0.1228 ±0.0244	0.6828 ±0.0589
MNESM-EL	**0.9535 ±0.0121**	0.7951 ±0.0709	**0.4398 ±0.0426**	0.7744 ±0.0883	**0.9694 ±0.0034**	**0.7268 ±0.0767**	**0.2998 ±0.0590**	**0.6911 ±0.1078**
数据集	Yeast-1-2-8-9-vs-7				Yeast5			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.8253 ±0.0177	0.6711 ±0.1485	0.1498 ±0.0788	0.6200 ±0.2011	0.9703 ±0.0122	0.9618 ±0.0320	0.6669 ±0.0925	0.9612 ±0.0325
UBAG	0.7285 ±0.0661	0.7147 ±0.0517	0.1423 ±0.0212	0.7089 ±0.0561	0.9393 ±0.0189	0.9458 ±0.0293	0.4917 ±0.0811	0.9451 ±0.0294
SBO	0.8171 ±0.0096	0.7299 ±0.1313	0.1851 ±0.0714	0.7065 ±0.1625	0.9757 ±0.0087	0.9444 ±0.0555	0.7018 ±0.0541	0.9418 ±0.0589
RBO	0.8456 ±0.0239	0.7389 ±0.0896	0.1992 ±0.0365	0.7191 ±0.1208	0.9440 ±0.1475	0.9604 ±0.0282	0.5158 ±0.0678	0.9600 ±0.0282
EBO	0.7696 ±0.0990	0.6714 ±0.0611	0.1440 ±0.0471	0.6537 ±0.0801	0.9602 ±0.0096	0.9458 ±0.0308	0.5849 ±0.0624	0.9452 ±0.0312
BAC	0.6472 ±0.0484	0.6727 ±0.0260	0.1122 ±0.0093	0.6702 ±0.0229	0.9333 ±0.0197	0.9534 ±0.0220	0.4736 ±0.0642	0.9526 ±0.0221
Easy	0.5957 ±0.1497	0.6783 ±0.0562	0.1130 ±0.0231	0.6591 ±0.0712	0.9198 ±0.0191	0.9479 ±0.0223	0.4253 ±0.0464	0.9470 ±0.0222
MNESM-EL(default)	0.8504 ±0.1242	**0.8152 ±0.0318**	0.2988 ±0.1210	**0.8035 ±0.0299**	0.9650 ±0.0140	0.9483 ±0.0256	0.6228 ±0.0757	0.9475 ±0.0260

表 4.20 与经典集成学习算法比较（续）

Table 4.20 Comparison with classical ensemble learning algorithms (continued)

数据集	Yeast-1-2-8-9-vs-7				Yeast5			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
MNESM-EL	**0.9762 ±0.0037**	0.7056 ±0.0551	**0.5227 ±0.0321**	0.6403 ±0.0890	**0.9811 ±0.0111**	**0.9688 ±0.0291**	**0.7589 ±0.1097**	**0.9682 ±0.0297**
数据集	Yeast6				Winequality-white-3_vs_7			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9521 ±0.0114	0.8360 ±0.1076	0.4103 ±0.0799	0.8179 ±0.1288	0.9333 ±0.0143	0.6605 ±0.0675	0.1980 ±0.0557	0.5865 ±0.1133
UBAG	0.8679 ±0.0335	0.8766 ±0.0594	0.2466 ±0.0502	0.8746 ±0.0593	0.7411 ±0.0529	0.7698 ±0.0618	0.1237 ±0.0255	0.7674 ±0.0581
SBO	0.9676 ±0.0084	0.7743 ±0.1489	0.4407 ±0.1667	0.7252 ±0.1973	0.9518 ±0.0032	0.7310 ±0.1207	0.3025 ±0.1000	0.6772 ±0.1771
RBO	0.8746 ±0.0377	0.8382 ±0.0795	0.2353 ±0.0390	0.8307 ±0.0848	0.7866 ±0.0873	0.7198 ±0.1365	0.1347 ±0.0713	0.7101 ±0.1409
EBO	0.8712 ±0.0517	0.8225 ±0.1086	0.2206 ±0.0575	0.8135 ±0.1236	0.7688 ±0.0550	0.7107 ±0.1565	0.1176 ±0.0589	0.6940 ±0.1782
BAC	0.7776 ±0.0334	0.8162 ±0.0426	0.1548 ±0.0158	0.8135 ±0.0405	0.7069± 0.0517	0.7279 ±0.1075	0.1043 ±0.0323	0.7223 ±0.1054
Easy	0.7755 ±0.0493	0.8293 ±0.0513	0.1603 ±0.0266	0.8246 ±0.0488	0.5966 ±0.1318	0.6715 ±0.0420	0.0779 ±0.0115	0.6521 ±0.0527
MNESM-EL(default)	0.8882 ±0.0337	**0.9148 ±0.0416**	0.2941 ±0.0620	**0.9136 ±0.0411**	0.8889 ±0.0147	0.8617 ±0.0779	0.2522 ±0.0589	0.8521 ±0.0788
MNESM-EL	**0.9747 ±0.0177**	0.8999 ±0.0595	**0.6365 ±0.1070**	0.8937 ±0.0651	**0.9917 ±0.0039**	**0.8736 ±0.1748**	**0.7778 ±0.1571**	**0.8595 ±0.2051**
数据集	Winequality-red-8_vs_6-7				Kr-vs-k-zero_vs_eight			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9005 ±0.0354	0.7349 ±0.0847	0.1937 ±0.0712	0.7054 ±0.1165	0.9294 ±0.0140	0.9564 ±0.0120	0.6436 ±0.0659	0.9562 ±0.0118
UBAG	0.6596 ±0.0886	0.7446 ±0.0555	0.0956 ±0.230	0.7323 ±0.0490	0.8376 ±0.0610	0.8779 ±0.0683	0.1802 ±0.0277	0.8704 ±0.0744
SBO	**0.9502 ±0.0139**	0.7298 ±0.1264	**0.2955 ±0.1582**	0.6764 ±0.1776	0.9374 ±0.0122	0.9177 ±0.0611	0.6434 ±0.0661	0.9151 ±0.0642

表 4.20 与经典集成学习算法比较（续）

Table 4.20 Comparison with classical ensemble learning algorithms (continued)

数据集	Winequality-red-8_vs_6-7				Kr-vs-k-zero_vs_eight			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
RBO	0.8070 ±0.0423	0.7139 ±0.1216	0.1151 ±0.0452	0.6886 ±0.1536	0.8945 ±0.0467	0.9462 ±0.0238	0.2836 ±0.0897	0.9444 ±0.0252
EBO	0.6830 ±0.1012	0.6750 ±0.0523	0.0813 ±0.0108	0.6610 ±0.0447	0.9095 ±0.0337	0.9539 ±0.0172	0.3081 ±0.0860	0.9526 ±0.0180
BAC	0.6783 ±0.1094	0.7625 ±0.1077	0.1043 ±0.0379	0.7467 ±0.1106	0.8362 ±0.0679	0.9165 ±0.0347	0.1970 ±0.0545	0.9128 ±0.0391
Easy	0.6549 ±0.0726	0.6933 ±0.1589	0.0819 ±0.0382	0.6748 ±0.1727	0.8602 ±0.0333	0.8732 ±0.0909	0.1979 ±0.0683	0.8693 ±0.0940
MNESM-EL(default)	0.7903 ±0.0981	0.8110 ±0.0652	0.1429 ±0.0000	0.8019 ±0.0612	0.9959 ±0.0029	0.9979 ±0.0015	0.9045 ±0.0648	0.9979 ±0.0015
MNESM-EL	0.8962 ±0.0071	**0.9183 ±0.0437**	0.2764 ±0.0347	**0.9097 ±0.0225**	**0.9979 ±0.0019**	**0.9990 ±0.0000**	**0.9510 ±0.0450**	**0.9990 ±0.0000**
数据集	Shuttle-2_vs_5				Kddcup-buffer_overflow_vs_back			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	**1±0**	**1±0**	**1±0**	**1±0**	0.9996 ±0.0010	0.9833 ±0.0373	0.9818 ±0.0407	0.9826 ±0.0390
UBAG	**1±0**	**1±0**	**1±0**	**1±0**	0.9861 ±0.0168	0.9929 ±0.0085	0.7471 ±0.2704	0.9929 ±0.0086
SBO	**1±0**	**1±0**	**1±0**	**1±0**	0.9986 ±0.0020	0.9828 ±0.0370	0.9532 ±0.0666	0.9821 ±0.0387
RBO	0.9834 ±0.0371	0.9915 ±0.0188	0.8533 ±0.3279	0.9913 ±0.0192	0.9605 ±0.0232	0.9800 ±0.0117	0.4848 ±0.2898	0.9797 ±0.0119
EBO	**1±0**	**1±0**	**1±0**	**1±0**	0.9852 ±0.0201	0.9760 ±0.0345	0.7387 ±0.2556	0.9752 ±0.0361
BAC	**1±0**	**1±0**	**1±0**	**1±0**	0.9771 ±0.0223	0.9884 ±0.0113	0.6533 ±0.3207	0.9882 ±0.0114
Easy	**1±0**	**1±0**	**1±0**	**1±0**	0.9520 ±0.0078	0.9757 ±0.0039	0.3622 ±0.0357	0.9754 ±0.0041
MNESM-EL(default)	0.9994 ±0.0008	0.9997 ±0.0004	0.9810 ±0.0261	0.9997 ±0.0004	0.9996 ±0.0010	0.9833 ±0.0373	0.9818 ±0.0407	0.9826 ±0.0390

表 4.20 与经典集成学习算法比较（续）

Table 4.20 Comparison with classical ensemble learning algorithms (continued)

数据集	Shuttle-2_vs_5				Kddcup-buffer_overflow_vs_back			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
MNESM-EL	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**
数据集	Kr-vs-k-zero_vs_fifteen				Rootkit_imapvsback			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SBAG	0.9694 ±0.0142	0.9570 ±0.0492	0.7258 ±0.0399	0.9553 ±0.0523	0.9854 ±0.0644	0.9543 ±0.0621	0.8769 ±0.1315	0.9525 ±0.0644
UBAG	0.9334 ±0.0196	0.9662 ±0.0099	0.2830 ±0.0757	0.9656 ±0.0102	0.9825 ±0.0279	0.9115 ±0.0506	0.8420 ±0.1243	0.9073 ±0.0528
SBO	0.9660 ±0.0153	0.9462 ±0.0542	0.7178 ±0.0448	0.9439 ±0.0577	0.9858 ±0.0290	0.9545 ±0.0623	0.8987 ±0.1244	0.9528 ±0.0646
RBO	0.9402 ±0.0347	0.9697 ±0.0176	0.3391 ±0.1441	0.9691 ±0.0181	0.9818 ±0.0283	0.9327 ±0.0620	0.8057 ±0.2371	0.9300 ±0.0643
EBO	0.9544 ±0.0340	0.9769 ±0.0172	0.4431 ±0.2470	0.9765 ±0.0176	0.9829 ±0.0282	0.9315 ±0.0631	0.8642 ±0.1432	0.9285 ±0.0658
BAC	0.9366 ±0.0292	0.9679 ±0.0148	0.3257 ±0.1712	0.9672 ±0.0151	0.9863 ±0.0292	0.9547 ±0.0625	0.9169 ±0.1327	0.9530 ±0.0648
Easy	0.9357 ±0.0235	0.9674 ±0.0119	0.2950 ±0.0914	0.9668 ±0.0122	0.9784 ±0.0266	0.9094 ±0.0514	0.7531 ±0.2110	0.9055 ±0.0535
MNESM-EL(default)	0.9995 ±0.0010	0.9998 ±0.0005	0.9846 ±0.0344	0.9998 ±0.0005	**1±0**	**1±0**	**1±0**	**1±0**
MNESM-EL	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**

A.5 表 4.23 的完整结果

表 A.5 为第四章中 4.3.4 节处表 4.23 的完整结果。主要记录了第四章提出的 MNESM-EL 算法与最先进的集成算法在 ACC、AUC、F-M 和 G-M 四个评价指标的对比结果。

表 4.23 SOTA 算法和本节提出算法之间的比较结果

Table 4.23 Comparison results between SOTA and proposed algorithm

数据集	Glass1				Wisconsin			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.7756 ±0.0801	0.7687 ±0.0901	0.7008 ±0.1109	0.7668 ±0.0911	0.9326 ±0.0224	0.9337 ±0.0234	0.9072 ±0.0303	0.9335 ±0.0234
SPE	0.7754 ±0.0646	0.7546 ±0.0679	0.6845 ±0.0901	0.7509 ±0.0694	0.9238 ±0.0149	0.9154 ±0.0055	0.8915 ±0.0150	0.9140 ±0.0057
HUE	0.7942 ±0.0351	0.7872 ±0.0430	0.7238 ±0.0462	0.7848 ±0.0426	0.9253 ±0.0202	0.9262 ±0.0182	0.8975 ±0.0255	0.9259 ±0.0183
ECUBoost	0.7620 ±0.0776	0.7543 ±0.0821	0.6849 ±0.0934	0.7511 ±0.0816	0.9385 ±0.0228	0.9401 ±0.0218	0.9154 ±0.0308	0.9399 ±0.0218
MNESM-EL(default)	0.8178 ±0.0723	0.8114 ±0.0720	0.7467 ±0.1329	0.7852 ±0.1040	0.9795 ±0.0120	0.9823 ±0.0112	0.9714 ±0.0168	0.9822 ±0.0112
MNESM-EL	**0.9859 ±0.0128**	**0.9862 ±0.0141**	**0.9802 ±0.0181**	**0.9860 ±0.0143**	**0.9927 ±0.0090**	**0.9924 ±0.0091**	**0.9895 ±0.0129**	**0.9924 ±0.0091**
数据集	Pima				Iris0			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.6523 ±0.0306	0.6474 ±0.0297	0.5590 ±0.0319	0.6466 ±0.0297	**1±0**	**1±0**	**1±0**	**1±0**
SPE	0.6470 ±0.0277	0.6335 ±0.0344	0.5372 ±0.0446	0.6311 ±0.0359	**1±0**	**1±0**	**1±0**	**1±0**
HUE	0.6588 ±0.0338	0.6419 ±0.0339	0.5455 ±0.0387	0.6392 ±0.0339	**1±0**	**1±0**	**1±0**	**1±0**
ECUBoost	0.6745 ±0.0314	0.6437 ±0.0312	0.5357 ±0.0431	0.6326 ±0.0367	**1±0**	**1±0**	**1±0**	**1±0**
MNESM-EL(default)	0.7616 ±0.0472	0.7683 ±0.0326	0.6969 ±0.0391	0.7574 ±0.0331	**1±0**	**1±0**	**1±0**	**1±0**
MNESM-EL	**0.8255 ±0.0299**	**0.8171 ±0.0331**	**0.7580 ±0.0414**	**0.8119 ±0.0350**	**1±0**	**1±0**	**1±0**	**1±0**

表 4.23 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.23 Comparison results between SOTA and proposed algorithm (continued)

数据集	Yeast1				Haberman			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.7358 ±0.0238	0.7256 ±0.0244	0.6054 ±0.0311	0.7241 ±0.0248	0.6312 ±0.0802	0.5877 ±0.0779	0.4199 ±0.0827	0.5792 ±0.0792
SPE	0.7237 ±0.0408	0.7040 ±0.0357	0.5804 ±0.0441	0.7015 ±0.0355	0.5846 ±0.0690	0.5823 ±0.0730	0.4259 ±0.0793	0.5807 ±0.0720
HUE	0.7243 ±0.0278	0.7058 ±0.0278	0.5818 ±0.0353	0.7042 ±0.0280	0.5819 ±0.0796	0.5339 ±0.0715	0.3559 ±0.0764	0.5188 ±0.0707
ECUBoost	0.7385 ±0.0191	0.7193 ±0.0161	0.5986 ±0.0205	0.7175 ±0.0162	0.4932 ±0.0634	0.5519 ±0.0743	0.4132 ±0.0719	0.5327 ±0.0719
MNESM-EL(default)	0.7251 ±0.0411	0.7313 ±0.0364	0.6110 ±0.0421	0.7288 ±0.0377	0.7661 ±0.0427	0.7193 ±0.0457	0.5744 ±0.0431	0.6934 ±0.0683
MNESM-EL	**0.7985 ±0.0225**	**0.7501 ±0.0458**	**0.6388 ±0.0622**	**0.7379 ±0.0674**	**0.9560 ±0.0254**	**0.9570 ±0.0112**	**0.9564 ±0.0110**	**0.9238 ±0.0387**
数据集	Vehicle2				Vehicle3			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9645 ±0.0134	0.9559 ±0.0189	0.9257 ±0.0280	0.9556 ±0.0191	0.7623 ±0.0278	0.7281 ±0.0367	0.5815 ±0.0494	0.7242 ±0.0387
SPE	0.9645 ±0.0158	0.9595 ±0.0166	0.9328 ±0.0294	0.9593 ±0.0167	0.7553 ±0.0079	0.7206 ±0.0073	0.5713 ±0.0100	0.7168 ±0.0088
HUE	0.9538 ±0.0219	0.9525 ±0.0178	0.9149 ±0.0375	0.9523 ±0.0178	0.7270 ±0.0374	0.7333 ±0.0376	0.5783 ±0.0438	0.7311 ±0.0363
ECUBoost	0.9704 ±0.0106	0.9636 ±0.0126	0.9434 ±0.0183	0.9632 ±0.0128	0.7647 ±0.0285	0.6860 ±0.0193	0.5308 ±0.0293	0.6672 ±0.0172
MNESM-EL(default)	0.9752 ±0.0153	0.9682 ±0.0174	0.9520 ±0.0295	0.9681 ±0.0175	0.8144 ±0.0424	0.7996 ±0.0273	0.6777 ±0.0457	0.7967 ±0.0264
MNESM-EL	**0.9834 ±0.0088**	**0.9784 ±0.0137**	**0.9679 ±0.0171**	**0.9783 ±0.0138**	**0.8475 ±0.0218**	**0.8356 ±0.0207**	**0.7279 ±0.0305**	**0.8350 ±0.0210**
数据集	Glass-0-1-2-3_vs_4-5-6				Vehicle0			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9346 ±0.0307	0.9173 ±0.0380	0.8668 ±0.0569	0.9157 ±0.0391	0.9597 ±0.0196	0.9545 ±0.0184	0.9181 ±0.0376	0.9544 ±0.0184

表 4.23 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.23 Comparison results between SOTA and proposed algorithm (continued)

数据集	Glass-0-1-2-3_vs_4-5-6				Vehicle0			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
SPE	0.8967 ±0.0448	0.8558 ±0.0552	0.7840 ±0.0720	0.8472 ±0.0607	0.9598 ±0.0137	0.9459 ±0.0160	0.9154 ±0.0267	0.9451 ±0.0168
HUE	0.7270 ±0.0374	0.7333 ±0.0376	0.5783 ±0.0438	0.7311 ±0.0363	0.9491 ±0.0087	0.9581 ±0.0087	0.9004 ±0.0162	0.9579 ±0.0086
ECUBoost	0.9345 ±0.0175	0.9172 ±0.0419	0.8640 ±0.0376	0.9133 ±0.0461	0.9539 ±0.0195	0.9542 ±0.0203	0.9084 ±0.0357	0.9535 ±0.0206
MNESM-EL(default)	0.9764 ±0.0168	0.9708 ±0.0274	0.9504 ±0.0354	0.9704 ±0.0278	0.9645 ±0.0168	0.9663 ±0.0176	0.9282 ±0.0333	0.9663 ±0.0176
MNESM-EL	**1±0**	**1±0**	**1±0**	**1±0**	**0.9716 ±0.0341**	**0.9779 ±0.0247**	**0.9459 ±0.0622**	**0.9777 ±0.0250**
数据集	Ecoli1				Ecoli2			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.8989 ±0.0314	0.8607 ±0.0500	0.7802 ±0.0693	0.8560 ±0.0536	0.9256 ±0.0523	0.8871 ±0.0689	0.7886 ±0.1235	0.8840 ±0.0704
SPE	0.8841 ±0.0349	0.8484 ±0.0653	0.7524 ±0.0802	0.8406 ±0.0732	0.9435 ±0.0303	0.8942 ±0.0525	0.8214 ±0.0922	0.8895 ±0.0569
HUE	0.8571 ±0.0545	0.8704 ±0.0412	0.7476 ±0.0791	0.8693 ±0.0418	0.8838 ±0.0176	0.8846 ±0.0208	0.7035 ±0.0223	0.8831 ±0.0203
ECUBoost	0.9136 ±0.0404	0.8569 ±0.0625	0.7981 ±0.0987	0.8488 ±0.0684	0.8746 ±0.1476	0.8575 ±0.0961	0.7371 ±0.1897	0.8454 ±0.1095
MNESM-EL(default)	0.9345 ±0.0249	0.9438 ±0.0164	0.8721 ±0.0410	0.9432 ±0.0166	0.9613 ±0.0171	0.9533 ±0.0311	0.8828 ±0.0524	0.9530 ±0.0313
MNESM-EL	**0.9910 ±0.0200**	**0.9847 ±0.0341**	**0.9793 ±0.0463**	**0.9844 ±0.0349**	**0.9910 ±0.0134**	**0.9865 ±0.0218**	**0.9713 ±0.0416**	**0.9862 ±0.0223**
数据集	Glass6				Yeast3			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9486 ±0.0092	0.9250 ±0.0623	0.8197 ±0.0512	0.9210 ±0.0676	0.9353 ±0.0062	0.8826 ±0.0331	0.7335 ±0.0327	0.8791 ±0.0354
SPE	0.9439 ±0.0347	0.8944 ±0.0963	0.7921 ±0.1383	0.8861 ±0.1090	0.9366 ±0.0157	0.8810 ±0.0263	0.7392 ±0.0576	0.8779 ±0.0281

表 4.23 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.23 Comparison results between SOTA and proposed algorithm (continued)

数据集	Glass6				Yeast3			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
HUE	0.9302 ±0.0465	0.9175 ±0.0435	0.7967 ±0.1158	0.9157 ±0.0441	0.9110 ±0.0208	0.8964 ±0.0203	0.6876 ±0.0478	0.8955 ±0.0213
ECUBoost	0.9485 ±0.0519	0.9250 ±0.0669	0.8387 ±0.1382	0.9203 ±0.0721	0.9366 ±0.0152	0.8969 ±0.0334	0.7477 ±0.0422	0.8942 ±0.0365
MNESM-EL(default)	0.9812 ±0.0199	0.9892 ±0.0113	0.9359 ±0.0690	0.9891 ±0.0115	0.9535 ±0.0080	0.9175 ±0.0314	0.8040 ±0.0366	0.9159 ±0.0328
MNESM-EL	**0.9953 ±0.0104**	**0.9973 ±0.0060**	**0.9846 ±0.0344**	**0.9973 ±0.0061**	**0.9656 ±0.0168**	**0.9404 ±0.0258**	**0.8563 ±0.0595**	**0.9394 ±0.0267**
数据集	Ecoli3				Yeast-2-vs-4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9078 ±0.0472	0.8097 ±0.1166	0.6100 ±0.1820	0.7882 ±0.1378	0.9416 ±0.0261	0.8623 ±0.0856	0.7188 ±0.1360	0.8517 ±0.0979
SPE	0.8986 ±0.0259	0.7919 ±0.0953	0.5695 ±0.1207	0.7721 ±0.1094	0.9572 ±0.0131	0.9316 ±0.0273	0.8096 ±0.0486	0.9302 ±0.0285
HUE	0.8572 ±0.0444	0.8698 ±0.0447	0.5736 ±0.0911	0.8693 ±0.0443	0.8910 ±0.0187	0.9047 ±0.0378	0.6277 ±0.0546	0.9037 ±0.0374
ECUBoost	0.9195 ±0.0336	0.8414 ±0.0921	0.6571 ±0.1281	0.8274 ±0.1096	0.9163 ±0.0265	0.8661 ±0.0434	0.6630 ±0.0430	0.8594 ±0.0508
MNESM-EL(default)	0.9166 ±0.0135	0.8776 ±0.1354	0.6499 ±0.1227	0.8553 ±0.1824	0.9669 ±0.0148	0.9371 ±0.0604	0.8404 ±0.0791	0.9344 ±0.0651
MNESM-EL	**0.9852 ±0.0148**	**0.9917 ±0.0083**	**0.9367 ±0.0625**	**0.9917 ±0.0083**	**0.9942 ±0.0053**	**0.9789 ±0.0265**	**0.9694 ±0.0280**	**0.9784 ±0.0272**
数据集	Yeast-0-5-6-7-9-vs-4				Glass-0-1-6_vs_2			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.8806 ±0.0233	0.8095 ±0.0620	0.5387 ±0.0817	0.8021 ±0.0676	0.7916 ±0.0600	0.5700 ±0.0783	0.2004 ±0.1249	0.4436 ±0.2274
SPE	0.8599 ±0.0494	0.8016 ±0.0910	0.5109 ±0.1306	0.7956 ±0.0947	0.7759 ±0.0543	0.7054 ±0.1384	0.2966 ±0.1573	0.6121 ±0.3086
HUE	0.8086 ±0.0549	0.7813 ±0.0486	0.4440 ±0.1000	0.7794 ±0.0493	0.6399 ±0.1113	0.7059 ±0.0675	0.2799 ±0.0489	0.6843 ±0.0737

表 4.23 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.23 Comparison results between SOTA and proposed algorithm (continued)

数据集	Yeast-0-5-6-7-9-vs-4				Glass-0-1-6_vs_2			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
ECUBoost	0.8977 ±0.0299	0.7840 ±0.0367	0.5538 ±0.0394	0.7672 ±0.0488	0.6197 ±0.1118	0.5061 ±0.1231	0.1207 ±0.0815	0.3878 ±0.2236
MNESM-EL(default)	0.8486 ±0.0285	**0.8813 ±0.0309**	0.5432 ±0.0482	**0.8801 ±0.0305**	0.8086 ±0.0927	0.8583 ±0.0779	0.4715 ±0.1238	0.8525 ±0.0793
MNESM-EL	**0.9593 ±0.0258**	0.8705 ±0.1821	**0.7214 ±0.3026**	0.8224 ±0.2851	**0.9842 ±0.0444**	**0.9964 ±0.0071**	**0.9643 ±0.0714**	**0.9964 ±0.0072**
数据集	Glass2				Yeast1vs7			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.7944 ±0.0165	0.7202 ±0.1439	0.3147 ±0.1203	0.6918 ±0.1640	0.8323 ±0.0389	0.7088 ±0.0945	0.2996 ±0.0735	0.6767 ±0.1230
SPE	0.7849 ±0.0237	0.6842 ±0.0887	0.2911 ±0.0997	0.6617 ±0.1144	0.7581 ±0.0205	0.7001 ±0.0920	0.2519 ±0.0564	0.6888 ±0.0945
HUE	0.6966 ±0.0859	0.7596 ±0.0851	0.3145 ±0.0845	0.7518 ±0.0819	0.6950 ±0.0887	0.6663 ±0.1180	0.2188 ±0.0905	0.6430 ±0.1286
ECUBoost	0.7988 ±0.0549	0.7003 ±0.0758	0.3233 ±0.0975	0.6831 ±0.0928	0.8583 ±0.0308	0.7537 ±0.0489	0.3722 ±0.0445	0.7390 ±0.0603
MNESM-EL(default)	0.8543 ±0.1076	0.9199 ±0.0594	0.6005 ±0.2240	0.9149 ±0.0638	0.7525 ±0.0637	0.8159 ±0.0870	0.3228 ±0.0673	0.8072 ±0.0844
MNESM-EL	**0.9937 ±0.0073**	**0.9724 ±0.0373**	**0.9286 ±0.0825**	**0.9936 ±0.0073**	**0.9236 ±0.0303**	**0.8817 ±0.0933**	**0.5934 ±0.0311**	**0.8741 ±0.1020**
数据集	Glass4				Ecoli4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9486 ±0.0270	0.8160 ±0.1426	0.5895 ±0.2248	0.7847 ±0.1711	0.9582 ±0.0274	0.8373 ±0.1251	0.6716 ±0.2234	0.8096 ±0.1669
SPE	0.9486 ±0.0227	0.8943 ±0.1058	0.6599 ±0.1688	0.8842 ±0.1187	0.9642 ±0.0223	0.8873 ±0.0871	0.7365 ±0.1263	0.8756 ±0.1012
HUE	0.8321 ±0.0919	0.8626 ±0.0873	0.4204 ±0.1110	0.8502 ±0.0989	0.8747 ±0.0515	0.8865 ±0.1137	0.4833 ±0.1598	0.8808 ±0.1211
ECUBoost	0.9627 ±0.0237	0.9492 ±0.0710	0.7690 ±0.1489	0.9466 ±0.0759	0.9612 ±0.0152	0.8623 ±0.1014	0.6978 ±0.0939	0.8436 ±0.1202

表 4.23 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.23 Comparison results between SOTA and proposed algorithm (continued)

数据集	Glass4				Ecoli4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
MNESM-EL(default)	0.9847 ±0.0133	0.9403 ±0.0928	0.8857 ±0.1030	0.9346 ±0.1025	0.9653 ±0.0087	0.9035 ±0.0700	0.7389 ±0.0674	0.8985 ±0.0742
MNESM-EL	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**
数据集	Abalone9-18				Shuttle-c2-vs-c4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9083 ±0.0205	0.7935 ±0.0862	0.4554 ±0.1128	0.7758 ±0.1065	**1±0**	**1±0**	**1±0**	**1±0**
SPE	0.8768 ±0.0096	0.7574 ±0.0591	0.3636 ±0.0334	0.7407 ±0.0688	0.9923 ±0.0153	0.9000 ±0.2000	0.8000 ±0.4000	0.8000 ±0.4000
HUE	0.8371 ±0.0160	0.7571 ±0.0417	0.3202 ±0.0416	0.7501 ±0.0469	**1±0**	**1±0**	**1±0**	**1±0**
ECUBoost	0.8617 ±0.0470	0.7951 ±0.0890	0.3780 ±0.0694	0.7766 ±0.1180	0.9923 ±0.0153	0.9500 ±0.0999	0.9333 ±0.1333	0.9414 ±0.1171
MNESM-EL(default)	0.9429 ±0.0141	0.7631 ±0.0830	0.5238 ±0.0412	0.7276 ±0.1167	**1±0**	**1±0**	**1±0**	**1±0**
MNESM-EL	**0.9829 ±0.0048**	**0.9026 ±0.0442**	**0.8375 ±0.0530**	**0.8975 ±0.0489**	**1±0**	**1±0**	**1±0**	**1±0**
数据集	Glass5				Yeast2vs8			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9812 ±0.0271	0.8926 ±0.1968	0.7142 ±0.3938	0.7925 ±0.3965	0.9169 ±0.0287	0.7653 ±0.0626	0.3915 ±0.1006	0.7433 ±0.0756
SPE	0.9812 ±0.0271	0.9902 ±0.0142	0.8476 ±0.1890	0.9900 ±0.0144	0.8609 ±0.0267	0.7600 ±0.1574	0.2637 ±0.1019	0.7180 ±0.2037
HUE	0.8788 ±0.0677	0.9365 ±0.0356	0.4504 ±0.1291	0.9336 ±0.0382	0.7923 ±0.0579	0.7959 ±0.0973	0.2517 ±0.0684	0.7895 ±0.0990
ECUBoost	0.9112 ±0.0629	0.9536 ±0.0330	0.5454 ±0.2082	0.9518 ±0.0348	0.8318 ±0.0444	0.7448 ±0.0453	0.2510 ±0.0470	0.7334 ±0.0569
MNESM-EL(default)	0.9845 ±0.0134	0.9126 ±0.1409	0.8222 ±0.1678	0.8983 ±0.1657	0.8824 ±0.0627	0.8988 ±0.0418	0.4218 ±0.1143	0.8878 ±0.0438

表 4.23 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.23 Comparison results between SOTA and proposed algorithm (continued)

数据集	Glass5				Yeast2vs8			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
MNESM-EL	**1±0**	**1±0**	**1±0**	**1±0**	**0.9917 ±0.0087**	**0.9000 ±0.1046**	**0.8762 ±0.1372**	**0.8944 ±0.1212**
数据集	Yeast4				Winequality-red-4			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9083 ±0.0164	0.7893 ±0.0782	0.3316 ±0.0671	0.7725 ±0.0917	0.7785 ±0.0302	0.6124 ±0.0568	0.1142 ±0.0266	0.5779 ±0.0831
SPE	0.8712 ±0.0095	0.8000 ±0.0392	0.2791 ±0.0350	0.7951 ±0.0437	0.7173 ±0.0542	0.6168 ±0.0693	0.1091 ±0.0345	0.6010 ±0.0795
HUE	0.8167 ±0.0300	0.8112 ±0.0534	0.2351 ±0.0373	0.8094 ±0.0520	0.6960 ±0.0204	0.6892 ±0.0451	0.1294 ±0.0156	0.6877 ±0.0459
ECUBoost	0.9204 ±0.0229	0.8176 ±0.0429	0.3891 ±0.0734	0.8087 ±0.0485	0.6292 ±0.1777	0.5906 ±0.0374	0.0932 ±0.0192	0.5529 ±0.0582
MNESM-EL(default)	0.8719 ±0.0671	**0.9337 ±0.0347**	0.3693 ±0.1069	**0.9308 ±0.0377**	0.6232 ±0.0569	0.6880 ±0.0603	0.1228 ±0.0244	0.6828 ±0.0589
MNESM-EL	**0.9535 ±0.0121**	0.7951 ±0.0709	**0.4398 ±0.0426**	0.7744 ±0.0883	**0.9694 ±0.0034**	**0.7268 ±0.0767**	**0.2998 ±0.0590**	**0.6911 ±0.1078**
数据集	Yeast-1-2-8-9-vs-7				Yeast5			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.7877 ±0.0520	0.6646 ±0.0267	0.1424 ±0.0266	0.6491 ±0.0288	0.9770 ±0.0068	0.9006 ±0.0427	0.6854 ±0.0728	0.8956 ±0.0481
SPE	0.6980 ±0.0373	0.6989 ±0.0447	0.1274 ±0.0117	0.6940 ±0.0469	0.9757 ±0.0107	0.8892 ±0.0673	0.6666 ±0.1285	0.8815 ±0.0777
HUE	0.6737 ±0.0439	0.6703 ±0.0719	0.1129 ±0.0223	0.6592 ±0.0845	0.9501 ±0.0100	0.9513 ±0.0299	0.5349 ±0.0514	0.9509 ±0.0300
ECUBoost	0.6737 ±0.1902	0.7025 ±0.1043	0.1559 ±0.0735	0.6843 ±0.1096	0.9770 ±0.0077	0.8885 ±0.0738	0.6720 ±0.0938	0.8794 ±0.0842
MNESM-EL(default)	0.8504 ±0.1242	**0.8152 ±0.0318**	0.2988 ±0.1210	**0.8035 ±0.0299**	0.9650 ±0.0140	0.9483 ±0.0256	0.6228 ±0.0757	0.9475 ±0.0260
MNESM-EL	**0.9762 ±0.0037**	0.7056 ±0.0551	**0.5227 ±0.0321**	0.6403 ±0.0890	**0.9811 ±0.0111**	**0.9688 ±0.0291**	**0.7589 ±0.1097**	**0.9682 ±0.0297**

表 4.23 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.23 Comparison results between SOTA and proposed algorithm (continued)

数据集	Yeast6				Winequality-white-3_vs_7			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9420 ±0.0124	0.8030 ±0.0698	0.3509 ±0.0635	0.7842 ±0.0874	0.9433 ±0.0214	0.7511 ±0.1385	0.2923 ±0.1600	0.6427 ±0.3257
SPE	0.9103 ±0.0311	0.8425 ±0.1048	0.3038 ±0.0909	0.8302 ±0.1192	0.8888 ±0.0312	0.7232 ±0.0841	0.1834 ±0.0531	0.6890 ±0.1201
HUE	0.8786 ±0.0248	0.8542 ±0.0245	0.2482 ±0.0312	0.8529 ±0.0265	0.8022 ±0.0191	0.7034 ±0.0887	0.1153 ±0.0293	0.6816 ±0.1219
ECUBoost	0.9615 ±0.0083	0.8130 ±0.0597	0.4507 ±0.0919	0.7946 ±0.0768	0.6188 ±0.1883	0.6829 ±0.0831	0.1007 ±0.0560	0.6595 ±0.0964
MNESM-EL(default)	0.8882 ±0.0337	**0.9148 ±0.0416**	0.2941 ±0.0620	**0.9136 ±0.0411**	0.8889 ±0.0147	0.8617 ±0.0779	0.2522 ±0.0589	0.8521 ±0.0788
MNESM-EL	**0.9747 ±0.0177**	0.8999 ±0.0595	**0.6365 ±0.1070**	0.8937 ±0.0651	**0.9917 ±0.0039**	**0.8736 ±0.1748**	**0.7778 ±0.1571**	**0.8595 ±0.2051**
数据集	Winequality-red-8_vs_6-7				Kr-vs-k-zero_vs_eight			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.7964 ±0.0550	0.5859 ±0.1207	0.0732 ±0.0488	0.4735 ±0.2590	0.9863 ±0.0075	0.9244 ±0.0983	0.7045 ±0.1528	0.9151 ±0.1137
SPE	0.6257 ±0.0731	0.6213 ±0.0944	0.0623 ±0.0188	0.5999 ±0.1044	0.9678 ±0.0073	0.8627 ±0.1268	0.4549 ±0.1158	0.8407 ±0.1573
HUE	0.5918 ±0.0551	0.6367 ±0.0701	0.0638 ±0.0046	0.6250 ±0.0588	0.9171 ±0.0135	0.9577 ±0.0069	0.3116 ±0.0331	0.9568 ±0.0072
ECUBoost	0.2350 ±0.1469	0.5604 ±0.0913	0.0480 ±0.0092	0.4130 ±0.1613	0.8712 ±0.0521	0.8951 ±0.0940	0.2418 ±0.1103	0.8914 ±0.0970
MNESM-EL(default)	0.7903 ±0.0981	0.8110 ±0.0652	0.1429 ±0.0000	0.8019 ±0.0612	0.9959 ±0.0029	0.9979 ±0.0015	0.9045 ±0.0648	0.9979 ±0.0015
MNESM-EL	**0.8962 ±0.0071**	**0.9183 ±0.0437**	**0.2764 ±0.0347**	**0.9097 ±0.0225**	**0.9979 ±0.0019**	**0.9990 ±0.0000**	**0.9510 ±0.0450**	**0.9990 ±0.0000**
数据集	Shuttle-2_vs_5				Kddcup-buffer_overflow_vs_back			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**
SPE	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**

表 4.23 SOTA 算法和本节提出算法之间的比较结果（续）

Table 4.23 Comparison results between SOTA and proposed algorithm (continued)

数据集	Shuttle-2_vs_5				Kddcup-buffer_overflow_vs_back			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
HUE	**1±0**	**1±0**	**1±0**	**1±0**	0.9995 ±0.0008	0.9833 ±0.0333	0.9818 ±0.0363	0.9825 ±0.0348
ECUBoost	**1±0**	**1±0**	**1±0**	**1±0**	0.9991 ±0.0010	0.9666 ±0.0408	0.9636 ±0.0445	0.9651 ±0.0426
MNESM-EL(default)	0.9994 ±0.0008	0.9997 ±0.0004	0.9810 ±0.0261	0.9997 ±0.0004	0.9996 ±0.0010	0.9833 ±0.0373	0.9818 ±0.0407	0.9826 ±0.0390
MNESM-EL	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**
数据集	Kr-vs-k-zero_vs_fifteen				Rootkit_imapvsback			
评价指标	ACC	AUC	F-M	G-M	ACC	AUC	F-M	G-M
EASE	0.9990 ±0.0011	0.9797 ±0.0398	0.9595 ±0.0498	0.9786 ±0.0421	0.9995 ±0.0008	0.9800 ±0.0399	0.9777 ±0.0444	0.9788 ±0.0422
SPE	0.9995 ±0.0009	0.9997 ±0.0004	0.9846 ±0.0307	0.9997 ±0.0004	0.9991 ±0.0011	0.9550 ±0.0556	0.9492 ±0.0630	0.9520 ±0.0593
HUE	0.9872 ±0.0099	0.9771 ±0.0317	0.6964 ±0.1634	0.9763 ±0.0331	0.9950 ±0.0078	0.9479 ±0.0637	0.8300 ±0.2357	0.9446 ±0.0678
ECUBoost	**1±0**	**1±0**	**1±0**	**1±0**	0.9991 ±0.0017	0.9600 ±0.0799	0.9500 ±0.1000	0.9549 ±0.0901
MNESM-EL(default)	0.9995 ±0.0010	0.9998 ±0.0005	0.9846 ±0.0344	0.9998 ±0.0005	**1±0**	**1±0**	**1±0**	**1±0**
MNESM-EL	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**	**1±0**

A.6 表 4.27 的完整结果

表 A.6 为第四章中 4.3.4 节处表 4.27 的完整结果。主要记录了第四章提出的 MNESM-EL 算法与基于样本生成的深度学习方法的对比结果。

表 4.27 与基于样本生成的深度学习方法的比较

Table 4.27 Comparison with sample generation based deep learning methods

数据集	算法	AUC	F-M	G-M
Ecoli1	CNN+SMOTE	0.6522±0.0381	0.4668±0.0509	0.6405±0.0399
	CNN+AE+GAN	0.8376±0.0541	0.4303±0.0690	0.8295±0.0556
	BED	0.8495±0.0251	0.7584±0.0268	0.8467±0.0269
	RVGAN-TL	0.8123±0.0510	0.7252±0.0654	0.7991±0.0583
	EAL-GAN	0.9226±0.0441	0.6968±0.0960	0.8624±0.0518
	DLE-ISMOTE	0.7663±0.0599	0.5826±0.0710	0.7463±0.0910
	MNESM-EL(default)	0.9438±0.0164	0.8721±0.0410	0.9432±0.0166
	MNESM-EL	**0.9847±0.0341**	**0.9793±0.0463**	**0.9844±0.0349**
Ecoli3	CNN+SMOTE	0.8288±0.0831	0.4810±0.0636	0.8209±0.0851
	CNN+AE+GAN	0.8325±0.0129	0.4944±0.0305	0.8321±0.0134
	BED	0.9197±0.0212	0.5941±0.0679	0.9159±0.0231
	RVGAN-TL	0.7443±0.0883	0.5621±0.1560	0.7031±0.1180
	EAL-GAN	0.9200±0.0574	0.6086±0.1530	0.8650±0.0664
	DLE-ISMOTE	0.8452±0.0183	0.5227±0.0227	0.8451±0.0185
	MNESM-EL(default)	0.8776±0.1354	0.6499±0.1227	0.8553±0.1824
	MNESM-EL	**0.9917±0.0083**	**0.9367±0.0625**	**0.9917±0.0083**
Glass-0-1-6_vs_2	CNN+SMOTE	0.6025±0.0765	0.2151±0.0601	0.5629±0.0842
	CNN+AE+GAN	0.6065±0.0932	0.2314±0.0872	0.5952±0.1070
	BED	0.7133±0.0775	0.2488±0.0416	0.6887±0.0682
	RVGAN-TL	0.5935±0.1600	0.1967±0.2410	0.3269±0.1560
	EAL-GAN	0.6389±0.1290	0.3704±0.1250	0.5992±0.0997
	DLE-ISMOTE	0.6698±0.1210	0.2269±0.0769	0.6143±0.1400
	MNESM-EL(default)	0.8583±0.0779	0.4715±0.1238	0.8525±0.0793
	MNESM-EL	**0.9964±0.0071**	**0.9643±0.0714**	**0.9964±0.0072**
Shuttle-c2-vs-c4	CNN+SMOTE	0.9957±0.0088	0.9918±0.0112	0.9957±0.0089
	CNN+AE+GAN	0.9997±0.0007	0.9959±0.0091	0.9997±0.0007

表 4.27 与基于样本生成的深度学习方法的比较（续）

Table 4.27 Comparison with sample generation based deep learning methods (continued)

数据集	算法	AUC	F-M	G-M
Shuttle-c2-vs-c4	BED	**1±0**	**1±0**	**1±0**
	RVGAN-TL	**1±0**	**1±0**	**1±0**
	EAL-GAN	0.9960±0.0120	0.9940±0.0143	0.9905±0.0234
	DLE-ISMOTE	0.9791±0.0022	0.9787±0.0054	0.9789±0.0028
	MNESM-EL(default)	**1±0**	**1±0**	**1±0**
	MNESM-EL	**1±0**	**1±0**	**1±0**
Yeast4	CNN+SMOTE	0.8279±0.0325	0.2963±0.0204	0.8250±0.0349
	CNN+AE+GAN	0.7970±0.0335	0.2983±0.0538	0.7907±0.0380
	BED	0.8573±0.0080	0.2508±0.0155	0.8562±0.0084
	RVGAN-TL	0.6352±0.0755	0.3328±0.0716	0.4948±0.0937
	EAL-GAN	**0.8764±0.0604**	0.3045±0.1130	0.4533±0.1130
	DLE-ISMOTE	0.8552±0.0179	0.2910±0.0252	0.8545±0.0181
	MNESM-EL(default)	0.9337±0.0347	0.3693±0.1069	0.9308±0.0377
	MNESM-EL	0.7951±0.0709	**0.4398±0.0426**	**0.7744±0.0883**
Yeast5	CNN+SMOTE	0.9242±0.0513	0.4922±0.1120	0.9228±0.0560
	CNN+AE+GAN	0.9183±0.0398	0.4335±0.0560	0.9168±0.0408
	BED	**0.9785±0.0016**	0.5925±0.0168	**0.9782±0.0016**
	RVGAN-TL	0.7991±0.0721	0.6638±0.0878	0.7685±0.0977
	EAL-GAN	0.9715±0.0391	0.5556±0.0242	0.8094±0.0264
	DLE-ISMOTE	0.9687±0.0086	0.4810±0.0707	0.9682±0.0089
	MNESM-EL(default)	0.9483±0.0256	0.6228±0.0757	0.9475±0.0260
	MNESM-EL	0.9688±0.0291	**0.7589±0.1097**	0.9682±0.0297
Yeast6	CNN+SMOTE	0.8739±0.0517	0.2753±0.0567	0.8724±0.0532
	CNN+AE+GAN	0.8663±0.0744	0.2485±0.0550	0.8639±0.0754
	BED	0.8829±0.0291	0.2586±0.0147	0.8823±0.0282
	RVGAN-TL	0.7098±0.0678	0.4821±0.1540	0.6415±0.1160
	EAL-GAN	0.9336±0.0355	0.5476±0.0982	0.7020±0.0496
	DLE-ISMOTE	**0.9345±0.0186**	0.2717±0.0261	**0.9321±0.0192**
	MNESM-EL(default)	0.9148±0.0416	0.2941±0.0620	0.9136±0.0411
	MNESM-EL	0.8999±0.0595	**0.6365±0.1070**	0.8937±0.0651

表 4.27 与基于样本生成的深度学习方法的比较（续）

Table 4.27 Comparison with sample generation based deep learning methods (continued)

数据集	算法	AUC	F-M	G-M
Winequality-red-8_vs_6-7	CNN+SMOTE	0.6434±0.0762	0.0896±0.0288	0.6250±0.0934
	CNN+AE+GAN	0.6026±0.0315	0.0550±0.0041	0.6002±0.0327
	BED	0.6613±0.0621	0.0801±0.0142	0.6587±0.0619
	RVGAN-TL	0.6470±0.0193	**0.3800±0.0653**	0.5447±0.0372
	EAL-GAN	0.5294±0.1690	0.0400±0.1000	0.0000±0.0000
	DLE-ISMOTE	0.5722±0.0810	0.0957±0.0791	0.5714±0.0865
	MNESM-EL(default)	0.8110±0.0652	0.1429±0.0000	0.8019±0.0612
	MNESM-EL	**0.9183±0.0437**	0.2764±0.0347	**0.9097±0.0225**
Shuttle-2_vs_5	CNN+SMOTE	0.9994±0.0008	0.9636±0.0498	0.9994±0.008
	CNN+AE+GAN	0.9989±0.0004	0.9351±0.0237	0.9989±0.004
	BED	0.9991±0.0008	0.9453±0.0471	0.9991±0.008
	RVGAN-TL	**1±0**	**1±0**	**1±0**
	EAL-GAN	**1±0**	**1±0**	**1±0**
	DLE-ISMOTE	0.9992±0.0008	0.9545±0.0455	0.9992±0.008
	MNESM-EL(default)	0.9997±0.0004	0.9810±0.0261	0.9997±0.0004
	MNESM-EL	**1±0**	**1±0**	**1±0**
Rootkit_imapvsback	CNN+SMOTE	0.9993±0.0006	0.9414±0.0541	0.9993±0.0006
	CNN+AE+GAN	0.9050±0.0102	0.8532±0.1380	0.8935±0.1210
	BED	**1±0**	**1±0**	**1±0**
	RVGAN-TL	**1±0**	**1±0**	**1±0**
	EAL-GAN	0.9538±0.0092	0.9190±0.0174	0.9298±0.0161
	DLE-ISMOTE	0.9375±0.0625	0.9286±0.0714	0.9330±0.0670
	MNESM-EL(default)	**1±0**	**1±0**	**1±0**
	MNESM-EL	**1±0**	**1±0**	**1±0**