

# Supplementary material for “BlindSMOTE: Evolutionary computation only based synthetic minority oversampling”

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# 1 Datasets

Datasets used in the experiments.

Table 1: Datasets of low imbalance ratio ( $IR \leq 10$ ).

	Dataset	Instances	Inputs	Minority	Majority	Imbalance ratio
1	ads	3,279	1,558	459	2,820	6.1
2	adult	48,842	105	11,687	37,155	3.2
3	AID1284Morered	362	914	57	305	5.4
4	AID1284red	362	103	57	305	5.4
5	AID439Morered	69	914	13	56	4.3
6	AID439red	69	81	13	56	4.3
7	AID721morered	94	914	21	73	3.5
8	AID721red	94	87	21	73	3.5
9	antivirus	372	531	72	300	4.2
10	bank	41,188	62	4,640	36,548	7.9
11	colposcopies-c	287	62	71	216	3.0
12	deposit	45,211	48	5,289	39,922	7.5
13	euthyroid	3,163	44	293	2,870	9.8
14	fertility	100	9	12	88	7.3
15	hepatitis	155	19	32	123	3.8
16	hERG-9inputs	130	9	26	104	4.0
17	hinselmann	97	62	15	82	5.5
18	hiv1-proteasa	5,938	160	1,010	4,928	4.9
19	htu2	17,898	8	1,639	16,259	9.9
20	immuno-therapy	90	7	19	71	3.7
21	lung-cancer-michigan	96	7,129	10	86	8.6
22	musk	6,598	166	1,017	5,581	5.5
23	semeion	1,593	265	161	1,432	8.9
24	sens-1-gram	3,801	15	502	3,299	6.6
25	sens-2-gram	3,801	209	502	3,299	6.6
26	sens-3-gram	3,801	1,877	502	3,299	6.6
27	sens-4-gram	3,801	11,408	502	3,299	6.6
28	shoppers	12,330	28	1,908	10,422	5.5
29	spect	267	22	55	212	3.9
30	steel-b	1,941	27	402	1,539	3.8
31	steel-k	1,941	27	391	1,550	4.0
32	steel-z	1,941	27	190	1,751	9.2
33	thoracic	470	27	70	400	5.7
34	tis	13,375	927	3,312	10,063	3.0
35	transfusion	748	4	178	570	3.2

Table 2: Datasets of medium imbalance ratio ( $10 < IR \leq 100$ )

	Dataset	Instances	Inputs	Minority	Majority	Imbalance ratio
1	AID1608Morered	1,033	914	68	965	14.2
2	AID1608red	1,033	154	68	965	14.2
3	AID362red	4,279	144	60	4,219	70.3
4	carG	1,728	16	69	1,659	24.0
5	ccds	36,449	4,016	1,391	35,058	25.2
6	census	29,926	409	1,912	28,014	14.7
7	cervical-B	858	35	55	803	14.6
8	cervical-C	858	35	44	814	18.5
9	cervical-H	858	35	35	823	23.5
10	cervical-S	858	35	74	784	10.6
11	climate	540	20	46	494	10.7
12	hiva	4,229	1,617	149	4,080	27.4
13	kddcup98	9,541	9,076	484	9,057	18.7
14	opn310k	10,481	200	922	9,559	10.4
15	ozone1hr	2,536	72	73	2,463	33.7
16	ozone8hr	2,534	72	160	2,374	14.8
17	polish-1st	7,027	64	271	6,756	24.9
18	polish-2nd	10,173	64	400	9,773	24.4
19	polish-3rd	10,503	64	495	10,008	20.2
20	polish-4th	9,792	64	515	9,277	18.0
21	polish-5th	5,910	64	410	5,500	13.4
22	secom	1,567	590	104	1,463	14.1
23	seismic	2,583	22	170	2,413	14.2
24	sick	3,772	33	231	3,541	15.3
25	steel-d	1,941	27	55	1,886	34.3
26	steel-p	1,941	27	158	1,783	11.3
27	steel-s	1,941	27	72	1,869	26.0
28	thrombin	1,909	139,351	42	1,867	44.5
29	ustilago	55,279	4,016	586	54,693	93.3
30	wilt	4,839	5	261	4,578	17.5

Table 3: Datasets of high imbalance ratio ( $IR > 100$ )

	Dataset	Instances	Inputs	Minority	Majority	Imbalance ratio
1	abalone19	4,177	10	32	4,145	129.5
2	AID373AID439red	59,795	154	13	59,782	4,598.6
3	AID373red	59,788	155	62	59,726	963.3
4	AID456red	9,982	153	27	9,955	368.7
5	AID604	95,662	154	340	95,322	280.4
6	AID604AID644_AllRed	59,782	154	67	59,715	891.3
7	AID687AID721red	33,067	153	21	33,046	1,573.6
8	AID687red	33,067	153	94	32,973	350.8
9	AID688red	27,189	153	248	26,941	108.6
10	AID746AID1284red	59,784	154	57	59,727	1,047.8
11	AID746red	59,788	154	366	59,422	162.4
12	anuran-f-b	7,195	22	68	7,127	104.8
13	arabidopsis	33,971	4,016	273	33,698	123.4
14	bio	145,751	74	1,296	144,455	111.5
15	block	57,492	11	210	57,282	272.8
16	chrom19	170,051	5	177	169,874	959.7
17	chrom21	126,770	1,612	33	126,737	3,840.5
18	dna	50,000	800	120	49,880	415.7
19	linkage	57,492	11	210	57,282	272.8
20	p53-mutants	31,420	5,408	151	31,269	207.1

## 2 Figures

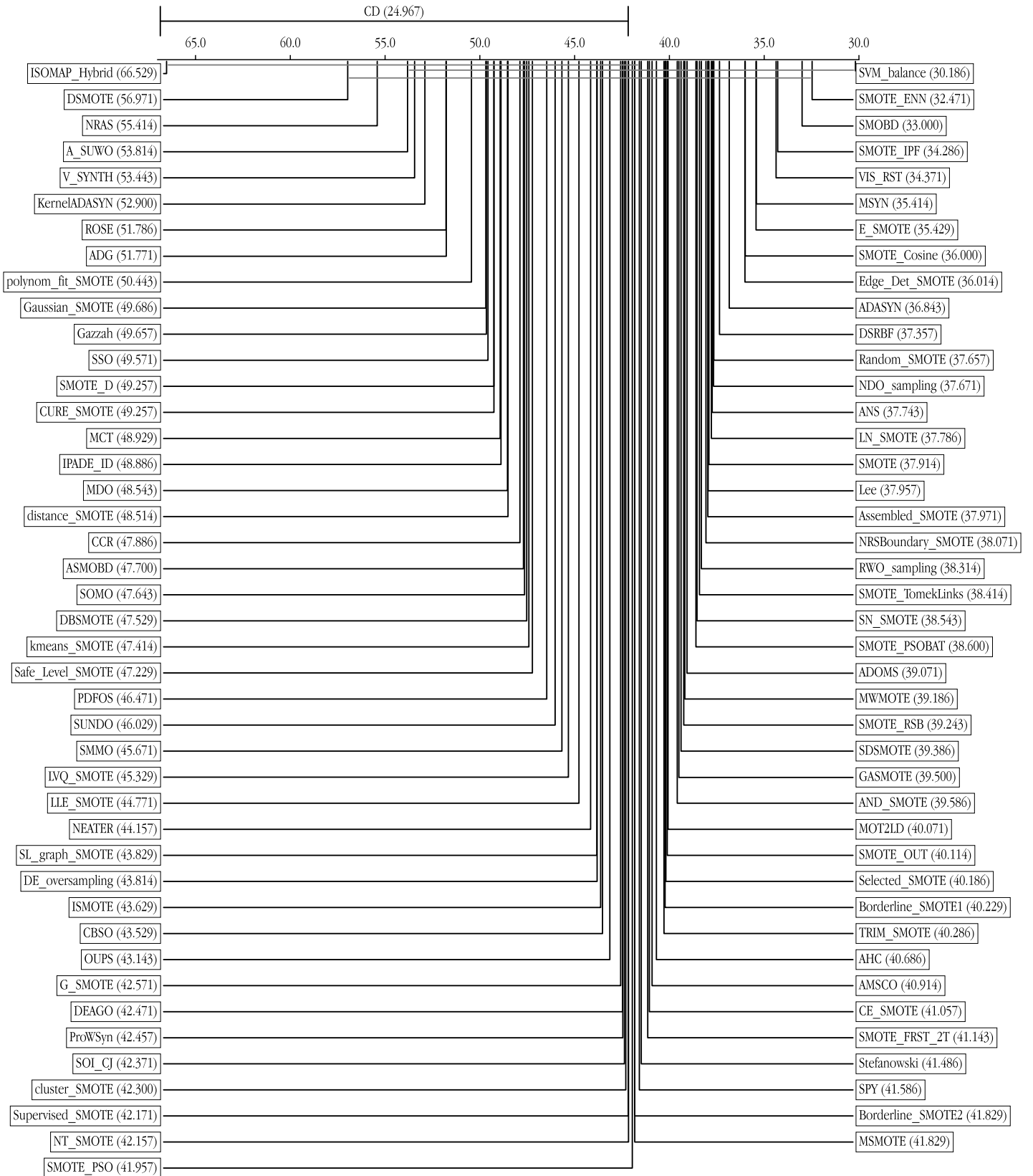


Figure 1: Nemenyi test for G-mean and 1-NN classifier for standard SMOTE based methods.

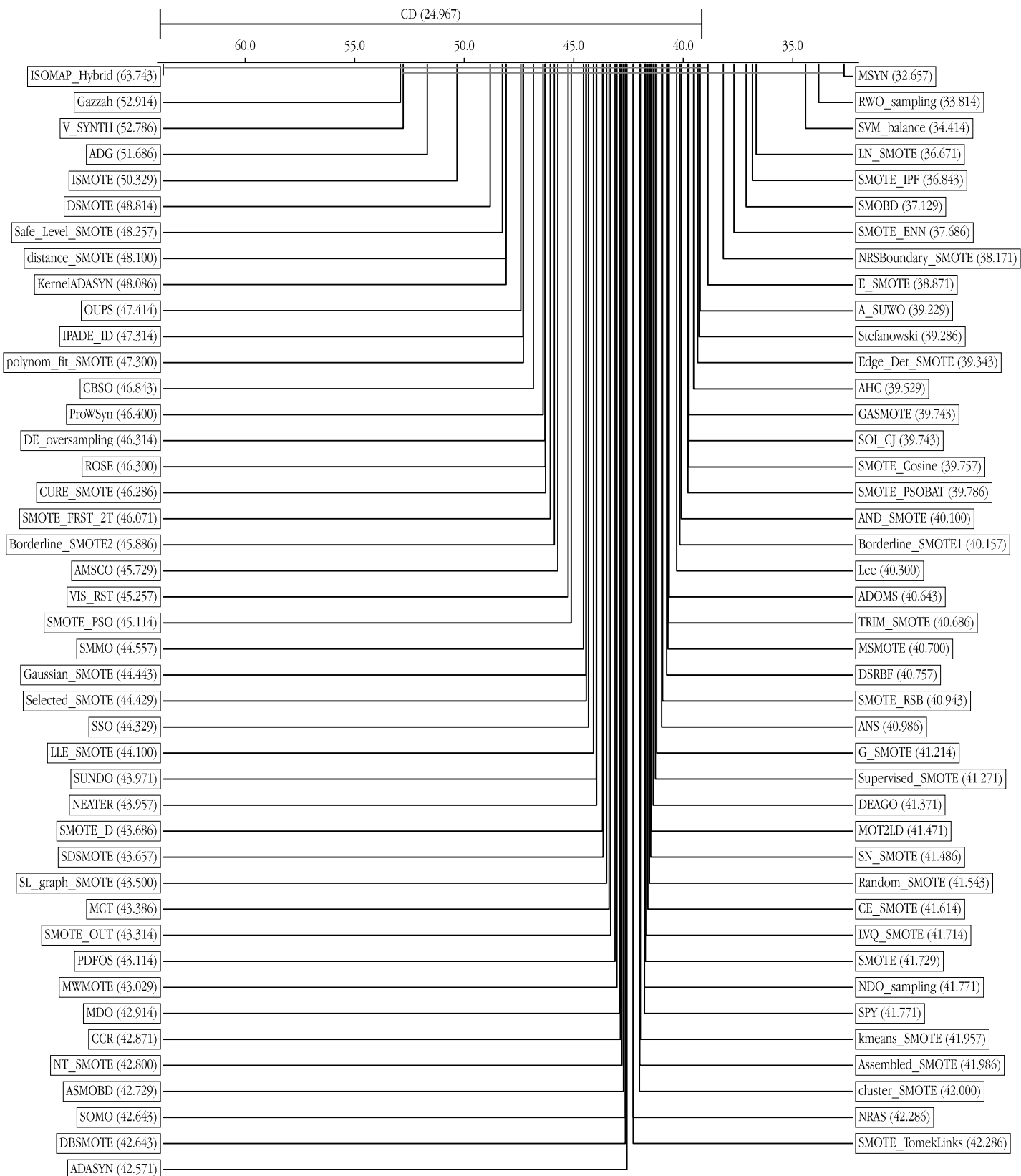


Figure 2: Nemenyi test for F1 and 1-NN classifier for standard SMOTE based methods.

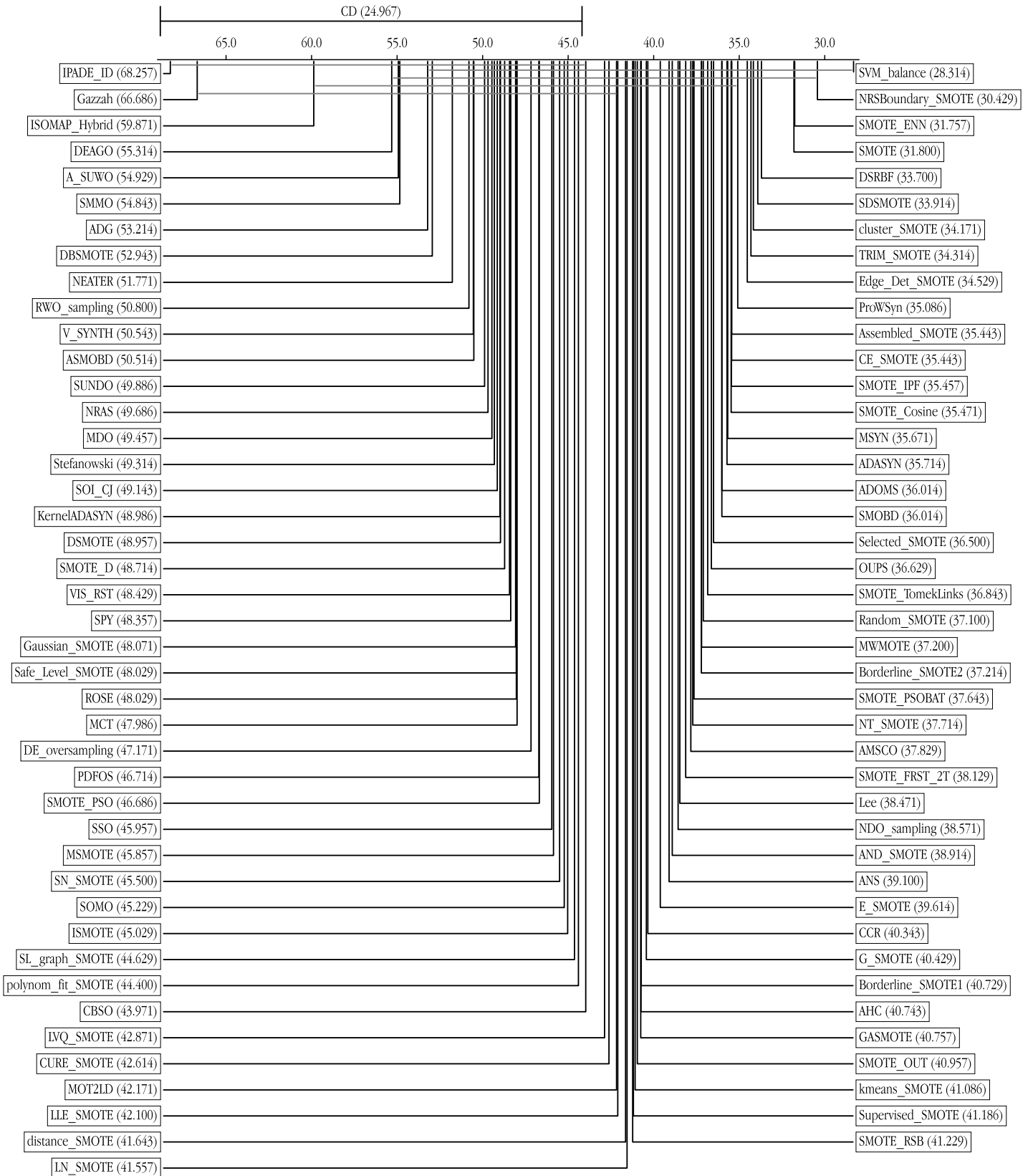


Figure 3: Nemenyi test for G-mean and C4.5 classifier for standard SMOTE based methods.

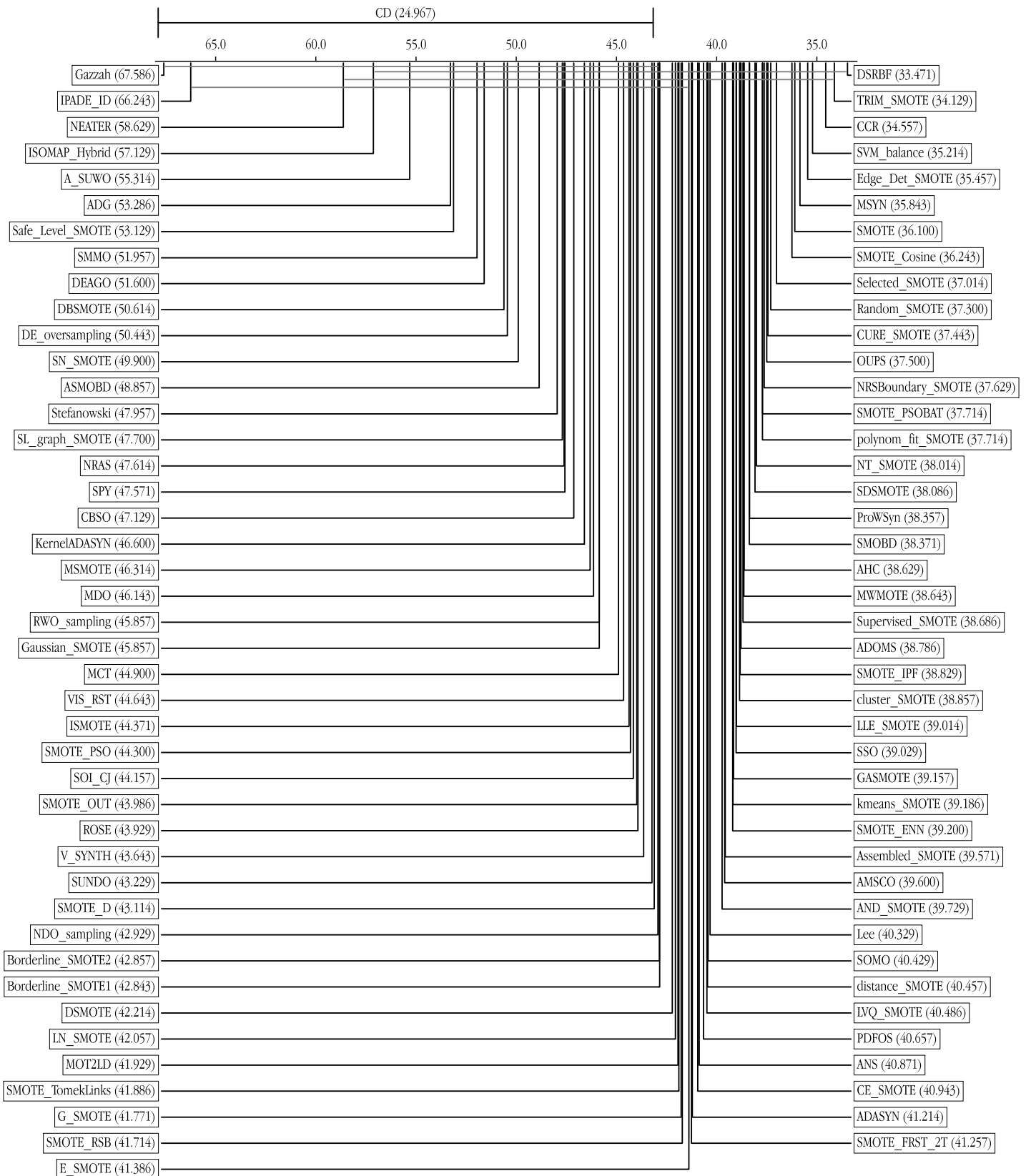


Figure 4: Nemenyi test for F1 and C4.5 classifier for standard SMOTE based methods.



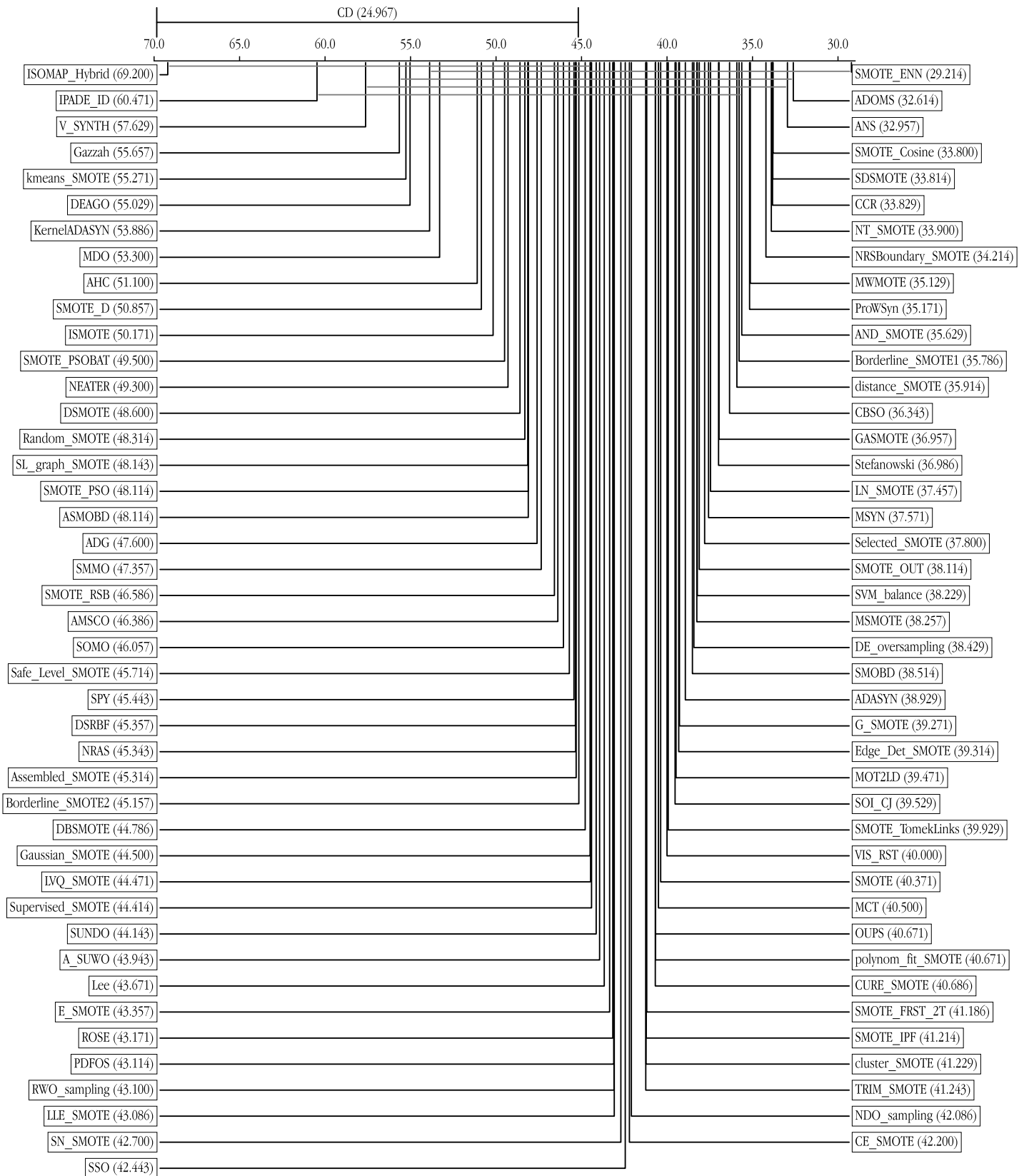


Figure 5: Nemenyi test for G-mean and a MLP classifier for standard SMOTE based methods.

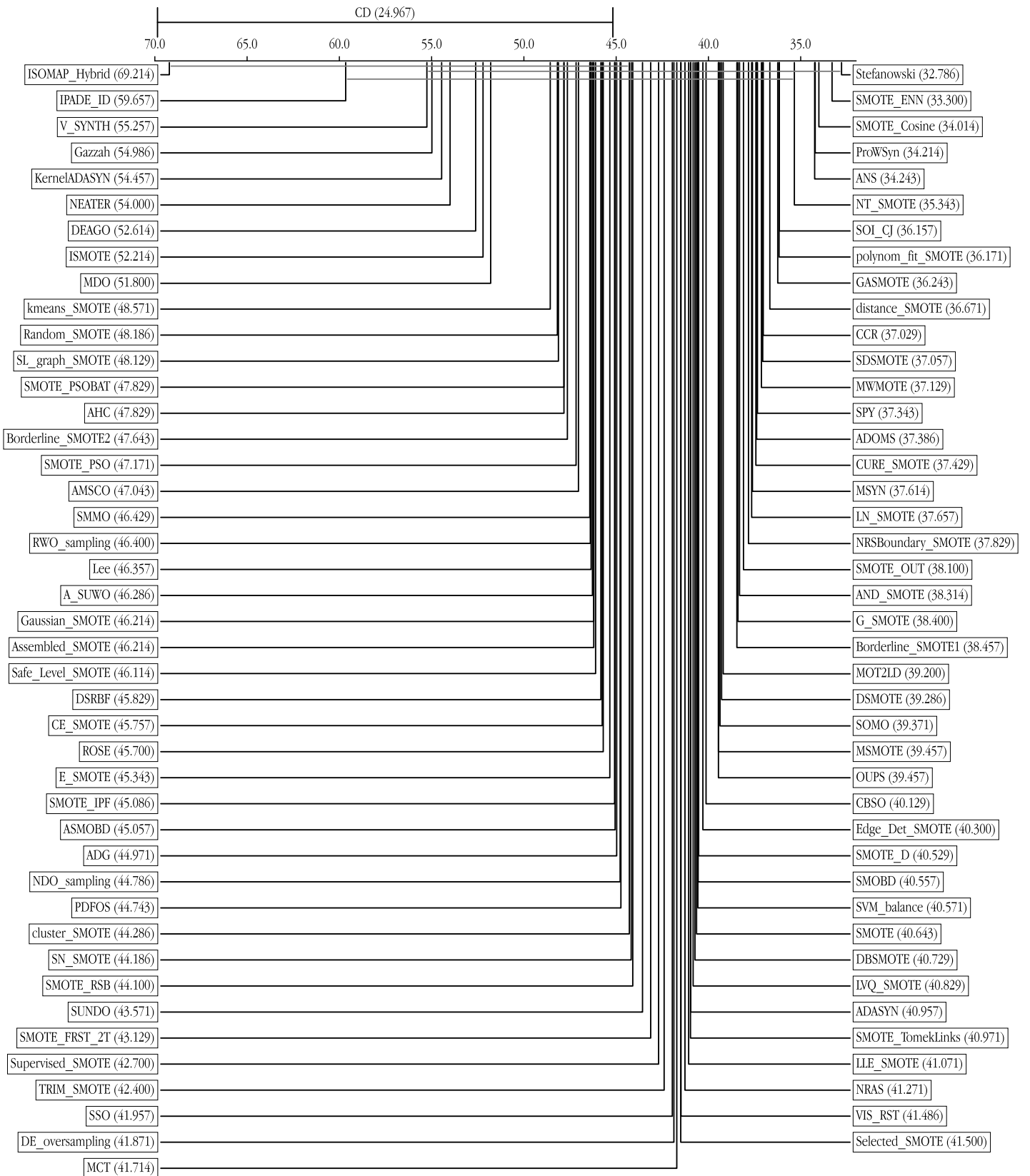


Figure 6: Nemenyi test for F1 and a MLP classifier for standard SMOTE based methods.

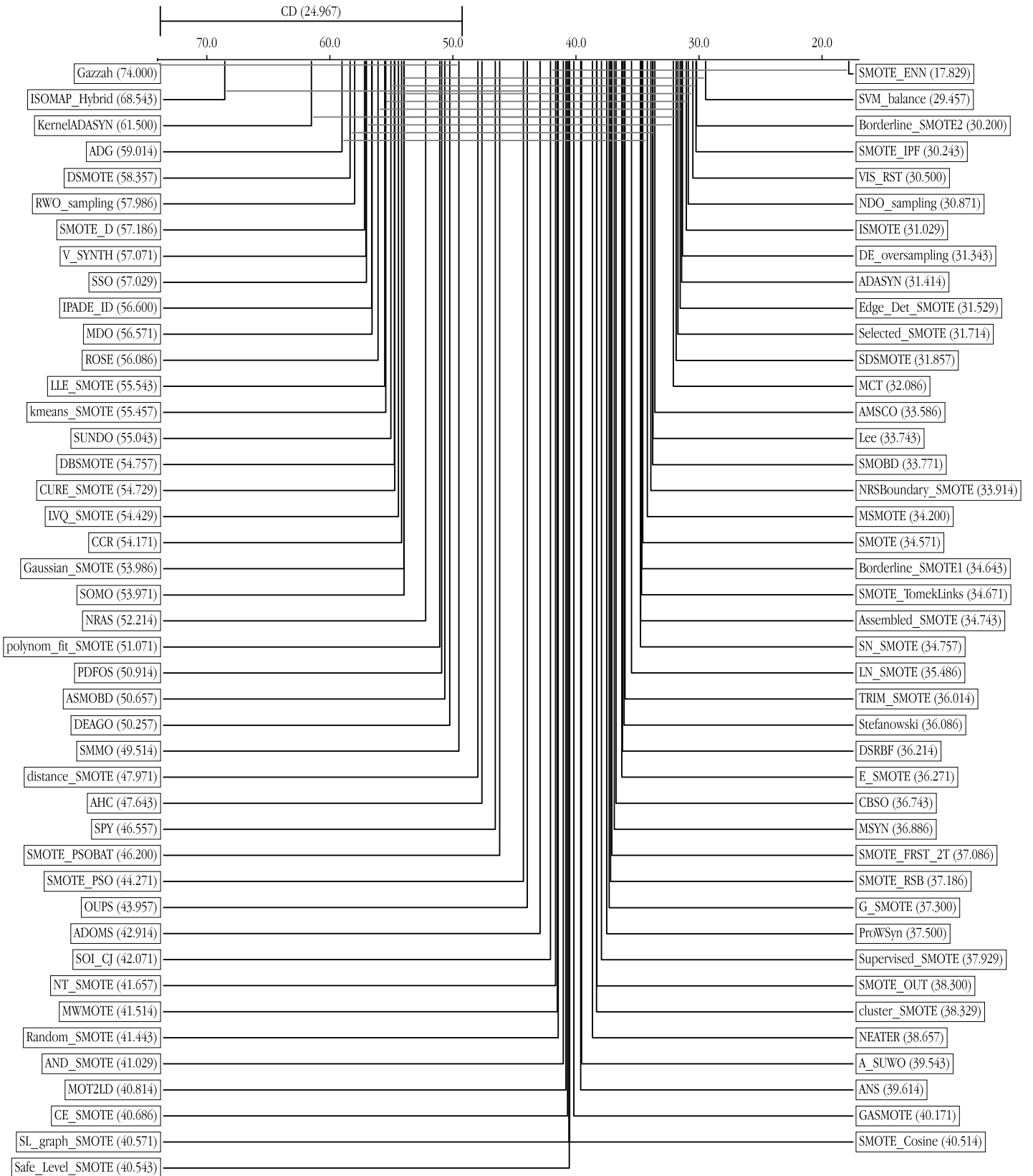


Figure 7: Nemenyi test for G-mean and RF classifier for standard SMOTE based methods.

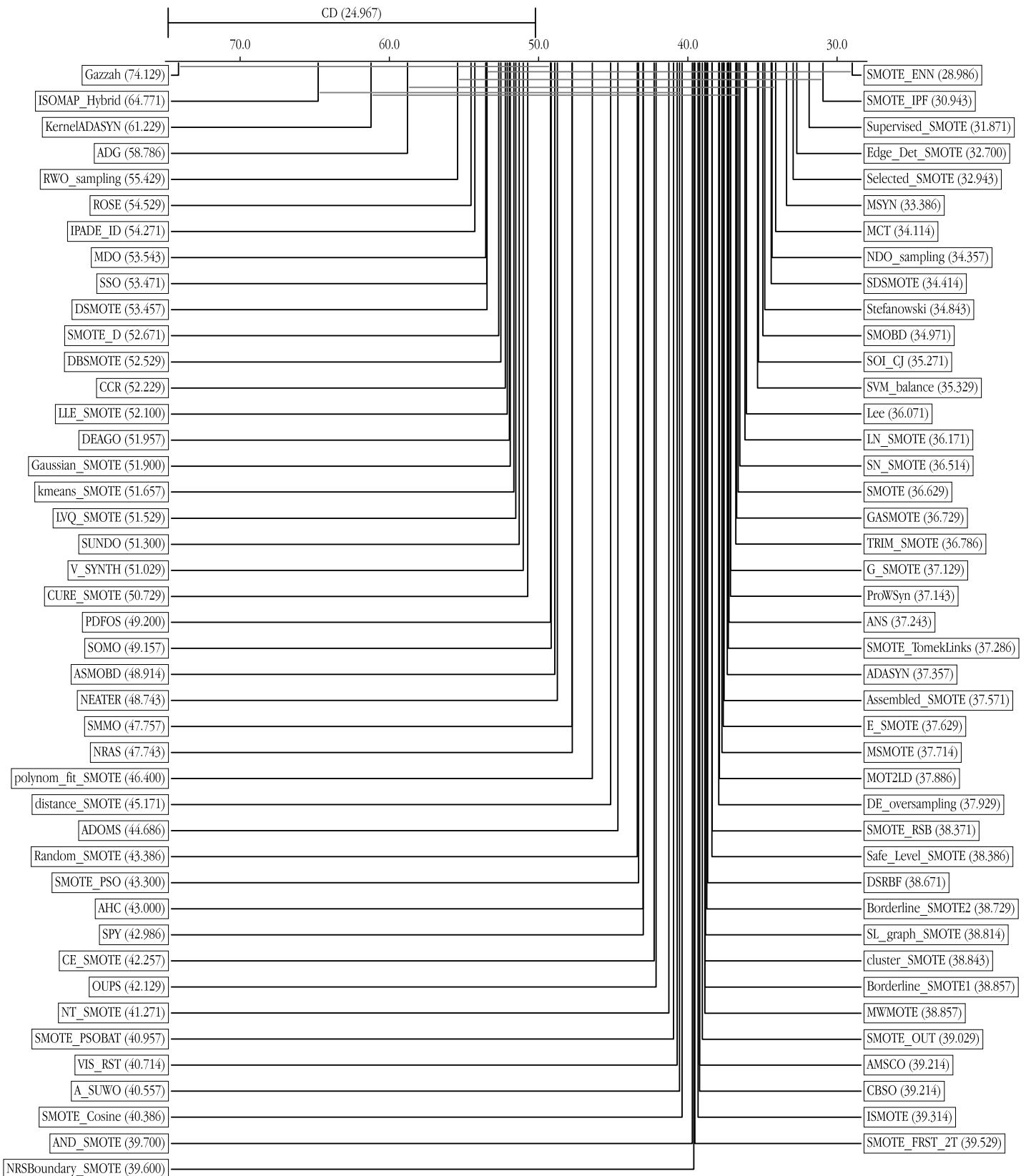


Figure 8: Nemenyi test for F1 and RF classifier for standard SMOTE based methods.

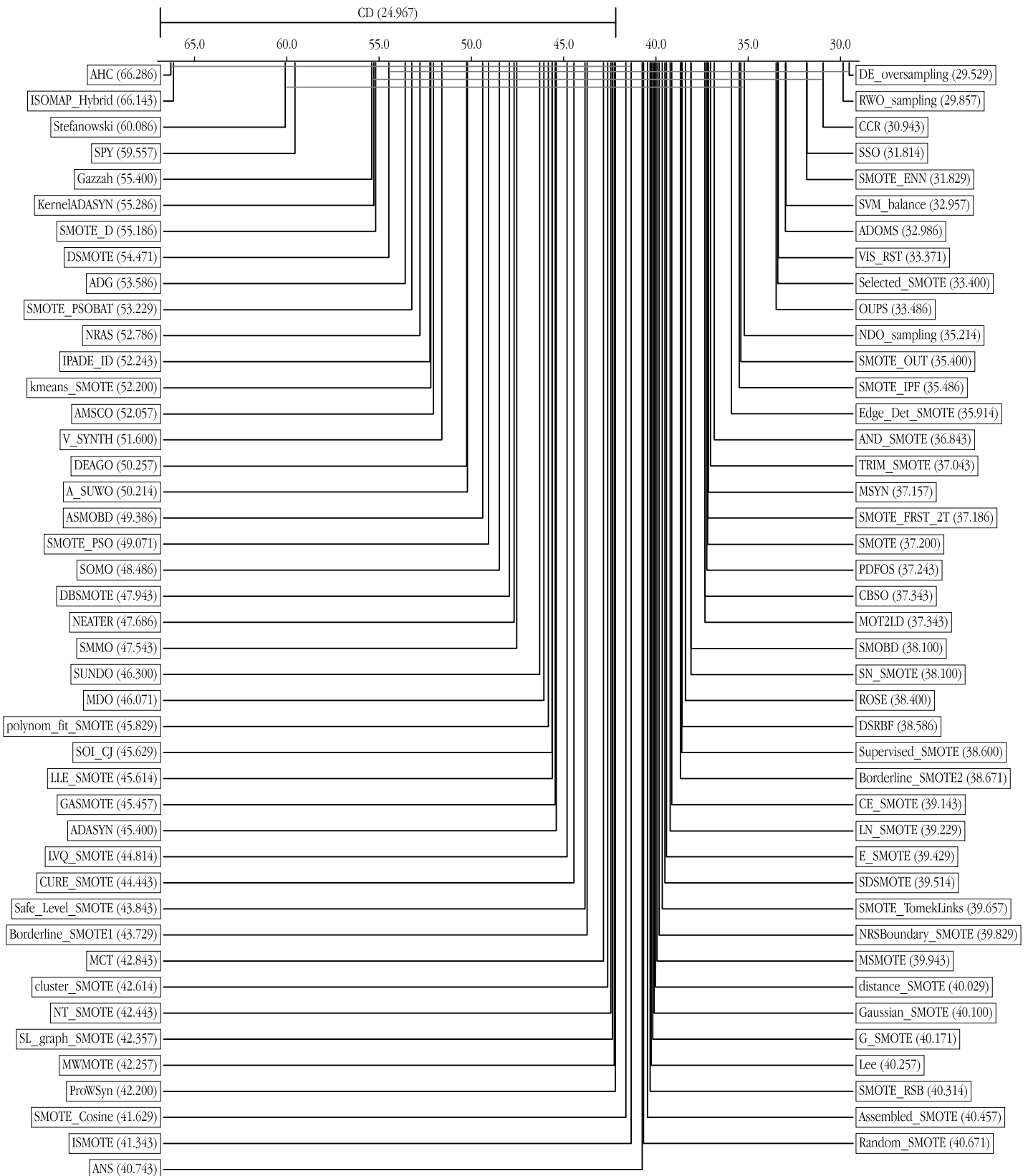


Figure 9: Nemenyi test for G-mean and SVM classifier for standard SMOTE based methods.

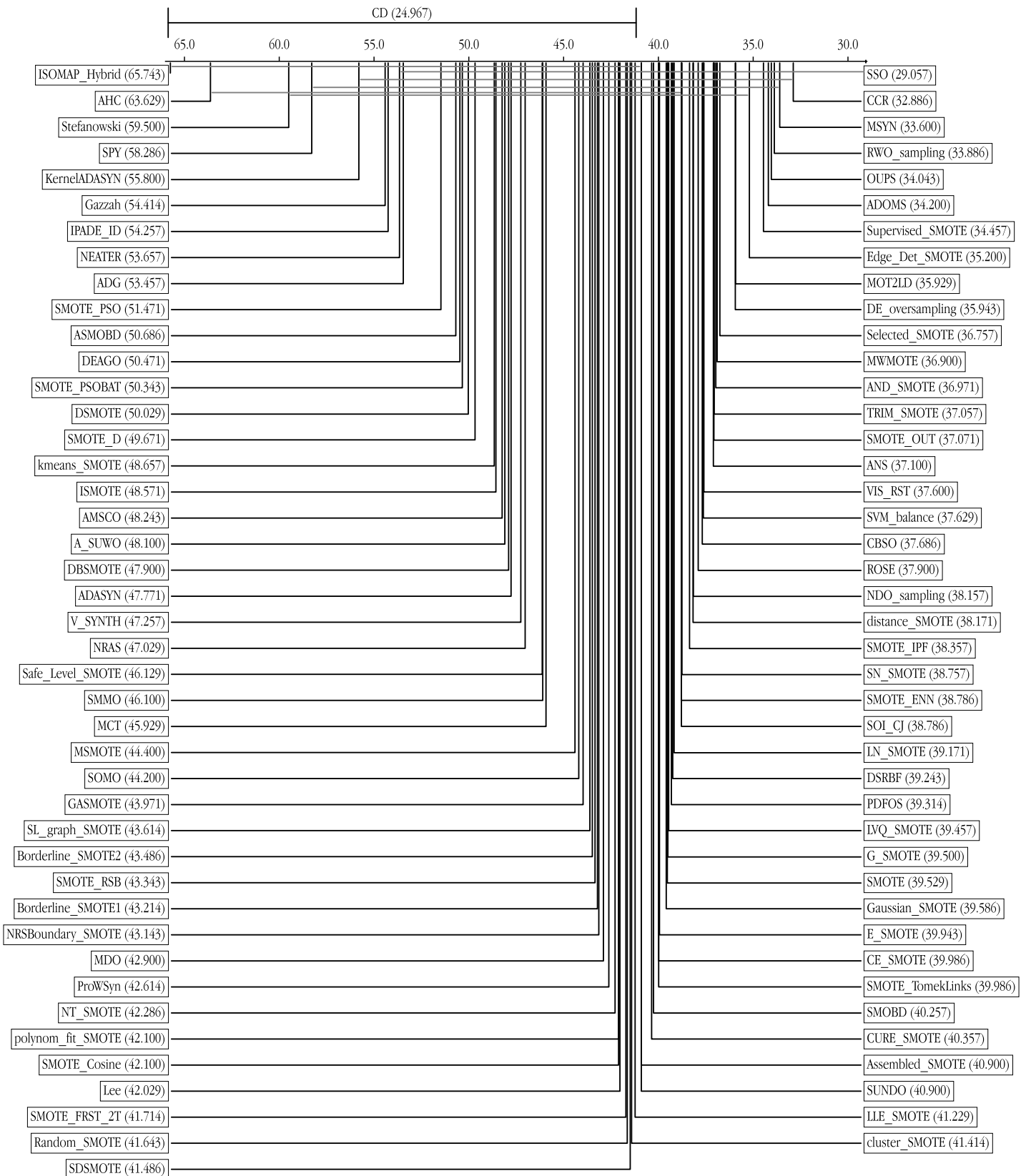
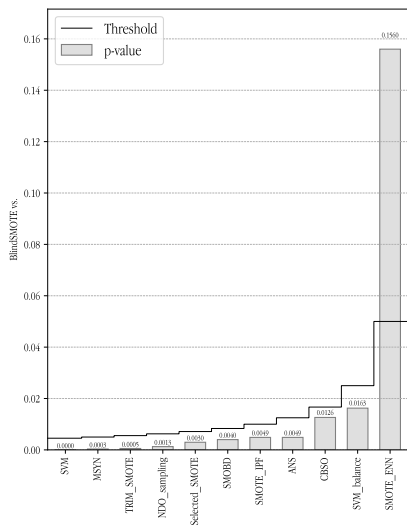
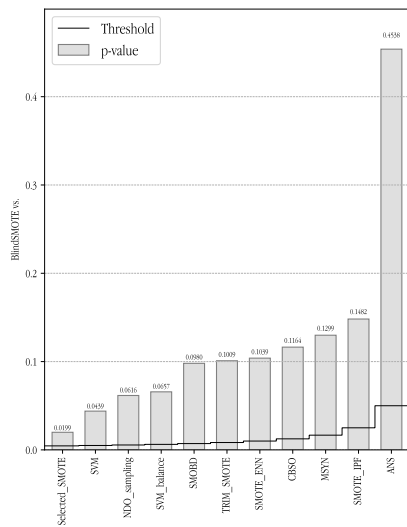


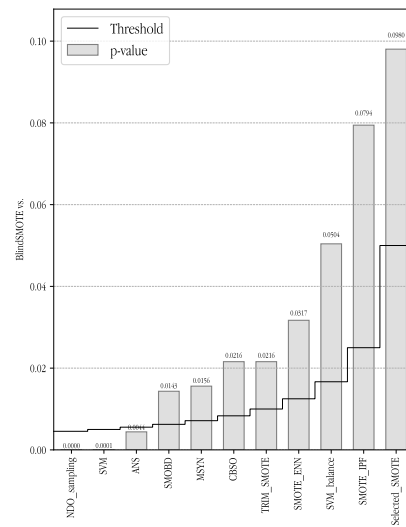
Figure 10: Nemenyi test for F1 and SVM classifier for standard SMOTE based methods.



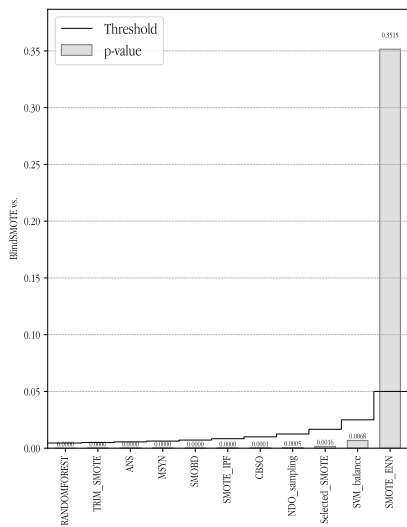
(a) SVM, G-mean



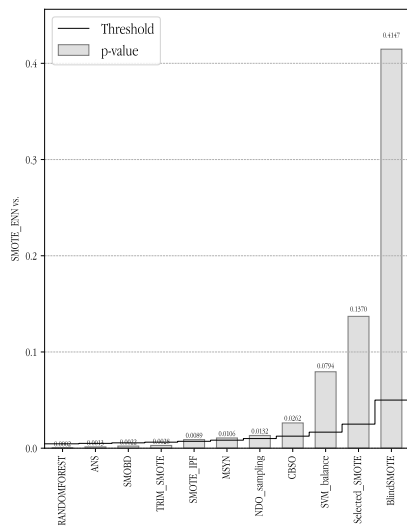
(b) SVM, F1



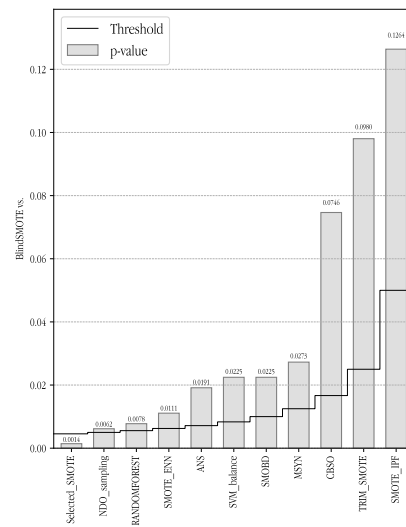
(c) SVM, auROC



(d) RF, G-mean

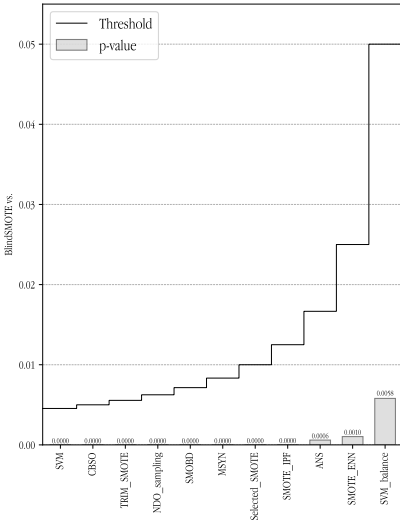


(e) RF, F1

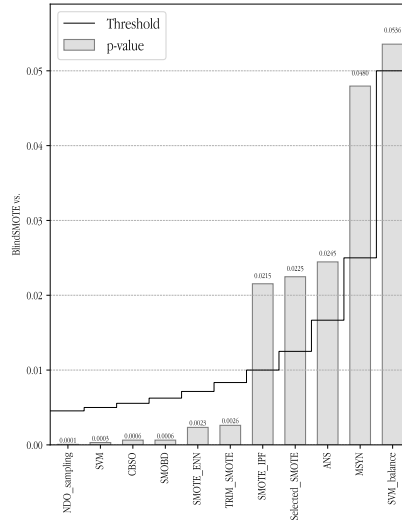


(f) RF, auROC

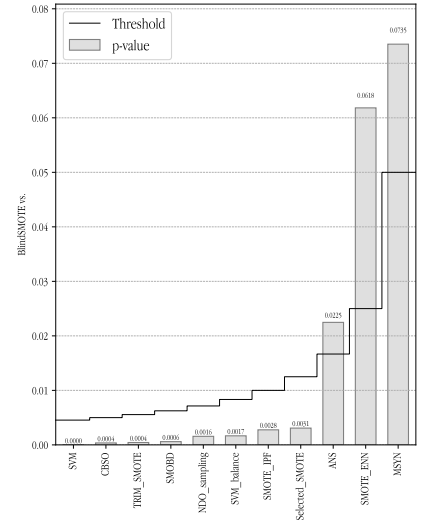
Figure 11: Holm test for G-mean and F1 for the best SMOTE methods and BlindSMOTE for SVM and RF and low IR datasets.



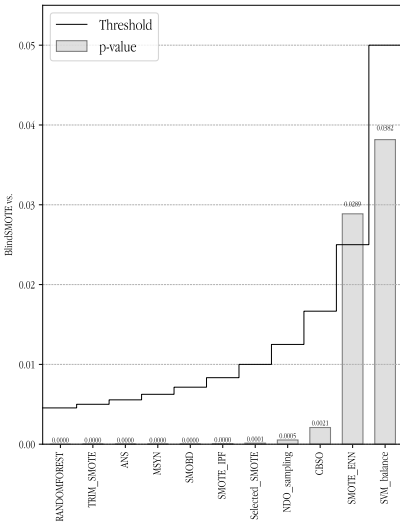
(a) SVM, G-mean



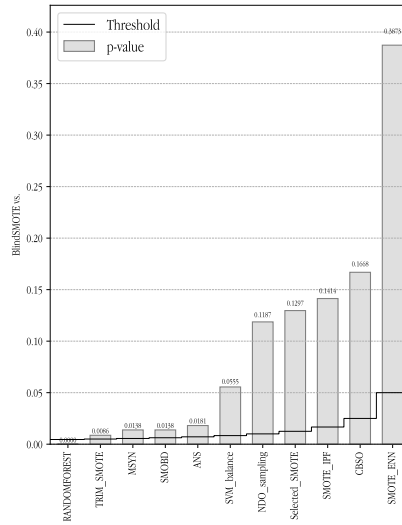
(b) SVM, F1



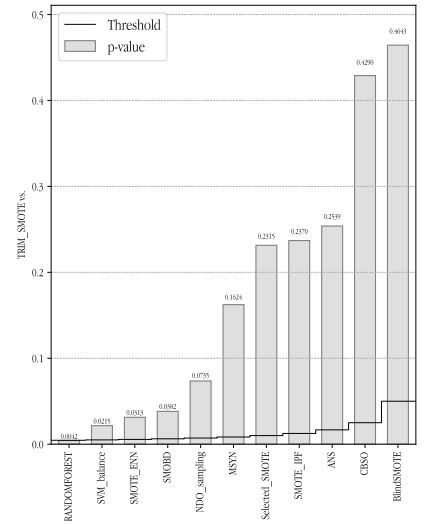
(c) SVM, auROC



(d) RF, G-mean



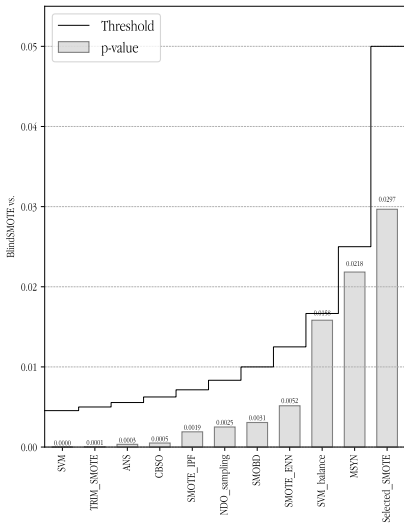
(e) RF, F1



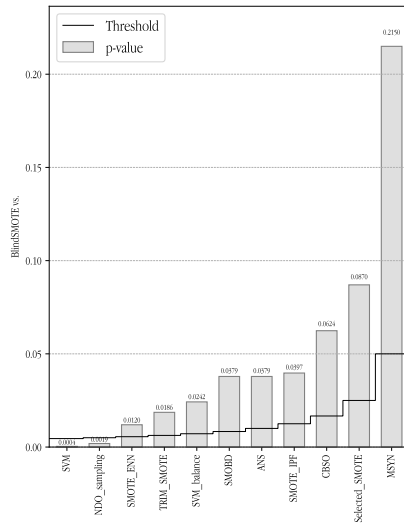
(f) RF, auROC

Figure 12: Holm test for G-mean, F1 and auROC for the best SMOTE methods and BlindSMOTE for SVM and RF and medium IR datasets.

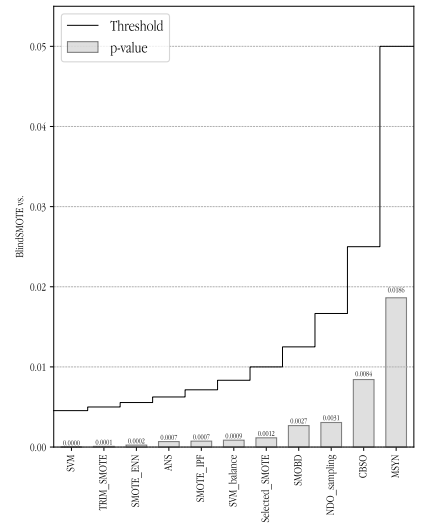




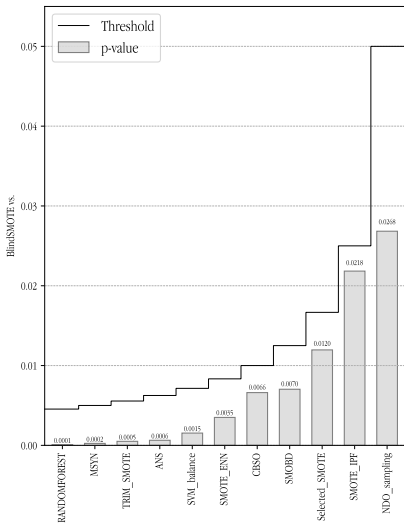
(a) SVM, G-mean



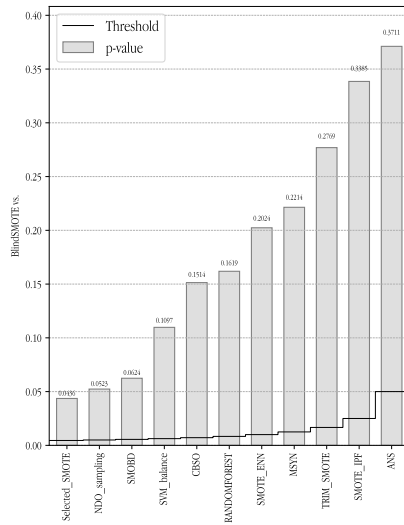
(b) SVM, F1



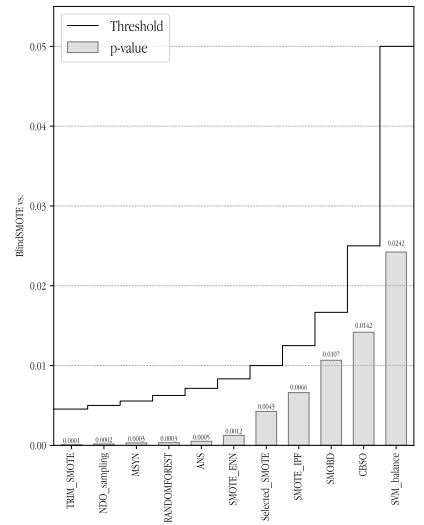
(c) SVM, auROC



(d) RF, G-mean



(e) RF, F1



(f) RF, auROC

Figure 13: Holm test for G-mean and F1 for the best SMOTE methods and BlindSMOTE for SVM and RF and high IR datasets.

### 3 Tables

Table 4: Results for G-mean metrics and all the methods using a SVM

Dataset	SVM	SMOTEENN	SVM_Balance	MSYN	CBSO	SMOTE_IPF	SelectedSMOTE	SMOBD	TRIM_SMOTE	NDO_Sampling	ANS	eSMOTE
ads	0.8847	0.7293	0.8521	0.8844	0.8490	0.8379	0.8849	0.8490	0.9504	0.9323	0.9407	0.9210
adult	0.7266	0.8109	0.8173	0.8175	0.8208	0.8093	0.8126	0.8039	0.8124	0.8093	0.7949	0.7976
AID604	0.0000	0.9677	0.9692	0.9699	0.9697	0.9698	0.9682	0.9680	0.8572	0.9668	0.8399	0.9018
AID688red	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4585
AID746red	0.0000	0.5745	0.5503	0.0000	0.4404	0.5504	0.5504	0.5504	0.4405	0.4970	0.4404	0.6487
aps-failure	0.7960	0.8462	0.9434	0.8896	0.8462	0.9440	0.9476	0.8896	0.9416	0.9542	0.9352	0.9530
arabidopsis1%	0.0000	0.0000	0.3849	0.3849	0.3849	0.3849	0.3849	0.3849	0.3849	0.4303	0.0000	0.7155
bank	0.5989	0.8608	0.8474	0.8343	0.8742	0.8447	0.8739	0.8480	0.8429	0.7893	0.7963	0.8691
bio	0.8319	0.9553	0.9417	0.9111	0.8761	0.9110	0.9233	0.9067	0.8897	0.9588	0.9302	0.9528
block1%	0.5000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9249	1.0000	1.0000	0.9990
ccds10%	0.0000	0.0000	0.4843	0.4769	0.4769	0.4843	0.4769	0.4843	0.4843	0.4769	0.4843	0.7705
census10%	0.5267	0.8451	0.5015	0.8435	0.8448	0.8133	0.8501	0.7601	0.7822	0.8490	0.8392	0.8397
chrom1910%	0.0000	0.8805	0.9677	0.9418	0.9161	0.9110	0.9690	0.9409	0.8813	0.9681	0.8495	0.9697
deposit	0.5313	0.8475	0.8282	0.7925	0.8373	0.8272	0.7913	0.8377	0.7825	0.8160	0.7304	0.8290
dna0.1%	0.1886	0.3774	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5802
dnage1%	0.9512	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.5802
euthyroid	0.8752	0.8980	0.9033	0.9250	0.8538	0.9147	0.9147	0.9150	0.9199	0.8706	0.9216	0.9216
hiv1-proteasa	0.8467	0.8906	0.7557	0.7565	0.8866	0.7557	0.7565	0.7557	0.7565	0.7557	0.7557	0.8974
hiva	0.2579	0.2569	0.2579	0.2579	0.1289	0.2579	0.2579	0.2579	0.2579	0.2574	0.2579	0.6181
htru2	0.9023	0.9421	0.9365	0.9304	0.9384	0.9342	0.9359	0.9345	0.9357	0.9409	0.9351	0.9381
kddcup9810%	0.0000	0.4080	0.3685	0.3164	0.3445	0.3166	0.3682	0.3682	0.3682	0.4291	0.2832	0.4472
linkage1%	0.9512	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9501	1.0000	0.9500	0.9757
musk	0.9843	0.9790	0.9843	0.9469	0.9843	0.9843	0.9843	0.9843	0.9843	0.9893	0.9843	0.9915
opn310k10%	0.0000	0.7411	0.6924	0.7510	0.6938	0.7570	0.7064	0.7512	0.6617	0.7579	0.7391	0.7503
ozone8hr	0.3210	0.5030	0.3914	0.2274	0.3217	0.2274	0.2270	0.2274	0.2270	0.3914	0.3210	0.7310
p53-mutants	0.6322	0.6821	0.6320	0.6321	0.6320	0.6320	0.6321	0.6320	0.6322	0.4469	0.6322	0.9336
polish-list	0.0000	0.4872	0.6595	0.3789	0.5748	0.4203	0.3763	0.3783	0.4612	0.4612	0.5700	0.6175
polish-2nd	0.0000	0.4443	0.5887	0.3573	0.5228	0.3717	0.3993	0.3713	0.3410	0.3711	0.6209	0.5937
polish-3rd	0.0000	0.2739	0.6128	0.5402	0.6198	0.5967	0.5953	0.2424	0.2789	0.2410	0.6413	0.6051
polish-4th	0.3086	0.6727	0.7601	0.6341	0.6806	0.3028	0.6534	0.2734	0.6114	0.6659	0.6967	0.6623
polish-5th	0.1562	0.6565	0.7005	0.7520	0.7080	0.6068	0.5687	0.0000	0.5881	0.7340	0.6984	0.7737
secom	0.4364	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2713
seismic	0.3416	0.4560	0.5439	0.4122	0.4113	0.4041	0.4059	0.3977	0.0000	0.3292	0.4718	0.6810
semeion	1.0000	1.0000	0.9014	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9682	1.0000
sens-1-gram	0.1963	0.4739	0.5657	0.2759	0.3756	0.3626	0.4257	0.3303	0.1957	0.3341	0.4389	0.5859
sens-2-gram	0.4178	0.6093	0.3933	0.5438	0.3690	0.3138	0.3713	0.3138	0.2820	0.5412	0.3702	0.6159
sens-3-gram	0.4633	0.6531	0.5211	0.5013	0.5343	0.5385	0.5079	0.5394	0.5013	0.5037	0.5368	0.6935
sens-4-gram	0.2416	0.5498	0.1966	0.1969	0.2408	0.1966	0.2412	0.2416	0.1973	0.4539	0.3109	0.5575
shoppers	0.6682	0.8488	0.8295	0.8214	0.8236	0.8288	0.8305	0.8275	0.8197	0.8273	0.7946	0.8192
sick	0.7462	0.8104	0.8128	0.7920	0.6270	0.7909	0.7909	0.7657	0.7909	0.8057	0.7657	0.8380
steel-b	0.7347	0.8211	0.8211	0.5078	0.5268	0.7961	0.8039	0.7903	0.5078	0.5061	0.8019	0.8105
steel-k	0.9747	0.9747	0.9747	0.9747	0.9747	0.9747	0.9747	0.9747	0.9747	0.9747	0.9747	0.9715
steel-p	0.6577	0.8151	0.8489	0.6559	0.0000	0.9062	0.8981	0.6540	0.6038	0.0000	0.8489	0.7864
steel-z	0.9045	0.9538	0.9019	0.9072	0.9045	0.9566	0.8707	0.8707	0.9045	0.9019	0.9566	0.9566
ustlago10%	0.0000	0.0000	0.4317	0.4317	0.4317	0.4317	0.4317	0.4317	0.4317	0.4116	0.5185	0.7942
wilt	0.9757	0.9901	0.9704	0.9923	0.9857	0.9901	0.9901	0.9934	0.9934	0.9846	0.9532	0.9868
Mean	0.4573	0.6548	0.6677	0.6259	0.6251	0.6370	0.6511	0.6099	0.6034	0.6316	0.6511	0.7785

Table 5: Wilcoxon test for G-mean metrics and all the methods using a SVM

	SVM	SMOTE-ENN	SVM-Balance	MSYN	CBSO	SMOTE-IPF	Selected-SMOTE	SMOBD	TRIM-SMOTE	NDO_Sampling	ANS	eSMOTE
Mean	0.4573	0.6548	0.6677	0.6259	0.6251	0.6370	0.6511	0.6099	0.6034	0.6316	0.6511	0.7785
Ranks	9.2889	5.3444	5.6778	6.8333	6.6667	6.6667	6.2111	7.2333	7.8667	6.2000	6.6333	3.3778
SVM	w/1	35/4	30/11	30/10	29/11	31/9	0.0001	28/11	27/11	32/10	31/7	42/2
	p	0.0000	0.0001	0.0002	0.0011	0.0001	0.0001	0.0011	0.0022	0.0002	0.0000	0.0000
R <sup>+</sup> /R <sup>-</sup>	950.5/84.5	871.0/164.0	843.5/191.5	807.5/227.5	859.5/175.5	869.5/165.5	805.5/229.5	789.0/246.0	846.0/189.0	897.0/138.0	1014.5/20.5	
SMOTE-ENN	w/1	21/18	14/25	13/25	14/24	15/23	12/27	15/25	12/29	14/25	15/25	31/13
	p	0.7864	0.0641	0.0830	0.0936	0.1700	0.0088	0.0033	0.0033	0.0947	0.1392	0.0001
R <sup>+</sup> /R <sup>-</sup>	541.5/493.5	364.0/671.0	369.0/666.0	369.0/666.0	369.0/666.0	396.0/639.0	285.5/749.5	257.0/778.0	369.5/665.5	386.5/648.5	858.5/176.5	
SVM-Balance	w/1	14/22	15/20	15/20	11/21	14/21	10/23	10/23	9/27	17/20	12/23	34/11
	p	0.0506	0.0900	0.0900	0.0476	0.1162	0.0134	0.0007	0.0007	0.4594	0.0705	0.0001
R <sup>+</sup> /R <sup>-</sup>	344.5/690.5	367.5/667.5	342.5/692.5	342.5/692.5	342.5/692.5	378.5/656.5	299.0/736.0	218.5/816.5	452.0/583.0	357.5/677.5	871.0/164.0	
MSYN	w/1	19/16	18/17	19/16	18/14	18/14	15/18	12/22	23/14	23/14	21/18	34/10
	p	0.5720	0.4905	0.1708	0.1708	0.1708	0.7557	0.0525	0.1075	0.1075	0.2541	0.0000
R <sup>+</sup> /R <sup>-</sup>	567.5/467.5	578.5/456.5	578.5/456.5	638.5/396.5	638.5/396.5	638.5/396.5	490.0/545.0	346.0/689.0	660.0/375.0	618.5/416.5	953.5/81.5	
CBSO	w/1	16/19	16/19	18/16	17/16	13/23	19/17	13/23	19/17	23/16	32/12	
	p	0.6841	0.6841	0.6470	0.8697	0.0639	0.4978	0.0639	0.4978	0.2101	0.0000	0.0000
R <sup>+</sup> /R <sup>-</sup>	481.5/553.5	558.0/477.0	558.0/477.0	503.0/532.0	503.0/532.0	353.5/681.5	577.5/457.5	628.5/406.5	918.5/116.5	628.5/406.5	918.5/116.5	
SMOTE-IPF	w/1	20/12	11/19	11/19	20/12	12/23	19/19	12/23	18/17	18/17	34/9	
	p	0.1604	0.0990	0.0990	0.1604	0.0245	0.6885	0.6841	0.6841	0.6841	0.0000	0.0000
R <sup>+</sup> /R <sup>-</sup>	641.5/393.5	372.0/663.0	372.0/663.0	372.0/663.0	372.0/663.0	318.5/716.5	553.0/482.0	553.5/481.5	921.5/113.5	553.5/481.5	921.5/113.5	
Selected-SMOTE	w/1	10/22	0.0174	0.0174	8/24	0.0018	0.6968	0.9955	18/20	0.9955	0.0000	0.0000
	p	0.2327	0.2327	0.2327	0.2327	0.2327	0.2327	0.2327	0.2327	0.2327	0.2327	0.2327
R <sup>+</sup> /R <sup>-</sup>	307.5/727.5	412.0/623.0	412.0/623.0	628.0/407.0	628.0/407.0	647.5/387.5	959.0/76.0	959.0/76.0	959.0/76.0	959.0/76.0	959.0/76.0	
SMOBD	w/1	27/12	27/12	27/12	27/12	27/12	27/12	27/12	27/12	27/12	27/12	39/5
	p	0.0044	0.0044	0.0044	0.0044	0.0044	0.0044	0.0044	0.0044	0.0044	0.0044	0.0000
TRIM-SMOTE	R <sup>+</sup> /R <sup>-</sup>	769.5/265.5	685.0/350.0	685.0/350.0	1000.5/34.5	1000.5/34.5	1000.5/34.5	1000.5/34.5	1000.5/34.5	1000.5/34.5	1000.5/34.5	1000.5/34.5
NDO_Sampling	w/1	17/23	17/23	17/23	17/23	17/23	17/23	17/23	17/23	17/23	17/23	31/13
	p	0.6354	0.6354	0.6354	0.6354	0.6354	0.6354	0.6354	0.6354	0.6354	0.6354	0.0000
R <sup>+</sup> /R <sup>-</sup>	475.5/559.5	886.5/148.5	886.5/148.5	886.5/148.5	886.5/148.5	886.5/148.5	886.5/148.5	886.5/148.5	886.5/148.5	886.5/148.5	886.5/148.5	
ANS	w/1	36/7	36/7	36/7	36/7	36/7	36/7	36/7	36/7	36/7	36/7	0.0000
	p	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
R <sup>+</sup> /R <sup>-</sup>	932.5/102.5	932.5/102.5	932.5/102.5	932.5/102.5	932.5/102.5	932.5/102.5	932.5/102.5	932.5/102.5	932.5/102.5	932.5/102.5	932.5/102.5	932.5/102.5
Iman-Davenport p-value: 0.0000												

Table 6: Results for G-mean metrics and all the methods using a C4.5 tree

Dataset	C4.5	SMOTEENN	SVM_Balance	MSYN	CBSO	SMOTE_IPF	SelectedSMOTE	SMOBD	TRIM_SMOTE	NDO_Sampling	ANS	eSMOTE
ads	0.9292	0.0000	0.6437	0.0000	0.1178	0.0000	0.0000	0.0000	0.0000	0.0000	0.8831	0.9204
adult	0.7644	0.6683	0.8190	0.7971	0.6847	0.7462	0.8060	0.6460	0.7126	0.6143	0.2074	0.7863
AID604	0.5938	0.6386	0.7323	0.7817	0.4043	0.6575	0.7890	0.6912	0.4773	0.6143	0.1695	0.8507
AID688red	0.0000	0.3677	0.3495	0.5083	0.0000	0.0000	0.3460	0.4976	0.4899	0.0000	0.2585	0.5685
AID746red	0.0000	0.4172	0.4013	0.3712	0.4371	0.4429	0.5501	0.3766	0.4988	0.0000	0.3280	0.6175
aps-failure	0.8047	0.8255	0.5188	0.8255	0.8255	0.8255	0.8542	0.8255	0.8992	0.8255	0.8792	0.9331
arabidopsis1%	0.2704	0.3364	0.2699	0.6130	0.4530	0.0000	0.6176	0.6176	0.1913	0.1910	0.3831	0.6024
bank	0.6746	0.8290	0.8007	0.7437	0.5646	0.7296	0.7343	0.7234	0.7917	0.7382	0.7911	0.8372
bio	0.8543	0.9265	0.9064	0.8725	0.9012	0.8973	0.8396	0.9142	0.8920	0.9057	0.8966	0.9266
block1%	0.9759	0.9997	1.0000	1.0000	1.0000	0.9754	0.9998	0.9994	0.9997	0.9994	1.0000	0.9990
ccds10%	0.4214	0.2047	0.4347	0.4209	0.3782	0.4289	0.3762	0.4212	0.5245	0.4704	0.3583	0.5777
census10%	0.6571	0.7342	0.6519	0.5441	0.7211	0.6086	0.5523	0.6856	0.5020	0.6669	0.6141	0.7862
chrom1910%	0.7452	0.9119	0.9417	0.8816	0.9422	0.9707	0.9419	0.9708	0.8495	0.9421	0.7815	0.9120
deposit	0.6811	0.7470	0.7228	0.7084	0.6338	0.7088	0.6553	0.7612	0.7776	0.7124	0.0730	0.8178
dna0.1%	0.0000	0.5126	0.4496	0.3466	0.3846	0.0000	0.3483	0.3817	0.3727	0.5738	0.3868	0.4997
euthyroid	0.8933	0.8930	0.9130	0.8533	0.9234	0.8917	0.9029	0.9055	0.8757	0.8580	0.8982	0.9336
hiv1-proteasa	0.7551	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7812
hiva	0.2544	0.2498	0.4644	0.5232	0.1529	0.4944	0.4512	0.4554	0.5774	0.4990	0.3801	0.4124
htru2	0.9139	0.9189	0.9385	0.9188	0.9178	0.9338	0.9093	0.9178	0.9272	0.9297	0.9237	0.9244
kddcup9810%	0.2412	0.0000	0.3107	0.4060	0.4172	0.4849	0.2777	0.4540	0.4849	0.0470	0.5991	0.5193
linkage1%	1.0000	0.8880	0.9972	0.9757	0.9757	0.9965	0.9967	0.9976	0.9945	0.9964	0.9972	0.9997
musk	0.9334	0.8742	0.8899	0.9180	0.8690	0.8845	0.9186	0.8977	0.9030	0.9124	0.9083	0.9109
opn310k10%	0.5502	0.7240	0.6871	0.6535	0.6045	0.5555	0.5702	0.5702	0.6019	0.6070	0.6560	0.6936
ozone8hr	0.3870	0.6840	0.3818	0.4974	0.4439	0.4997	0.4489	0.3844	0.3153	0.4883	0.3879	0.6655
p53-mutants	0.4463	0.7715	0.6797	0.5154	0.7289	0.7289	0.5154	0.5154	0.5769	0.6787	0.7284	0.8888
polish-list	0.5358	0.5150	0.6741	0.5884	0.5493	0.5489	0.5209	0.4904	0.5631	0.4821	0.4471	0.6879
polish-2nd	0.4717	0.4946	0.6085	0.5159	0.5401	0.4512	0.5239	0.5008	0.5923	0.5828	0.5541	0.5369
polish-3rd	0.3123	0.6048	0.6773	0.5106	0.5358	0.5373	0.3639	0.5417	0.4150	0.4531	0.3791	0.5963
polish-4th	0.6487	0.7187	0.7436	0.6989	0.6687	0.7235	0.8052	0.6060	0.7398	0.7256	0.7253	0.7525
polish-5th	0.7078	0.7613	0.7157	0.7562	0.7860	0.7170	0.6549	0.6791	0.7822	0.7355	0.7141	0.7454
secom	0.5363	0.6025	0.2949	0.0000	0.2995	0.5247	0.4220	0.4236	0.6082	0.4037	0.4252	0.4903
seismic	0.3394	0.6004	0.6498	0.6004	0.4666	0.4990	0.5994	0.5182	0.3336	0.5676	0.4148	0.6808
semeion	0.9354	0.0000	0.0000	0.4330	0.3511	0.0000	0.0000	0.0000	0.0000	0.6984	0.4330	0.9649
sens-1-gram	0.1399	0.6014	0.5342	0.5274	0.4045	0.4924	0.5641	0.5721	0.1395	0.5482	0.5138	0.5267
sens-2-gram	0.3864	0.6865	0.5414	0.5180	0.5633	0.5463	0.4963	0.6344	0.4569	0.5407	0.6161	0.5618
sens-3-gram	0.4569	0.6275	0.5363	0.6130	0.4843	0.5797	0.3409	0.6066	0.6209	0.5158	0.5663	0.6305
sens-4-gram	0.5239	0.5257	0.4407	0.5427	0.5566	0.4015	0.5678	0.5114	0.5613	0.5085	0.4949	0.6206
shoppers	0.6853	0.8293	0.7708	0.7366	0.7182	0.7048	0.7694	0.7301	0.7909	0.7151	0.8234	0.8222
sick	0.8019	0.9742	0.9672	0.9269	0.7735	0.9224	0.9537	0.9269	0.8914	0.9273	0.9697	0.9441
steel-b	0.7365	0.7859	0.7863	0.7373	0.7907	0.7958	0.7919	0.8081	0.8020	0.8111	0.8335	0.8390
steel-k	0.9684	0.9588	0.9588	0.9810	0.9555	0.9684	0.9493	0.9778	0.9778	0.9684	0.9778	0.9555
steel-p	0.5512	0.7839	0.6532	0.7179	0.6084	0.6084	0.7223	0.7201	0.6830	0.7352	0.8415	0.7985
steel-z	0.9943	0.9799	0.9886	0.9650	0.9622	0.9799	0.9566	0.9799	0.9972	0.9753	0.9650	0.9538
usllago10%	0.1826	0.4229	0.2855	0.2212	0.3775	0.4022	0.3154	0.2236	0.5500	0.9972	0.5500	0.6298
wilt	0.9303	0.9868	0.9671	0.9469	0.9485	0.9671	0.9704	0.9934	0.9501	0.9813	0.9934	0.9857
Mean	0.5929	0.6352	0.6377	0.6270	0.5996	0.5966	0.6143	0.6270	0.6154	0.6116	0.6207	0.7575

Table 7: Wilcoxon test for G-mean metrics and all the methods using a C4.5 tree

	C4.5	SMOTE_ENN	SVM_Balance	MSYN	CBSO	SMOTE_IPF	Selected_SMOTE	SMOBD	TRIM_SMOTE	NDO_Sampling	ANS	eSMOTE
Mean	0.5929	0.6352	0.6377	0.6270	0.5996	0.5966	0.6143	0.6270	0.6154	0.6116	0.6207	0.7575
Ranks	8.7444	5.7111	5.8000	6.9111	7.4222	7.3889	7.1111	6.4111	6.4222	6.6778	6.1889	3.2111
C4.5		32/13 0.0073	32/13 0.0029	35/10 0.0022	29/15 0.1423	28/14 0.0223	29/16 0.0145	30/15 0.0090	31/14 0.0087	29/13 0.0170	31/14 0.0373	39/6 0.0000
$R^+/R^-$		755.0/280.0	781.0/254.0	789.0/246.0	647.5/387.5	720.0/315.0	734.0/301.0	749.0/286.0	750.0/285.0	729.0/306.0	702.0/333.0	997.0/38.0
SMOTE_ENN		19/23 0.5997	15/26 0.2810	17/26 0.0470	16/27 0.0178	14/26 0.0178	18/24 0.2760	16/24 0.2495	21/20 0.4805	14/28 0.0463	20/24 0.3097	31/14 0.0004
$R^+/R^-$		471.0/564.0	422.0/613.0	341.5/693.5	307.5/727.5	421.0/614.0	415.5/619.5	455.0/580.0	341.0/694.0	341.0/694.0	427.5/607.5	830.0/205.0
SVM_Balance		14/29 0.2785	14/29 0.2785	17/26 0.1017	14/28 0.0383	14/28 0.0383	15/28 0.1167	21/22 0.6762	18/25 0.4770	17/27 0.2062	20/22 0.9146	34/11 0.0000
$R^+/R^-$		372.5/662.5	372.5/662.5	334.0/701.0	334.0/701.0	334.0/701.0	378.5/656.5	480.5/554.5	454.5/580.5	405.5/629.5	508.0/527.0	877.0/158.0
MSYN		20/22 0.3576	19/22 0.3576	19/22 0.3576	20/22 0.3233	20/22 0.3233	22/20 0.5997	20/20 0.9820	24/19 0.7095	22/20 0.9955	23/18 0.8434	36/9 0.0000
$R^+/R^-$		436.0/599.0	430.0/605.0	430.0/605.0	471.0/564.0	471.0/564.0	515.5/519.5	550.5/484.5	518.0/517.0	518.0/517.0	535.0/500.0	956.0/79.0
CBSO		25/16 0.3817	25/16 0.3817	25/16 0.3817	25/16 0.3817	25/16 0.3817	21/23 0.7605	25/17 0.2293	26/18 0.3972	25/17 0.2912	27/16 0.1616	38/6 0.0000
$R^+/R^-$		595.0/440.0	595.0/440.0	595.0/440.0	544.5/490.5	544.5/490.5	624.0/411.0	624.0/411.0	592.5/442.5	611.0/424.0	641.5/393.5	995.5/39.5
SMOTE_IPF		26/14 0.6476	26/14 0.6476	26/14 0.6476	26/14 0.1866	26/14 0.1866	22/20 0.6476	26/14 0.2519	25/17 0.6190	24/16 0.2990	28/16 0.2021	39/6 0.0000
$R^+/R^-$		634.5/400.5	634.5/400.5	634.5/400.5	619.0/416.0	619.0/416.0	619.0/416.0	630.5/425.5	609.5/425.5	609.5/425.5	630.5/404.5	964.0/71.0
Selected_SMOTE		24/17 0.4196	24/17 0.4196	24/17 0.4196	24/17 0.4805	24/17 0.4805	23/19 0.4805	24/17 0.4805	23/19 0.4805	23/20 0.7011	27/17 0.4770	36/9 0.0000
$R^+/R^-$		589.0/446.0	589.0/446.0	589.0/446.0	580.0/455.0	580.0/455.0	580.0/455.0	580.0/455.0	551.5/483.5	551.5/483.5	580.5/454.5	957.0/78.0
SMOBD		22/19 0.8434	22/19 0.8434	22/19 0.8434	22/19 0.8434	22/19 0.8434	22/19 0.8434	22/19 0.8434	22/19 0.8434	18/23 0.7137	21/21 0.7908	36/9 0.0000
$R^+/R^-$		485.0/550.0	485.0/550.0	485.0/550.0	485.0/550.0	485.0/550.0	485.0/550.0	485.0/550.0	485.0/550.0	485.0/550.0	494.0/541.0	925.0/110.0
TRIM_SMOTE		23/19 0.9191	23/19 0.9191	23/19 0.9191	23/19 0.9191	23/19 0.9191	23/19 0.9191	23/19 0.9191	23/19 0.9191	21/22 0.9191	23/19 0.7648	37/8 0.0000
$R^+/R^-$		508.5/526.5	508.5/526.5	508.5/526.5	508.5/526.5	508.5/526.5	508.5/526.5	508.5/526.5	508.5/526.5	508.5/526.5	544.0/491.0	912.0/123.0
NDO_Sampling		22/22 0.9101	22/22 0.9101	22/22 0.9101	22/22 0.9101	22/22 0.9101	22/22 0.9101	22/22 0.9101	22/22 0.9101	22/22 0.9101	22/22 0.9101	34/11 0.0000
$R^+/R^-$		527.5/507.5	527.5/507.5	527.5/507.5	527.5/507.5	527.5/507.5	527.5/507.5	527.5/507.5	527.5/507.5	527.5/507.5	909.0/126.0	35/10 0.0000
ANS		912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0
$R^+/R^-$		912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0	912.0/123.0
Iman-Davenport $p$ -value: 0.0000												

Table 8: Results for G-mean metrics and all the methods using a Random Forest

Dataset	RF	SMOTEENN	SVM-Balance	MSYN	CBSO	SMOTE_IPF	SelectedSMOTE	SMOBD	TRIM_SMOTE	NDO_Sampling	ANS	eSMOTE
ads	0.9441	0.9504	0.9424	0.8933	0.9617	0.9521	0.9521	0.9424	0.9538	0.9538	0.9555	0.9159
adult	0.7492	0.8152	0.8296	0.8199	0.7772	0.8250	0.8250	0.7807	0.8261	0.8261	0.7645	0.8210
AID604	0.9701	0.9699	0.9693	0.9507	0.8299	0.9701	0.8060	0.7715	0.9701	0.8712	0.9701	0.8365
AID688red	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5674
AID746red	0.3333	0.4405	0.4708	0.3726	0.5474	0.4711	0.6067	0.5437	0.6746	0.6746	0.4407	0.7485
aps-failure	0.7444	0.8908	0.9123	0.8908	0.8908	0.8908	0.9175	0.8908	0.9093	0.8908	0.9204	0.9544
arabidopsis1%	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
bank	0.6259	0.8258	0.7641	0.8011	0.7937	0.7309	0.8249	0.7265	0.7112	0.8422	0.6702	0.8743
bio	0.8637	0.9186	0.9021	0.8590	0.9609	0.8979	0.9086	0.9064	0.8939	0.9293	0.9066	0.9546
block1%	1.0000	1.0000	0.9759	1.0000	1.0000	1.0000	0.9759	1.0000	1.0000	1.0000	1.0000	1.0000
ccds10%	0.1890	0.0000	0.2670	0.1890	0.1890	0.1890	0.1890	0.1890	0.1890	0.1890	0.1890	0.5430
census10%	0.5271	0.7161	0.5316	0.7680	0.5615	0.7700	0.7700	0.5890	0.6033	0.6060	0.5313	0.8427
chrom1910%	0.8164	0.8812	0.9122	0.8816	0.8495	0.9122	0.9124	0.9123	0.8817	0.9123	0.8497	0.9415
deposit	0.6189	0.8042	0.7740	0.8158	0.6992	0.7279	0.7983	0.7815	0.8070	0.8070	0.6591	0.8584
dna0.1%	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2654
euthyroid	0.8768	0.9369	0.9267	0.8917	0.8917	0.9077	0.9077	0.9110	0.8737	0.9061	0.8917	0.9250
hiv1-proteasa	0.6957	0.8470	0.7215	0.7095	0.7004	0.6964	0.7470	0.7026	0.6830	0.7636	0.6600	0.8903
hiva	0.2572	0.2560	0.2576	0.2563	0.3629	0.2572	0.2572	0.2569	0.2572	0.3625	0.2569	0.5520
htru2	0.9003	0.9342	0.9307	0.9188	0.9260	0.9313	0.9209	0.9351	0.9230	0.9263	0.8497	0.9411
kddcup9810%	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.5595
linkage1%	0.9759	1.0000	1.0000	0.9759	0.9759	1.0000	0.9759	0.9512	0.9759	0.9512	0.9759	1.0000
musk	0.8689	0.8894	0.8950	0.8729	0.8966	0.9075	0.9129	0.8948	0.8856	0.8902	0.9021	0.9116
opn310k10%	0.2930	0.7718	0.7752	0.6446	0.7740	0.6491	0.6363	0.6651	0.6666	0.6103	0.6639	0.7904
ozone8hr	0.0000	0.5412	0.4997	0.4509	0.5041	0.3896	0.5845	0.4489	0.3203	0.5019	0.3167	0.7292
p53-mutants	0.2581	0.8499	0.8874	0.7284	0.9229	0.9229	0.9251	0.9227	0.8157	0.8877	0.8155	0.8795
polish-list	0.1923	0.5644	0.6480	0.4246	0.5687	0.4654	0.4665	0.3296	0.3820	0.4268	0.5666	0.7750
polish-2nd	0.2734	0.5753	0.6185	0.4421	0.6374	0.4938	0.5201	0.3827	0.4954	0.5633	0.5384	0.7016
polish-3rd	0.0000	0.6102	0.6319	0.6282	0.6633	0.5430	0.6492	0.3976	0.1414	0.6687	0.6216	0.6724
polish-4th	0.4592	0.7416	0.7486	0.7824	0.7037	0.6944	0.7824	0.5298	0.6448	0.7606	0.7154	0.7417
polish-5th	0.5817	0.7942	0.7462	0.7345	0.7814	0.7622	0.7366	0.7006	0.7461	0.7600	0.7780	0.8142
secom	0.0000	0.5168	0.3162	0.3151	0.3162	0.0000	0.3151	0.0000	0.0000	0.0000	0.3151	0.5068
seismic	0.0000	0.6509	0.6234	0.5275	0.4131	0.5240	0.4718	0.5252	0.2420	0.4708	0.4131	0.7519
semeion	0.9014	0.9354	0.9014	0.9014	0.9014	0.9014	0.9014	0.9354	0.9014	0.9014	0.9014	0.9014
sens-1-gram	0.0000	0.4982	0.5595	0.3858	0.4412	0.4038	0.5668	0.3833	0.0000	0.4320	0.4178	0.5957
sens-2-gram	0.2442	0.6604	0.5087	0.4376	0.4355	0.5358	0.5358	0.4320	0.1985	0.5673	0.4335	0.6812
sens-3-gram	0.3162	0.6676	0.5186	0.4424	0.5360	0.5170	0.5162	0.5005	0.4824	0.5112	0.5334	0.6419
sens-4-gram	0.3148	0.6085	0.3638	0.3877	0.4539	0.3644	0.3889	0.3384	0.3896	0.4105	0.4306	0.6425
shoppers	0.7196	0.8394	0.8371	0.7913	0.8046	0.7880	0.8313	0.8034	0.7963	0.8022	0.7827	0.8423
sick	0.7746	0.8681	0.8855	0.8705	0.8485	0.8693	0.8693	0.8705	0.8223	0.9152	0.8485	0.8868
steel-b	0.6992	0.7985	0.8335	0.7963	0.8231	0.8047	0.8214	0.8320	0.8156	0.8291	0.7932	0.8147
steel-k	0.9618	0.9747	0.9747	0.9747	0.9618	0.9747	0.9747	0.9618	0.9747	0.9747	0.9747	0.9842
steel-p	0.7031	0.9436	0.9380	0.8151	0.8862	0.9196	0.8836	0.8465	0.8151	0.8836	0.8151	0.9126
steel-z	0.9378	0.9914	0.9943	0.9650	0.9943	0.9943	0.9678	0.9914	0.9678	0.9914	0.9650	0.9650
usllago10%	0.0000	0.0524	0.0000	0.0000	0.1841	0.0000	0.0000	0.0000	0.0000	0.0000	0.1301	0.3676
wilt	0.8888	0.9715	0.9272	0.9069	0.9501	0.9501	0.9272	0.9511	0.9522	0.9448	0.9303	0.9639
Mean	0.4995	0.6778	0.6605	0.6272	0.6516	0.6305	0.6561	0.6096	0.5831	0.6499	0.6232	0.7659

Table 9: Wilcoxon test for G-mean metrics and all the methods using a Random Forest

	RF	SMOTE-ENN	SVM-Balance	MSYN	CBSO	SMOTE-IPF	Selected-SMOTE	SMOBD	TRIM-SMOTE	NDO-Sampling	ANS	eSMOTE
Mean	0.4995	0.6778	0.6605	0.6272	0.6516	0.6305	0.6561	0.6096	0.5831	0.6499	0.6232	0.7659
Ranks	10:4000	5:0111	5:3000	7:8222	5:8222	6:6667	5:5778	7:5222	8:0444	5:6111	7:5333	2:6889
RF	w/1	37/3	36/3	32/4	35/1	34/0	34/2	32/4	29/3	35/2	33/2	40/2
	p	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	R <sup>+</sup> /R <sup>-</sup>	986.5/48.5	995.0/40.0	951.5/83.5	985.5/49.5	1002.0/33.0	972.5/62.5	939.5/95.5	935.5/99.5	981.0/54.0	975.5/59.5	1007.0/28.0
SMOTE-ENN	w/1	17/22	9/29	14/25	12/26	17/23	9/28	8/31	16/21	9/30	33/9	33/9
	p	0.2358	0.0001	0.0445	0.0019	0.1484	0.0002	0.0000	0.0000	0.1287	0.0000	0.0001
	R <sup>+</sup> /R <sup>-</sup>	412.5/622.5	171.0/864.0	339.5/695.5	242.0/793.0	389.5/645.5	191.0/844.0	122.5/912.5	383.0/652.0	148.5/886.5	863.0/172.0	863.0/172.0
SVM-Balance	w/1	6/32	17/21	12/25	18/19	7/31	10/29	7/31	20/19	10/28	33/9	33/9
	p	0.0001	0.3603	0.0034	0.9595	0.0007	0.0007	0.0000	0.9012	0.0003	0.0000	0.0000
	R <sup>+</sup> /R <sup>-</sup>	181.5/853.5	436.5/598.5	258.0/777.0	513.0/522.0	215.5/819.5	150.5/884.5	506.5/528.5	196.5/838.5	906.0/129.0	906.0/129.0	906.0/129.0
MSYN	w/1	23/12	22/14	28/6	18/16	28/8	17/14	17/14	28/8	17/14	39/2	39/2
	p	0.0408	0.1752	0.0002	0.5156	0.0028	0.5156	0.0028	0.0028	0.7085	0.7085	0.0000
	R <sup>+</sup> /R <sup>-</sup>	698.5/336.5	637.5/397.5	846.0/189.0	466.5/568.5	460.0/575.0	782.5/252.5	550.5/484.5	990.0/45.0	990.0/45.0	990.0/45.0	990.0/45.0
CBSO	w/1	13/21	8/29	12/25	8/29	17/20	7/27	17/20	7/27	37/5	37/5	37/5
	p	0.1121	0.5457	0.0102	0.0002	0.9145	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000
	R <sup>+</sup> /R <sup>-</sup>	377.0/658.0	571.0/464.0	290.0/745.0	188.0/847.0	527.0/508.0	194.0/841.0	194.0/841.0	963.0/72.0	963.0/72.0	963.0/72.0	963.0/72.0
SMOTE-IPF	w/1	23/11	10/24	15/21	21/15	14/21	14/21	14/21	36/5	36/5	36/5	36/5
	p	0.0248	0.0015	0.1359	0.1137	0.1898	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	R <sup>+</sup> /R <sup>-</sup>	716.0/319.0	236.0/799.0	385.5/649.5	657.5/377.5	401.5/633.5	950.5/84.5	950.5/84.5	950.5/84.5	950.5/84.5	950.5/84.5	950.5/84.5
Selected-SMOTE	w/1	9/30	8/26	0.0002	0.8522	20/17	11/24	11/24	35/8	35/8	35/8	35/8
	p	0.0002	0.0002	0.0002	0.8522	0.8522	0.0096	0.0096	0.0000	0.0000	0.0000	0.0000
	R <sup>+</sup> /R <sup>-</sup>	191.5/843.5	189.0/846.0	534.0/501.0	288.5/746.5	943.5/91.5	943.5/91.5	943.5/91.5	943.5/91.5	943.5/91.5	943.5/91.5	943.5/91.5
SMOBD	w/1	16/21	25/10	17/20	25/10	17/20	17/20	17/20	38/5	38/5	38/5	38/5
	p	0.2038	0.0010	0.8257	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	R <sup>+</sup> /R <sup>-</sup>	808.5/226.5	498.0/537.0	808.5/226.5	498.0/537.0	975.5/59.5	975.5/59.5	975.5/59.5	975.5/59.5	975.5/59.5	975.5/59.5	975.5/59.5
TRIM-SMOTE	w/1	29/6	19/14	38/4	38/4	38/4	38/4	38/4	38/4	38/4	38/4	38/4
	p	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	R <sup>+</sup> /R <sup>-</sup>	875.5/159.5	652.0/383.0	987.0/48.0	987.0/48.0	987.0/48.0	987.0/48.0	987.0/48.0	987.0/48.0	987.0/48.0	987.0/48.0	987.0/48.0
NDO-Sampling	w/1	12/25	34/8	34/8	34/8	34/8	34/8	34/8	34/8	34/8	34/8	34/8
	p	0.0095	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	R <sup>+</sup> /R <sup>-</sup>	288.0/747.0	931.0/104.0	931.0/104.0	931.0/104.0	931.0/104.0	931.0/104.0	931.0/104.0	931.0/104.0	931.0/104.0	931.0/104.0	931.0/104.0
ANS	w/1	39/2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	p	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	R <sup>+</sup> /R <sup>-</sup>	988.0/47.0	988.0/47.0	988.0/47.0	988.0/47.0	988.0/47.0	988.0/47.0	988.0/47.0	988.0/47.0	988.0/47.0	988.0/47.0	988.0/47.0
Iman-Davenport $p$ -value: 0.0000												



Table 10: Results for F1 metrics and all the methods using a SVM

Dataset	SVM	SMOTEENN	SVM_Balance	MSYN	CBSO	SMOTE_IPF	SelectedSMOTE	SMOBD	TRIM_SMOTE	NDO_Sampling	ANS	eSMOTE
ads	0.8780	0.4107	0.8000	0.8180	0.7816	0.7765	0.7586	0.7816	0.9231	0.8723	0.9213	0.8817
adult	0.6410	0.6490	0.6651	0.6703	0.6633	0.6684	0.6534	0.6407	0.6484	0.6637	0.6727	0.6768
AID604	0.0000	0.5614	0.7619	0.9014	0.8649	0.8889	0.6095	0.5926	0.7576	0.4848	0.7385	0.1429
AID688red	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0219
AID746red	0.0000	0.2218	0.2178	0.0000	0.2245	0.2245	0.2268	0.2245	0.2500	0.1565	0.2456	0.0933
aps-failure	0.7220	0.6513	0.5618	0.7649	0.6513	0.6596	0.6579	0.7649	0.6005	0.6398	0.7311	0.6564
arabidopsis1%	0.0000	0.0158	0.2581	0.2581	0.2581	0.1290	0.2581	0.2581	0.2581	0.3125	0.0000	0.2778
bank	0.4666	0.5877	0.5929	0.6000	0.5742	0.6059	0.5791	0.6039	0.6068	0.5748	0.6176	0.6111
bio	0.8036	0.8172	0.5109	0.8675	0.7663	0.8504	0.8377	0.8458	0.8340	0.3710	0.7314	0.6867
block1%	0.4884	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.7200	1.0000	1.0000	0.9767
ccds10%	0.0000	0.0740	0.3474	0.3386	0.3386	0.3474	0.3386	0.3474	0.3474	0.3386	0.3474	0.3524
census10%	0.4032	0.3907	0.3228	0.4354	0.4088	0.4417	0.4053	0.4606	0.5133	0.3904	0.4563	0.4781
chrom1910%	0.0000	0.3218	0.1889	0.4507	0.5217	0.2941	0.2519	0.3107	0.5000	0.2073	0.6047	0.4762
deposit	0.3975	0.5641	0.5610	0.5796	0.5836	0.5708	0.5712	0.5426	0.5719	0.5546	0.5736	0.5920
dna0.1%	0.0526	0.1333	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0284
linkage1%	0.0526	0.1333	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0284
euthyroid	0.8276	0.7647	0.7105	0.7588	0.7797	0.7000	0.7000	0.7382	0.7273	0.7869	0.7368	0.7536
hiv1-proteasa	0.7772	0.7665	0.6901	0.6941	0.7925	0.6901	0.6941	0.6881	0.6941	0.7523	0.6901	0.8060
hiva	0.1176	0.1000	0.1176	0.1176	0.0588	0.1176	0.1176	0.1176	0.1176	0.1082	0.1176	0.1778
htru2	0.8816	0.8287	0.8497	0.8701	0.7657	0.8538	0.8448	0.8563	0.8665	0.8630	0.8614	0.8793
kddcup9810%	0.0000	0.1259	0.1386	0.1408	0.1446	0.1429	0.1373	0.1373	0.1373	0.0987	0.1159	0.0842
linkage1%	0.9500	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.7170	1.0000	0.7037	0.9545
musk	0.9802	0.9519	0.9802	0.9351	0.9802	0.9802	0.9802	0.9802	0.9802	0.9852	0.9802	0.9754
opn310k10%	0.0000	0.3657	0.4298	0.4236	0.4115	0.4038	0.4435	0.3891	0.3930	0.4063	0.3695	0.4420
ozone8hr	0.1538	0.3030	0.2069	0.0833	0.1600	0.0833	0.0800	0.0833	0.0800	0.2069	0.1538	0.4211
p53-mutants	0.5000	0.4516	0.4615	0.4800	0.4615	0.4615	0.4800	0.4615	0.5000	0.2727	0.5000	0.2105
polish-list	0.0000	0.1538	0.1214	0.1538	0.1818	0.1587	0.1311	0.1481	0.1935	0.1935	0.1667	0.1791
polish-2nd	0.0000	0.1065	0.1002	0.0968	0.1318	0.0976	0.1045	0.0960	0.0885	0.0952	0.1564	0.1111
polish-3rd	0.0000	0.0690	0.1284	0.2078	0.2416	0.2222	0.2174	0.0811	0.0976	0.0706	0.1568	0.1728
polish-4th	0.1515	0.2456	0.2405	0.3214	0.3017	0.1000	0.2762	0.0976	0.2958	0.2842	0.2286	0.3544
polish-5th	0.0476	0.3200	0.3117	0.4111	0.3552	0.3636	0.3333	0.0000	0.3488	0.3846	0.3894	0.4468
secom	0.2105	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
seismic	0.1905	0.1633	0.1935	0.2069	0.2000	0.1579	0.1667	0.1333	0.0000	0.1053	0.2353	0.3030
semeion	1.0000	1.0000	0.8966	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9677	1.0000
sens-1-gram	0.0625	0.2407	0.2716	0.1143	0.1649	0.1818	0.1976	0.1395	0.0606	0.1519	0.2157	0.1895
sens-2-gram	0.2609	0.3125	0.2319	0.3516	0.2121	0.1667	0.2258	0.1667	0.1429	0.3404	0.2188	0.3333
sens-3-gram	0.3188	0.3370	0.3784	0.3514	0.3704	0.3947	0.2462	0.4000	0.3514	0.2947	0.3846	0.3956
sens-4-gram	0.0968	0.2447	0.0635	0.0635	0.0938	0.0635	0.0952	0.0968	0.0656	0.2683	0.1515	0.3419
shoppers	0.5743	0.6437	0.6329	0.6699	0.6560	0.6745	0.6604	0.6698	0.6635	0.6621	0.6582	0.6700
sick	0.6829	0.6296	0.6538	0.6667	0.4878	0.6531	0.6531	0.6250	0.6531	0.5862	0.6250	0.6667
steel-b	0.6234	0.6667	0.6667	0.3793	0.3934	0.6744	0.6742	0.6591	0.3793	0.3729	0.6905	0.7111
steel-k	0.9744	0.9744	0.9744	0.9744	0.9744	0.9744	0.9744	0.9744	0.9744	0.9744	0.9744	0.9500
steel-p	0.5600	0.6667	0.6857	0.5385	0.0000	0.6829	0.6364	0.5185	0.4444	0.0000	0.6857	0.6000
steel-z	0.8000	0.8182	0.7805	0.8205	0.8000	0.8372	0.7317	0.7317	0.8000	0.7805	0.8372	0.7727
usllago10%	0.0000	0.0211	0.3056	0.3056	0.3056	0.3056	0.3056	0.3056	0.3056	0.2817	0.2602	0.2267
wilt	0.9200	0.8421	0.8364	0.8727	0.7871	0.8421	0.8421	0.8889	0.8889	0.7742	0.8800	0.9231
Mean	0.3892	0.4359	0.4633	0.4821	0.4637	0.4760	0.4688	0.4568	0.4556	0.4371	0.4834	0.4890

Table 11: Wilcoxon test for F1 metrics and all the methods using a SVM

	SVM	SMOTE_ENN	SVM_Balance	MSYN	CBISO	SMOTE_IPF	Selected_SMOTE	SMOBD	TRIM_SMOTE	NDO_Sampling	ANS	eSMOTE
Mean	0.3892	0.4559	0.4633	0.4821	0.4637	0.4760	0.4688	0.4568	0.4556	0.4371	0.4834	0.4890
Ranks	7.8333	7.2778	7.0444	5.4667	6.2333	6.1778	6.8000	7.1333	6.5444	7.3667	5.5444	4.5778
SVM	w/1	29/13	25/16	26/14	25/15	25/15	24/16	22/17	22/16	24/18	27/11	33/11
	p	0.0033	0.0236	0.0075	0.0469	0.0104	0.0167	0.0521	0.0830	0.1005	0.0023	0.0001
	R <sup>+</sup> /R <sup>-</sup>	778.0/257.0	718.0/317.0	754.5/280.5	693.5/341.5	744.5/290.5	729.5/305.5	689.5/345.5	671.0/364.0	663.0/372.0	787.0/248.0	853.5/181.5
SMOTE_ENN	w/1	19/20	19/20	27/11	24/14	26/12	24/14	20/19	26/15	17/22	27/14	30/13
	p	0.9370	0.9370	0.0372	0.3574	0.0830	0.3754	0.9101	0.5763	0.3042	0.0831	0.0277
	R <sup>+</sup> /R <sup>-</sup>	510.5/524.5	702.0/333.0	599.0/436.0	599.0/436.0	671.0/364.0	596.0/439.0	527.5/507.5	567.0/468.0	426.5/608.5	671.0/364.0	712.5/322.5
SVM_Balance	w/1	26/10	26/10	20/15	20/15	19/13	19/16	14/19	20/16	16/21	24/11	32/12
	p	0.0268	0.0268	0.2880	0.2880	0.2722	0.6031	0.4251	0.6271	0.3015	0.0365	0.0088
	R <sup>+</sup> /R <sup>-</sup>	611.5/321.5	713.5/321.5	611.5/423.5	614.5/420.5	614.5/420.5	563.5/471.5	447.0/588.0	560.5/474.5	458.0/577.0	702.5/332.5	749.5/285.5
MSYN	w/1	15/20	15/20	15/20	15/20	15/20	9/23	10/23	11/23	10/27	20/19	29/13
	p	0.3255	0.3255	0.2536	0.0289	0.0289	0.0289	0.0349	0.0401	0.0257	0.9101	0.0736
	R <sup>+</sup> /R <sup>-</sup>	430.5/604.5	416.5/618.5	416.5/618.5	324.5/710.5	331.0/704.0	336.0/699.0	336.0/699.0	336.0/699.0	320.0/715.0	527.5/507.5	676.0/359.0
CBISO	w/1	17/18	17/18	15/19	14/19	14/19	14/22	14/19	14/22	15/21	24/15	27/16
	p	0.9910	0.9910	0.4251	0.4251	0.4251	0.2731	0.4251	0.2731	0.2267	0.2142	0.0948
	R <sup>+</sup> /R <sup>-</sup>	518.5/516.5	455.0/580.0	447.0/588.0	447.0/588.0	447.0/588.0	420.5/614.5	420.5/614.5	420.5/614.5	410.5/624.5	627.5/407.5	665.5/369.5
SMOTE_IPF	w/1	13/19	13/19	10/20	10/20	10/20	16/19	16/19	16/19	14/24	23/12	28/15
	p	0.2873	0.2873	0.1112	0.1112	0.1112	0.3903	0.3903	0.3903	0.1260	0.1577	0.0904
	R <sup>+</sup> /R <sup>-</sup>	423.5/611.5	377.0/658.0	377.0/658.0	441.5/593.5	377.0/658.0	441.5/593.5	382.0/653.0	441.5/593.5	382.0/653.0	642.5/392.5	667.5/367.5
Selected_SMOTE	w/1	15/17	15/17	0.7341	0.7341	0.7341	0.7341	0.7341	0.7341	0.3692	0.0616	0.0445
	p	0.7047	0.7047	0.4874	0.4874	0.4874	0.4874	0.4874	0.4874	0.3692	0.0616	0.0445
	R <sup>+</sup> /R <sup>-</sup>	551.0/484.0	551.0/484.0	551.0/484.0	551.0/484.0	551.0/484.0	551.0/484.0	551.0/484.0	551.0/484.0	438.0/597.0	683.0/352.0	695.5/339.5
SMOBD	w/1	18/15	18/15	17/21	17/21	17/21	18/15	18/15	18/15	17/21	23/13	31/12
	p	0.4874	0.4874	0.0366	0.0366	0.0366	0.0366	0.0366	0.0366	0.4874	0.0366	0.0178
	R <sup>+</sup> /R <sup>-</sup>	702.5/307.5	702.5/307.5	702.5/307.5	702.5/307.5	702.5/307.5	702.5/307.5	702.5/307.5	702.5/307.5	456.0/579.0	702.5/307.5	727.5/307.5
TRIM_SMOTE	w/1	16/23	16/23	16/23	16/23	16/23	16/23	16/23	16/23	16/23	19/18	30/13
	p	0.4293	0.4293	0.4293	0.4293	0.4293	0.4293	0.4293	0.4293	0.4293	0.2516	0.0240
	R <sup>+</sup> /R <sup>-</sup>	619.0/416.0	619.0/416.0	619.0/416.0	619.0/416.0	619.0/416.0	619.0/416.0	619.0/416.0	619.0/416.0	447.5/587.5	619.0/416.0	717.5/317.5
NDO_Sampling	w/1	25/15	25/15	25/15	25/15	25/15	25/15	25/15	25/15	25/15	25/15	29/14
	p	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041	0.0041
	R <sup>+</sup> /R <sup>-</sup>	691.5/343.5	691.5/343.5	691.5/343.5	691.5/343.5	691.5/343.5	691.5/343.5	691.5/343.5	691.5/343.5	691.5/343.5	691.5/343.5	771.5/263.5
ANS	w/1	27/17	27/17	27/17	27/17	27/17	27/17	27/17	27/17	27/17	27/17	27/17
	p	0.3848	0.3848	0.3848	0.3848	0.3848	0.3848	0.3848	0.3848	0.3848	0.3848	0.3848
	R <sup>+</sup> /R <sup>-</sup>	594.5/440.5	594.5/440.5	594.5/440.5	594.5/440.5	594.5/440.5	594.5/440.5	594.5/440.5	594.5/440.5	594.5/440.5	594.5/440.5	594.5/440.5
Iman-Davenport	p-value: 0.0003											

Table 12: Results for F1 metrics and all the methods using a C4.5 tree

Dataset	C4.5	SMOTEENN	SVM-Balance	MSYN	CBSO	SMOTE_IPF	SelectedSMOTE	SMOBD	TRIM_SMOTE	NDO_Sampling	ANS	eSMOTE
ads	0.9091	0.2460	0.3496	0.2460	0.2439	0.2460	0.2460	0.2460	0.2460	0.2460	0.8675	0.8864
adult	0.6851	0.5102	0.6654	0.6787	0.5089	0.6819	0.6819	0.4844	0.5392	0.6785	0.3794	0.6922
AID604	0.4286	0.0116	0.0226	0.0470	0.0054	0.0172	0.0406	0.0265	0.0465	0.0112	0.0079	0.1140
AID688red	0.0000	0.0196	0.0207	0.0226	0.0000	0.0000	0.0199	0.0228	0.0190	0.0000	0.0195	0.0231
AID746red	0.0000	0.0138	0.0133	0.1149	0.0095	0.0000	0.0145	0.0500	0.0300	0.0000	0.0157	0.0463
aps-failure	0.7120	0.6667	0.0421	0.6667	0.6667	0.6667	0.6433	0.6667	0.6788	0.6667	0.6667	0.5163
arabidopsis1%	0.0556	0.0160	0.0465	0.0429	0.0412	0.0000	0.0273	0.0273	0.0290	0.0256	0.1290	0.0363
bank	0.4923	0.5928	0.5874	0.5435	0.2346	0.5462	0.5553	0.5171	0.5769	0.4872	0.4993	0.5843
bio	0.7787	0.5343	0.5427	0.5277	0.4988	0.5072	0.6571	0.5288	0.6667	0.5131	0.6145	0.3100
block1%	0.9756	0.9375	1.0000	1.0000	1.0000	0.8511	0.9545	0.8571	0.9333	0.8571	1.0000	1.0000
ccds10%	0.1625	0.0759	0.1551	0.0544	0.1296	0.0541	0.0645	0.1615	0.0901	0.0645	0.1089	0.1641
census10%	0.4520	0.4280	0.4365	0.3264	0.3725	0.3412	0.1366	0.4218	0.3297	0.4098	0.2554	0.4073
chrom1910%	0.5882	0.4348	0.4384	0.6087	0.5818	0.4533	0.4776	0.4857	0.6047	0.5333	0.5641	0.5231
deposit	0.4941	0.3872	0.3573	0.3478	0.2998	0.3473	0.3063	0.4037	0.4300	0.3512	0.2044	0.5657
dna0.1%	0.0000	0.0191	0.0054	0.0033	0.0040	0.0000	0.0033	0.0043	0.0039	0.0075	0.0066	0.0160
euthyroid	0.8475	0.7324	0.6914	0.7931	0.8438	0.8333	0.8000	0.6904	0.7143	0.6957	0.6835	0.7761
hiv1-proteas	0.6263	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6316
hiva	0.0714	0.0476	0.0602	0.1075	0.0612	0.0656	0.0556	0.0619	0.1348	0.1739	0.0707	0.1509
htru2	0.8790	0.7592	0.8433	0.8696	0.7513	0.7531	0.7887	0.7513	0.8421	0.7967	0.7923	0.8704
kddcup9810%	0.0619	0.0976	0.0971	0.1192	0.1033	0.1009	0.0777	0.0802	0.0883	0.0978	0.1309	0.0780
linkage1%	1.0000	0.0335	0.5676	0.9302	0.9302	0.5122	0.5250	0.6087	0.4000	0.5060	0.5676	1.0000
musk	0.9045	0.7941	0.8300	0.8670	0.8103	0.8241	0.8923	0.8485	0.8543	0.8821	0.8600	0.8657
opn310k10%	0.3297	0.3275	0.3419	0.3826	0.3276	0.2464	0.3204	0.2331	0.2977	0.2963	0.3200	0.2768
ozone8hr	0.1765	0.3636	0.1500	0.2632	0.2105	0.2778	0.2424	0.1622	0.1176	0.2174	0.1818	0.2540
p53-mutants	0.1935	0.3673	0.2642	0.2581	0.4571	0.4571	0.2581	0.2581	0.4000	0.2258	0.4103	0.0956
polish-list	0.2857	0.1509	0.1264	0.1264	0.1800	0.1782	0.1739	0.1687	0.2609	0.1346	0.1188	0.1805
polish-2nd	0.3000	0.1384	0.1063	0.1862	0.1722	0.1268	0.1778	0.1606	0.2542	0.2041	0.1609	0.1386
polish-3rd	0.1250	0.2100	0.1585	0.2105	0.1893	0.1951	0.1261	0.2148	0.1765	0.1719	0.1000	0.2396
polish-4th	0.5570	0.2995	0.2266	0.3720	0.2955	0.3571	0.4898	0.2675	0.3899	0.3681	0.3229	0.3246
polish-5th	0.5676	0.4030	0.3247	0.5000	0.5294	0.4182	0.3762	0.3956	0.5047	0.3906	0.4035	0.4511
secom	0.3158	0.1818	0.0667	0.0000	0.0769	0.2400	0.1429	0.1481	0.3200	0.1026	0.1538	0.0889
seismic	0.1667	0.2593	0.2105	0.2593	0.2051	0.1695	0.1951	0.2326	0.1250	0.2727	0.2308	0.4118
semeion	0.9333	0.0000	0.0000	0.3158	0.2000	0.0000	0.0000	0.0000	0.0000	0.3077	0.3158	0.9375
sens-1-gram	0.0345	0.2903	0.2340	0.2677	0.1437	0.2192	0.2598	0.2609	0.0333	0.2754	0.2157	0.2051
sens-2-gram	0.2000	0.3600	0.2364	0.2289	0.2683	0.2404	0.2254	0.3222	0.2031	0.2769	0.3086	0.3077
sens-3-gram	0.2286	0.3077	0.2400	0.3185	0.2190	0.2694	0.1239	0.3492	0.3453	0.2357	0.2559	0.2872
sens-4-gram	0.2832	0.2326	0.1920	0.2419	0.2513	0.1613	0.2571	0.2167	0.2599	0.2236	0.2614	0.2174
shoppers	0.5579	0.6135	0.5866	0.5498	0.5876	0.5514	0.5816	0.5950	0.6615	0.5445	0.6309	0.6540
sick	0.8511	0.9057	0.8276	0.5581	0.7317	0.5393	0.8846	0.5581	0.6462	0.6479	0.7042	0.8235
steel-b	0.6024	0.6316	0.6095	0.5843	0.6829	0.6392	0.6452	0.6667	0.6526	0.6739	0.6800	0.6408
steel-k	0.9500	0.9157	0.9157	0.9630	0.9367	0.9500	0.9136	0.9512	0.9512	0.9512	0.9512	0.9512
steel-p	0.3846	0.4783	0.2281	0.4500	0.5714	0.2020	0.4444	0.4615	0.6316	0.5625	0.6316	0.5789
steel-z	0.9500	0.8444	0.9048	0.9000	0.8780	0.8444	0.8372	0.8444	0.9744	0.8919	0.9000	0.8372
usllago10%	0.0268	0.0253	0.0368	0.0224	0.0120	0.0149	0.0656	0.0387	0.0323	0.0244	0.0323	0.0775
wilt	0.8400	0.8000	0.7931	0.7857	0.8074	0.7931	0.8364	0.8889	0.8302	0.7385	0.8889	0.8421
Mean	0.4663	0.3659	0.3456	0.3952	0.3785	0.3719	0.3631	0.3809	0.3720	0.3720	0.3916	0.4462

Table 13: Wilcoxon test for F1 metrics and all the methods using a C4.5 tree

	C4.5	SMOTE_ENN	SVM_Balance	MSYN	CBISO	SMOTE_IPF	Selected_SMOTE	SMOBD	TRIM_SMOTE	NDO_Sampling	ANS	eSMOTE
Mean	0.4663	0.3659	0.3456	0.3952	0.3785	0.3536	0.3719	0.3631	0.3809	0.3720	0.3916	0.4462
Ranks	5.1333	6.7333	7.4111	5.6667	7.1889	7.9556	7.0556	6.7667	5.9778	7.2222	6.1000	4.7889
C4.5	w/1	16/29	16/29	18/27	13/31	12/30	17/28	17/28	18/27	12/30	19/26	24/20
	p	0.0186	0.0018	0.0832	0.0049	0.0004	0.0102	0.0049	0.0210	0.0028	0.0383	0.6598
	R <sup>+</sup> /R <sup>-</sup>	309.0/726.0	241.0/794.0	364.0/671.0	268.5/766.5	205.0/830.0	290.0/745.0	268.0/767.0	313.0/722.0	253.0/782.0	334.0/701.0	478.5/556.5
SMOTE_ENN	w/1	17/25	24/17	21/22	21/22	17/23	20/22	18/22	27/15	16/26	25/18	29/16
	p	0.1469	0.2293	0.9012	0.9012	0.2271	0.9775	0.4840	0.0683	0.4876	0.4099	0.0298
	R <sup>+</sup> /R <sup>-</sup>	389.0/646.0	624.0/411.0	528.5/506.5	410.5/624.5	520.0/515.0	520.0/515.0	455.5/579.5	679.0/356.0	456.0/579.0	590.5/444.5	710.0/325.0
SVM_Balance	w/1	26/17	26/17	22/21	22/21	19/23	22/21	28/15	24/19	23/21	26/16	34/10
	p	0.0152	0.0152	0.4164	0.4164	0.5310	0.2102	0.1193	0.1248	0.4911	0.0489	0.0001
	R <sup>+</sup> /R <sup>-</sup>	732.5/302.5	589.5/445.5	462.0/573.0	628.5/406.5	628.5/406.5	628.5/406.5	655.5/379.5	653.5/381.5	578.5/456.5	692.0/343.0	861.5/173.5
MSYN	w/1	14/27	14/27	11/31	14/27	11/31	16/26	15/25	22/21	15/27	16/24	24/20
	p	0.0915	0.0915	0.0009	0.0915	0.0009	0.1029	0.0388	0.9640	0.0476	0.4494	0.2062
	R <sup>+</sup> /R <sup>-</sup>	368.0/667.0	368.0/667.0	224.0/811.0	373.0/662.0	334.5/700.5	373.0/662.0	334.5/700.5	513.5/521.5	342.0/693.0	450.5/584.5	629.5/405.5
CBISO	w/1	19/22	19/22	0.6274	0.6274	0.6274	0.6274	0.6274	0.8878	0.8878	0.3402	0.0115
	p	0.2861	0.2861	0.423.0/612.0	474.5/560.5	480.0/555.0	474.5/560.5	480.0/555.0	558.5/476.5	530.0/505.0	602.0/433.0	741.5/293.5
	R <sup>+</sup> /R <sup>-</sup>	25/17	25/17	26/14	30/12	27/16	24/16	26/14	30/12	24/16	27/16	34/11
SMOTE_IPF	w/1	0.1962	0.1962	0.0801	0.0801	0.0801	0.1516	0.0801	0.1516	0.1090	0.1090	0.0007
	p	632.0/403.0	632.0/403.0	672.5/362.5	732.0/303.0	672.5/362.5	732.0/303.0	644.5/390.5	659.5/375.5	644.5/390.5	659.5/375.5	817.0/218.0
	R <sup>+</sup> /R <sup>-</sup>	24/18	24/18	0.8522	0.8522	0.4327	0.4327	0.4327	0.4327	0.7692	0.3547	0.0311
Selected_SMOTE	w/1	20/21	20/21	25/16	25/16	20/21	20/21	25/16	25/16	20/21	24/17	30/14
	p	0.7995	0.7995	587.0/448.0	587.0/448.0	491.5/543.5	491.5/543.5	599.5/435.5	599.5/435.5	599.5/435.5	708.5/326.5	708.5/326.5
	R <sup>+</sup> /R <sup>-</sup>	674.0/361.0	674.0/361.0	674.0/361.0	674.0/361.0	540.0/495.0	540.0/495.0	631.0/404.0	631.0/404.0	631.0/404.0	759.5/275.5	759.5/275.5
TRIM_SMOTE	w/1	15/28	15/28	398.5/636.5	398.5/636.5	494.0/541.0	494.0/541.0	663.5/371.5	663.5/371.5	751.0/284.0	751.0/284.0	751.0/284.0
	p	0.1792	0.1792	644.5/390.5	644.5/390.5	644.5/390.5	644.5/390.5	644.5/390.5	644.5/390.5	644.5/390.5	644.5/390.5	644.5/390.5
	R <sup>+</sup> /R <sup>-</sup>	27/16	27/16	0.1517	0.1517	0.0084	0.0084	0.0084	0.0084	0.1517	0.1517	0.0084
NDO_Sampling	w/1	689.5/345.5	689.5/345.5	0.0522	0.0522	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5
	p	0.0001	0.0001	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5
	R <sup>+</sup> /R <sup>-</sup>	27/16	27/16	0.0522	0.0522	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5
ANS	w/1	689.5/345.5	689.5/345.5	0.0001	0.0001	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5
	p	0.0001	0.0001	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5
	R <sup>+</sup> /R <sup>-</sup>	689.5/345.5	689.5/345.5	0.0001	0.0001	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5	689.5/345.5
Iman-Davenport	p-value: 0.0001											

Table 14: Results for F1 metrics and all the methods using a Random Forest

Dataset	RF	SMOTEENN	SVM-Balance	MSYN	CBSO	SMOTE_IPF	SelectedSMOTE	SMOBD	TRIM_SMOTE	NDO_Sampling	ANS	eSMOTE
ads	0.9425	0.9231	0.9318	0.8810	0.9348	0.9333	0.9333	0.9318	0.9438	0.9438	0.9545	0.9213
adult	0.6549	0.6770	0.6821	0.6749	0.6667	0.6736	0.6784	0.6675	0.6712	0.6798	0.9438	0.9213
AID604	0.9697	0.9143	0.7805	0.1438	0.1655	0.7697	0.1060	0.1045	0.1120	0.1120	0.9697	0.3500
AID688red	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AID746red	0.2000	0.2593	0.2759	0.2222	0.1358	0.3137	0.0761	0.0917	0.2174	0.0612	0.2800	0.1520
aps-failure	0.6847	0.8195	0.7302	0.8195	0.8195	0.8195	0.7811	0.8195	0.7651	0.8195	0.7452	0.5995
arabicdopsis1%	0.0000	0.0158	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
bank	0.4967	0.6084	0.5886	0.5850	0.5996	0.5677	0.5939	0.5618	0.5532	0.5832	0.5347	0.6117
bio	0.8398	0.7885	0.8000	0.8067	0.5041	0.8015	0.6585	0.8075	0.8287	0.6726	0.8359	0.7603
block1%	1.0000	1.0000	0.9756	1.0000	1.0000	1.0000	0.9756	1.0000	1.0000	1.0000	1.0000	1.0000
ccds10%	0.0690	0.0740	0.1282	0.0690	0.0690	0.0690	0.0690	0.0690	0.0690	0.0690	0.0690	0.2099
census10%	0.4098	0.5149	0.4032	0.4234	0.4318	0.4321	0.4069	0.4468	0.4698	0.4482	0.3984	0.4500
chrom1910%	0.7500	0.4590	0.5085	0.6222	0.6047	0.5172	0.6000	0.5357	0.7179	0.5660	0.6842	0.4658
deposit	0.4860	0.4660	0.5796	0.5735	0.5584	0.5602	0.5511	0.5455	0.5618	0.5485	0.5260	0.6049
dna0.1%	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
euthyroid	0.8421	0.8358	0.7671	0.8333	0.8333	0.8387	0.8387	0.8667	0.8136	0.8254	0.8333	0.8387
hiv1-proteasa	0.6173	0.7290	0.6429	0.6341	0.6145	0.6211	0.6484	0.6258	0.6076	0.6816	0.5732	0.7411
hiva	0.1053	0.0870	0.1111	0.0909	0.1818	0.1053	0.1053	0.1000	0.1053	0.1739	0.1000	0.2632
htrud2	0.8617	0.8305	0.8480	0.8696	0.8324	0.8624	0.8624	0.8614	0.8554	0.8589	0.8471	0.8295
kddcup9810%	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
linkage1%	0.9756	1.0000	1.0000	0.9756	0.9756	1.0000	0.9756	0.9500	0.9756	0.9500	0.9756	1.0000
musk	0.8603	0.8497	0.8817	0.8571	0.8913	0.9032	0.9091	0.8557	0.8791	0.8542	0.8973	0.8830
opn310k10%	0.1553	0.3797	0.4452	0.4339	0.4174	0.4221	0.4727	0.4091	0.4513	0.3874	0.3786	0.5045
ozone8hr	0.0000	0.2857	0.2778	0.2581	0.3125	0.1935	0.3256	0.2424	0.1481	0.2941	0.1250	0.3333
p53-mutants	0.1053	0.3014	0.3158	0.4103	0.3171	0.3171	0.3881	0.3133	0.6452	0.3243	0.6061	0.2400
polish-list	0.0690	0.2727	0.1170	0.2000	0.3214	0.2400	0.2553	0.1333	0.1951	0.2326	0.2951	0.3421
polish-2nd	0.1304	0.2617	0.1096	0.2286	0.2353	0.2703	0.3284	0.1739	0.2941	0.3421	0.2824	0.3303
polish-3rd	0.0000	0.2878	0.1397	0.2140	0.2564	0.3659	0.2155	0.2286	0.0385	0.2407	0.3846	0.2651
polish-4th	0.3333	0.4000	0.2326	0.4094	0.4426	0.4685	0.4094	0.3261	0.4889	0.3523	0.4444	0.4114
polish-5th	0.4667	0.5045	0.3529	0.5412	0.5000	0.5435	0.5610	0.4941	0.5217	0.5263	0.5652	0.4952
secom	0.0000	0.2069	0.1818	0.1667	0.1818	0.0000	0.1667	0.0000	0.0000	0.0000	0.1667	0.0000
seismic	0.0000	0.3265	0.2388	0.2857	0.2143	0.2632	0.2353	0.2703	0.1053	0.2286	0.2143	0.3750
semeion	0.8966	0.9333	0.8966	0.8966	0.8966	0.8966	0.8966	0.9333	0.8966	0.8966	0.8966	0.9333
sens-1-gram	0.0000	0.2459	0.2710	0.1975	0.2222	0.2000	0.3167	0.1882	0.0000	0.2439	0.1961	0.2720
sens-2-gram	0.1091	0.3709	0.3146	0.2703	0.2597	0.2500	0.3200	0.2439	0.0702	0.3495	0.2500	0.3784
sens-3-gram	0.1818	0.3413	0.3636	0.2985	0.3797	0.3544	0.3500	0.3467	0.3333	0.3256	0.3659	0.4000
sens-4-gram	0.1724	0.3015	0.1867	0.2051	0.2683	0.1892	0.2105	0.1690	0.2133	0.2250	0.2381	0.2800
shoppers	0.6201	0.6697	0.6622	0.6632	0.6718	0.6496	0.6621	0.6621	0.6649	0.6617	0.6667	0.6732
sick	0.7500	0.8085	0.7692	0.8444	0.8372	0.8261	0.8261	0.8444	0.7727	0.8936	0.8372	0.8511
steel-b	0.6087	0.6226	0.6800	0.7000	0.7045	0.6988	0.7229	0.7294	0.7059	0.7209	0.6667	0.6667
steel-k	0.9610	0.9744	0.9744	0.9744	0.9610	0.9620	0.9744	0.9610	0.9744	0.9744	0.9744	0.9873
steel-p	0.6154	0.7500	0.7143	0.6667	0.7429	0.7778	0.7222	0.6667	0.6667	0.7222	0.6667	0.6316
steel-z	0.8718	0.9268	0.9500	0.9000	0.9500	0.9231	0.9231	0.9268	0.9231	0.9268	0.9000	0.8780
uslilago10%	0.0000	0.0212	0.0000	0.0000	0.0656	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0645
wilt	0.8636	0.8519	0.7925	0.8000	0.8302	0.8302	0.8679	0.8462	0.8627	0.7586	0.8400	0.7273
Mean	0.4372	0.5115	0.4505	0.4810	0.4846	0.4988	0.4871	0.4656	0.4884	0.4779	0.5077	0.4981

Table 15: Wilcoxon test for F1 metrics and all the methods using a Random Forest

	RF	SMOTE-ENN	SVM-Balance	MSYN	CBISO	SMOTE-IPF	Selected-SMOTE	SMOBD	TRIM-SMOTE	NDO_Sampling	ANS	eSMOTE
Mean	0.4372	0.5115	0.4805	0.4810	0.4846	0.4988	0.4871	0.4656	0.4884	0.4779	0.5077	0.4981
Ranks	8.7889	5.4000	6.9778	6.7222	5.9889	6.1111	5.8889	7.4778	6.7111	6.4111	6.5333	4.9889
RF	w/1	32/9	27/12	28/8	27/9	28/7	28/8	24/12	25/7	28/9	27/8	30/9
	p	0.0000	0.0096	0.0005	0.0012	0.0003	0.0008	0.0065	0.0002	0.0019	0.0001	0.0011
	R <sup>+</sup> /R <sup>-</sup>	879.0/156.0	747.0/288.0	826.5/208.5	804.5/230.5	841.5/193.5	815.5/219.5	758.5/276.5	848.5/186.5	793.0/242.0	864.5/170.5	806.5/228.5
SMOTE-ENN	w/1	15/25	11/28	16/24	19/20	18/23	12/26	12/26	14/26	14/24	17/23	23/16
	p	0.0139	0.0111	0.3260	0.4699	0.3401	0.0052	0.0662	0.0571	0.0571	0.4228	0.5801
	R <sup>+</sup> /R <sup>-</sup>	299.5/735.5	292.5/742.5	430.5/604.5	453.5/581.5	433.0/602.0	270.0/765.0	365.5/669.5	349.0/686.0	349.0/686.0	446.5/588.5	566.5/468.5
SVM-Balance	w/1	19/19	19/19	24/14	22/15	24/13	18/21	18/21	20/18	22/17	20/18	27/13
	p	0.5647	0.5647	0.1015	0.1882	0.0462	0.8833	0.7691	0.4292	0.3204	0.4292	0.0641
	R <sup>+</sup> /R <sup>-</sup>	568.5/466.5	662.5/372.5	634.0/401.0	634.0/401.0	694.0/341.0	504.5/530.5	543.5/429.5	605.5/429.5	605.5/429.5	587.5/447.5	681.5/353.5
MSYN	w/1	21/14	18/18	21/13	12/23	17/17	17/17	17/17	17/17	18/18	17/14	28/12
	p	0.2096	0.5798	0.1592	0.0505	0.9684	0.0505	0.0505	0.9684	0.9190	0.3955	0.0564
	R <sup>+</sup> /R <sup>-</sup>	628.5/406.5	566.5/468.5	642.0/393.0	344.5/690.5	514.0/521.0	526.5/508.5	592.5/442.5	592.5/442.5	526.5/508.5	592.5/442.5	686.5/348.5
CBISO	w/1	19/15	17/21	11/26	11/26	17/20	14/20	14/20	14/20	15/22	14/20	26/14
	p	0.7217	0.8433	0.0066	0.0066	0.3573	0.4658	0.0862	0.4658	0.2079	0.0862	0.0862
	R <sup>+</sup> /R <sup>-</sup>	549.0/486.0	500.0/535.0	277.0/758.0	436.0/599.0	406.0/629.0	453.0/582.0	453.0/582.0	453.0/582.0	406.0/629.0	453.0/582.0	669.5/365.5
SMOTE-IPF	w/1	13/23	16/19	19/17	16/19	16/19	16/19	16/19	16/19	19/17	16/20	21/16
	p	0.5083	0.3540	0.8212	0.3540	0.8212	0.6842	0.5015	0.6842	0.8212	0.6842	0.5015
	R <sup>+</sup> /R <sup>-</sup>	360.5/674.5	435.5/599.5	497.5/537.5	497.5/537.5	481.5/553.5	481.5/553.5	577.0/458.0	481.5/553.5	497.5/537.5	481.5/553.5	577.0/458.0
Selected-SMOTE	w/1	13/26	12/22	13/26	13/26	13/26	13/26	13/26	13/26	16/21	15/20	27/13
	p	0.0189	0.1255	0.0189	0.0189	0.0189	0.0189	0.0189	0.1255	0.3342	0.5643	0.1615
	R <sup>+</sup> /R <sup>-</sup>	309.5/725.5	382.0/603.0	360.5/653.0	360.5/653.0	382.0/603.0	466.5/568.5	466.5/568.5	466.5/568.5	432.0/603.0	466.5/568.5	641.5/393.5
SMOBD	w/1	20/16	23/12	20/16	23/12	23/12	20/16	20/16	20/16	23/12	19/16	27/11
	p	0.0479	0.5269	0.0479	0.5269	0.0479	0.5269	0.0479	0.5269	0.0479	0.2632	0.0089
	R <sup>+</sup> /R <sup>-</sup>	692.5/342.5	573.5/461.5	692.5/342.5	573.5/461.5	692.5/342.5	573.5/461.5	692.5/342.5	573.5/461.5	692.5/342.5	616.5/418.5	749.0/286.0
TRIM-SMOTE	w/1	21/14	21/14	21/14	21/14	21/14	21/14	21/14	21/14	21/14	16/17	24/15
	p	0.4029	0.7643	0.4029	0.7643	0.4029	0.7643	0.4029	0.7643	0.4029	0.7643	0.2060
	R <sup>+</sup> /R <sup>-</sup>	591.5/443.5	544.0/491.0	591.5/443.5	544.0/491.0	591.5/443.5	544.0/491.0	591.5/443.5	544.0/491.0	591.5/443.5	544.0/491.0	629.5/405.5
NDO_Sampling	w/1	18/19	18/19	18/19	18/19	18/19	18/19	18/19	18/19	18/19	18/19	27/12
	p	0.8257	0.8257	0.8257	0.8257	0.8257	0.8257	0.8257	0.8257	0.8257	0.8257	0.0302
	R <sup>+</sup> /R <sup>-</sup>	537.0/498.0	709.5/325.5	537.0/498.0	709.5/325.5	537.0/498.0	709.5/325.5	537.0/498.0	709.5/325.5	537.0/498.0	709.5/325.5	23/16
ANS	w/1	23/16	23/16	23/16	23/16	23/16	23/16	23/16	23/16	23/16	23/16	0.4981
	p	0.4981	0.4981	0.4981	0.4981	0.4981	0.4981	0.4981	0.4981	0.4981	0.4981	577.5/457.5
	R <sup>+</sup> /R <sup>-</sup>	577.5/457.5	577.5/457.5	577.5/457.5	577.5/457.5	577.5/457.5	577.5/457.5	577.5/457.5	577.5/457.5	577.5/457.5	577.5/457.5	577.5/457.5
Iman-Davenport	p-value: 0.0001											

Table 16: Results for auROC metrics and all the methods using a SVM

Dataset	SVM	SMOTEENN	SVM_Balance	MSYN	CBSO	SMOTE_IPF	SelectedSMOTE	SMOBD	TRIM_SMOTE	NDO_Sampling	ANS	eSMOTE
ads	0.9533	0.8474	0.9641	0.9541	0.9707	0.9719	0.9717	0.9746	0.9609	0.9467	0.9639	0.9748
adult	0.8339	0.8436	0.8817	0.8810	0.8820	0.8815	0.8815	0.8763	0.8820	0.8820	0.8753	0.8729
AID604	0.5000	0.9692	0.9698	0.9705	0.9704	0.9676	0.9697	0.9697	0.9261	0.9688	0.9113	0.9718
AID688red	0.5000	0.4984	0.4811	0.4888	0.5259	0.4935	0.4833	0.5047	0.4826	0.4944	0.4949	0.5222
AID746red	0.5000	0.6909	0.6919	0.5000	0.7021	0.6931	0.6790	0.6793	0.6424	0.7004	0.6676	0.7061
aps-failure	0.9214	0.9357	0.9536	0.9495	0.9357	0.9850	0.9842	0.9495	0.9551	0.9836	0.9744	0.9748
arabidopsis1%	0.5000	0.6216	0.8210	0.8208	0.8209	0.8209	0.8209	0.8209	0.8209	0.8209	0.5926	0.9381
bank	0.8459	0.9207	0.9274	0.9147	0.9290	0.9238	0.9238	0.9238	0.9263	0.8838	0.9105	0.9225
bio	0.9112	0.9563	0.9798	0.9454	0.9406	0.9489	0.9642	0.9450	0.9491	0.9745	0.9600	0.9690
block1%	0.9638	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9282	1.0000	1.0000	1.0000
ccds10%	0.5000	0.6515	0.8297	0.8298	0.8298	0.8297	0.8298	0.8297	0.8298	0.8295	0.8293	0.8648
census10%	0.8211	0.8984	0.7989	0.8952	0.9042	0.8857	0.8973	0.8693	0.8786	0.9053	0.8998	0.8910
chrom1910%	0.5000	0.9152	0.9703	0.9714	0.8606	0.9433	0.9708	0.9428	0.9160	0.9705	0.9163	0.9711
deposit	0.7118	0.9000	0.8976	0.8837	0.9078	0.9025	0.8799	0.8956	0.8797	0.8875	0.8701	0.8982
dna0.1%	0.5343	0.8673	0.6340	0.6338	0.5984	0.5984	0.6338	0.6340	0.6004	0.6342	0.4976	0.8835
euthyroid	0.9430	0.9474	0.9136	0.9347	0.9226	0.9477	0.9482	0.9408	0.9484	0.9213	0.9466	0.9473
hiv1-proteasa	0.9412	0.9463	0.9467	0.9473	0.9447	0.9428	0.9464	0.9467	0.9463	0.9451	0.9430	0.9438
hiva	0.7064	0.6970	0.5892	0.5963	0.5863	0.5913	0.5921	0.5912	0.7173	0.5620	0.6574	0.7185
htru2	0.9456	0.9622	0.9519	0.9528	0.9674	0.9610	0.9638	0.9608	0.9507	0.9591	0.9503	0.9694
kddcup9810%	0.5000	0.5606	0.5697	0.5882	0.5732	0.5902	0.5588	0.5591	0.5591	0.4868	0.5972	0.4998
linkage1%	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9520	1.0000	0.9760	1.0000
musk	0.9999	0.9935	0.9999	0.9986	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9982
opn310k10%	0.5000	0.7971	0.7831	0.7995	0.7822	0.7923	0.7763	0.7963	0.7842	0.7972	0.7841	0.7808
ozone8hr	0.6844	0.8207	0.7183	0.7241	0.7526	0.7167	0.7362	0.6971	0.6924	0.7018	0.6959	0.8998
p53-mutants	0.7979	0.8964	0.8304	0.8306	0.8302	0.8303	0.8306	0.8304	0.8309	0.7937	0.8644	0.8834
polish-list	0.5000	0.6815	0.6951	0.7250	0.6383	0.6718	0.6894	0.6664	0.6403	0.6615	0.6788	0.7491
polish-2nd	0.5000	0.5863	0.6605	0.5777	0.6759	0.5771	0.5468	0.5833	0.6044	0.5714	0.6994	0.6351
polish-3rd	0.5482	0.6107	0.6582	0.6898	0.7001	0.6655	0.6708	0.5655	0.5945	0.5671	0.6859	0.6990
polish-4th	0.6923	0.7493	0.7900	0.7568	0.7656	0.6759	0.7161	0.6796	0.7282	0.7388	0.7733	0.8198
polish-5th	0.6054	0.7852	0.7902	0.8401	0.8141	0.7592	0.7743	0.6977	0.7609	0.8081	0.8167	0.8002
secom	0.5863	0.5048	0.3976	0.4195	0.3979	0.4288	0.4414	0.4575	0.3914	0.3914	0.4538	0.4572
seismic	0.6158	0.7038	0.6246	0.7381	0.6452	0.6633	0.6803	0.6965	0.6785	0.6846	0.5799	0.6704
semeion	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
sens-1-gram	0.5282	0.6146	0.5960	0.5355	0.5742	0.5339	0.5734	0.6028	0.5441	0.5161	0.5995	0.5975
sens-2-gram	0.6543	0.6687	0.6847	0.6520	0.6820	0.6789	0.6699	0.6614	0.6771	0.6848	0.6545	0.6843
sens-3-gram	0.7293	0.7179	0.7509	0.7537	0.7343	0.7259	0.5831	0.7336	0.7460	0.6470	0.7332	0.7388
sens-4-gram	0.6176	0.6154	0.6692	0.6624	0.6764	0.6678	0.6525	0.6646	0.6546	0.6688	0.6886	0.6815
shoppers	0.8370	0.8886	0.8768	0.8958	0.8972	0.8941	0.8941	0.8991	0.8869	0.8918	0.8766	0.8925
sick	0.8685	0.9156	0.8987	0.9008	0.8910	0.8620	0.8610	0.8611	0.8585	0.8699	0.8308	0.9469
steel-b	0.8533	0.8895	0.8615	0.8709	0.8533	0.8666	0.8639	0.8543	0.8385	0.8557	0.8879	0.8994
steel-k	0.9866	0.9859	0.9860	0.9734	0.9843	0.9727	0.9843	0.9731	0.9853	0.9857	0.9851	0.9938
steel-p	0.9120	0.9045	0.9103	0.8813	0.8106	0.9693	0.9682	0.9033	0.8703	0.8124	0.9405	0.9520
steel-z	0.9614	0.9885	0.9855	0.9886	0.9885	0.9886	0.9886	0.9879	0.9882	0.9845	0.9647	0.9924
usllago10%	0.5000	0.6392	0.7913	0.7914	0.7915	0.7915	0.7914	0.7914	0.7915	0.8073	0.7089	0.9055
wilt	0.9993	0.9948	0.9945	0.9963	0.9941	0.9955	0.9955	0.9967	0.9955	0.9956	0.9956	0.9971
Mean	0.7336	0.8135	0.8153	0.8147	0.8144	0.8103	0.8133	0.8092	0.8061	0.8040	0.8076	0.8505

Table 17: Wilcoxon test for auROC metrics and all the methods using a SVM

	SVM	SMOTE-ENN	SVM-Balance	MSYN	CBISO	SMOTE-IPF	Selected-SMOTE	SMOBD	TRIM-SMOTE	NDO_Sampling	ANS	eSMOTE
Mean	0.7336	0.8135	0.8153	0.8147	0.8144	0.8103	0.8133	0.8092	0.8061	0.8040	0.8076	0.8505
Ranks	9.6111	6.1889	6.1667	5.7667	5.8444	6.2556	6.1000	6.7111	7.3778	7.1000	7.1222	3.7556
SVM	w/1	33/10	34/8	33/9	35/8	35/8	35/8	34/9	34/9	30/13	34/10	39/4
	p	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0000	0.0000
R <sup>+</sup> /R <sup>-</sup>		911.5/123.5	902.0/133.0	891.0/144.0	901.5/133.5	904.5/130.5	901.5/133.5	896.5/138.5	884.5/150.5	810.5/224.5	883.5/151.5	991.5/43.5
SMOTE-ENN	w/1	23/19	23/19	22/20	22/19	22/20	21/21	16/27	16/28	17/25	18/26	33/10
	p	0.8170	0.9236	0.8700	0.9236	0.8700	0.6639	0.1616	0.0658	0.1962	0.5200	0.0001
R <sup>+</sup> /R <sup>-</sup>		538.0/497.0	520.0/515.0	526.0/509.0	526.0/509.0	503.0/532.0	479.0/556.0	393.5/641.5	354.5/680.5	403.0/632.0	460.5/574.5	859.5/175.5
SVM-Balance	w/1	26/16	22/20	23/19	22/20	23/19	22/20	16/26	15/28	16/26	18/26	33/10
	p	0.3878	0.7306	0.9505	0.7306	0.9505	0.7821	0.2082	0.0302	0.0915	0.6354	0.0000
R <sup>+</sup> /R <sup>-</sup>		594.0/441.0	548.0/487.0	523.0/512.0	523.0/512.0	542.0/493.0	542.0/493.0	406.0/629.0	325.5/709.5	368.0/667.0	475.5/559.5	885.5/149.5
MSYN	w/1	20/21	19/23	19/23	20/21	19/23	17/25	18/24	17/27	13/29	20/24	31/12
	p	0.7562	0.4805	0.4805	0.7562	0.4805	0.4876	0.4004	0.0482	0.0136	0.6435	0.0003
R <sup>+</sup> /R <sup>-</sup>		490.0/545.0	455.0/580.0	455.0/580.0	490.0/545.0	455.0/580.0	456.0/579.0	443.0/592.0	342.5/692.5	299.0/736.0	476.5/558.5	839.5/195.5
CBISO	w/1	18/23	18/23	18/23	18/23	18/23	18/23	18/24	18/26	14/28	19/25	29/14
	p	0.4394	0.5459	0.4394	0.5459	0.4394	0.5459	0.5534	0.0948	0.0427	0.5310	0.0009
R <sup>+</sup> /R <sup>-</sup>		449.0/586.0	464.0/571.0	449.0/586.0	464.0/571.0	465.0/570.0	464.0/571.0	465.0/570.0	369.5/665.5	338.0/697.0	462.0/573.0	812.5/222.5
SMOTE-IPF	w/1	18/25	18/25	18/25	18/25	18/25	24/17	18/26	18/26	20/22	19/25	31/12
	p	0.2566	0.3547	0.2566	0.3547	0.2566	0.2566	0.1362	0.1362	0.4261	0.4295	0.0002
R <sup>+</sup> /R <sup>-</sup>		618.0/417.0	435.5/599.5	618.0/417.0	435.5/599.5	618.0/417.0	618.0/417.0	435.5/599.5	385.5/649.5	447.0/588.0	447.5/587.5	851.5/183.5
Selected-SMOTE	w/1	20/22	20/22	20/22	20/22	20/22	20/22	0.3817	15/29	18/24	17/27	31/12
	p	0.0139	0.0139	0.0139	0.0139	0.0139	0.0139	0.3817	0.0139	0.2662	0.3317	0.0002
R <sup>+</sup> /R <sup>-</sup>		440.0/595.0	289.5/735.5	440.0/595.0	289.5/735.5	440.0/595.0	289.5/735.5	440.0/595.0	299.5/735.5	419.0/616.0	431.5/603.5	850.5/184.5
SMOBD	w/1	20/23	20/23	20/23	20/23	20/23	20/23	0.2062	15/29	18/24	16/27	32/10
	p	0.3345	0.3345	0.3345	0.3345	0.3345	0.2062	0.2062	0.0139	0.3345	0.7865	0.0001
R <sup>+</sup> /R <sup>-</sup>		432.0/603.0	405.5/629.5	432.0/603.0	405.5/629.5	432.0/603.0	405.5/629.5	432.0/603.0	493.5/541.5	493.5/541.5	493.5/541.5	875.0/160.0
TRIM-SMOTE	w/1	26/18	26/18	26/18	26/18	26/18	26/18	26/18	23/21	26/18	23/21	35/9
	p	0.5200	0.5200	0.5200	0.5200	0.5200	0.5200	0.5200	0.3786	0.5200	0.3786	0.0000
R <sup>+</sup> /R <sup>-</sup>		574.5/460.5	595.5/439.5	574.5/460.5	595.5/439.5	574.5/460.5	595.5/439.5	574.5/460.5	595.5/439.5	595.5/439.5	595.5/439.5	936.5/98.5
NDO_Sampling	w/1	20/24	20/24	20/24	20/24	20/24	20/24	20/24	20/24	20/24	20/24	32/11
	p	0.7865	0.7865	0.7865	0.7865	0.7865	0.7865	0.7865	0.7865	0.7865	0.7865	0.0000
R <sup>+</sup> /R <sup>-</sup>		541.5/493.5	893.5/141.5	541.5/493.5	893.5/141.5	541.5/493.5	893.5/141.5	541.5/493.5	541.5/493.5	541.5/493.5	541.5/493.5	893.5/141.5
ANS	w/1	34/9	34/9	34/9	34/9	34/9	34/9	34/9	34/9	34/9	34/9	0.0001
	p	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
R <sup>+</sup> /R <sup>-</sup>		875.5/159.5	875.5/159.5	875.5/159.5	875.5/159.5	875.5/159.5	875.5/159.5	875.5/159.5	875.5/159.5	875.5/159.5	875.5/159.5	875.5/159.5
Iman-Davenport p-value: 0.0000												



Table 18: Results for auROC metrics and all the methods using a C4.5 tree

Dataset	C4.5	SMOTEENN	SVM_Balance	MSYN	CBSO	SMOTE_IPF	SelectedSMOTE	SMOBD	TRIM_SMOTE	NDO_Sampling	ANS	eSMOTE
ads	0.9548	0.5000	0.8575	0.4095	0.7160	0.5000	0.5000	0.4891	0.6630	0.8900	0.8900	0.9381
adult	0.8965	0.7370	0.8466	0.8756	0.7030	0.8750	0.8746	0.6132	0.8667	0.4190	0.8667	0.8836
AID604	0.7055	0.6449	0.7401	0.7307	0.4560	0.6527	0.7873	0.7050	0.6706	0.5034	0.5034	0.8488
AID688red	0.5000	0.5335	0.5611	0.5868	0.4996	0.5000	0.5424	0.5945	0.5000	0.5347	0.5347	0.3678
AID746red	0.5000	0.5643	0.5479	0.5646	0.4356	0.6383	0.6229	0.6394	0.4881	0.6145	0.6145	0.9693
aps-failure	0.8444	0.8683	0.4530	0.8683	0.8683	0.8683	0.8803	0.8683	0.8683	0.8949	0.8949	0.9534
arabidopsis1%	0.5286	0.5404	0.5260	0.6450	0.5728	0.5300	0.6380	0.6209	0.5282	0.5491	0.5491	0.6022
bank	0.8009	0.8533	0.8529	0.8109	0.5991	0.8169	0.8238	0.8010	0.7975	0.8171	0.8171	0.8921
bio	0.8683	0.9296	0.9122	0.8707	0.9068	0.9105	0.8688	0.9193	0.8966	0.9027	0.9027	0.9070
block1%	0.9762	1.0000	1.0000	1.0000	1.0000	0.9761	1.0000	1.0000	0.9997	1.0000	1.0000	0.9988
ccds10%	0.5853	0.5141	0.5847	0.4108	0.5649	0.5809	0.4063	0.3743	0.5457	0.5532	0.5532	0.6620
census10%	0.7748	0.7974	0.7729	0.7829	0.7795	0.7659	0.6065	0.7898	0.6737	0.6884	0.6884	0.8112
chrom1910%	0.8609	0.9156	0.9428	0.9163	0.9438	0.9715	0.9440	0.9716	0.8885	0.8885	0.8885	0.9677
deposit	0.7819	0.7271	0.7395	0.7219	0.7687	0.7167	0.6961	0.7692	0.7907	0.4354	0.4354	0.8269
dna0.1%	0.5150	0.5913	0.4853	0.3538	0.3726	0.4970	0.3552	0.4132	0.3886	0.5748	0.5748	0.6776
euthyroid	0.8847	0.8842	0.9151	0.8777	0.9295	0.8748	0.9062	0.9128	0.8832	0.8717	0.8717	0.9021
hiv1-proteasa	0.8005	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.8606
hiva	0.6355	0.5327	0.4087	0.6414	0.4018	0.4790	0.4381	0.4760	0.6217	0.5143	0.5143	0.5007
htru2	0.9119	0.9150	0.9388	0.9531	0.9310	0.9322	0.9035	0.9269	0.9391	0.9253	0.9253	0.9463
kddcup9810%	0.5002	0.5000	0.5155	0.5415	0.5278	0.4967	0.5021	0.4789	0.4922	0.5687	0.5687	0.5718
linkage1%	1.0000	0.8943	0.9972	0.9760	0.9760	0.9972	0.9972	0.9976	0.9972	0.9960	0.9960	0.9982
musk	0.9444	0.8951	0.8906	0.9267	0.8795	0.8899	0.9195	0.9035	0.9086	0.9230	0.9230	0.9393
opn310k10%	0.6585	0.7170	0.7153	0.7091	0.6233	0.6314	0.6398	0.6155	0.6412	0.6757	0.6757	0.7003
ozone8hr	0.5578	0.7123	0.6090	0.5992	0.5660	0.5903	0.5900	0.5468	0.5061	0.5467	0.5467	0.6429
p53-mutants	0.5978	0.7955	0.7309	0.6647	0.7621	0.7621	0.6949	0.6642	0.7316	0.7641	0.7641	0.8375
polish-list	0.7338	0.6081	0.6944	0.6514	0.6045	0.6123	0.5974	0.6129	0.6665	0.5711	0.5711	0.7107
polish-2nd	0.6363	0.5990	0.6122	0.6147	0.6072	0.6091	0.6054	0.5960	0.6411	0.5828	0.5828	0.7107
polish-3rd	0.6001	0.6463	0.6568	0.6298	0.6364	0.6194	0.5473	0.6307	0.6069	0.6072	0.6072	0.6494
polish-4th	0.7471	0.7290	0.7473	0.7318	0.7439	0.7592	0.7714	0.6910	0.8162	0.7243	0.7243	0.7867
polish-5th	0.7312	0.7606	0.7458	0.7792	0.7955	0.7727	0.7271	0.7213	0.8005	0.7535	0.7535	0.7732
secom	0.6247	0.6253	0.4795	0.4486	0.5411	0.6092	0.5479	0.5880	0.5089	0.5247	0.5247	0.4322
seismic	0.7846	0.6972	0.6169	0.6562	0.5899	0.5930	0.6245	0.6605	0.3102	0.4627	0.4627	0.7316
semeion	0.9375	0.4650	0.4930	0.5937	0.5564	0.5000	0.5000	0.5000	0.5472	0.5937	0.5937	0.9604
sens-1-gram	0.5134	0.5972	0.5377	0.6107	0.4347	0.5346	0.5942	0.5596	0.5141	0.4935	0.4935	0.5523
sens-2-gram	0.5231	0.7198	0.5378	0.5479	0.5814	0.5608	0.5341	0.6113	0.5858	0.6400	0.6400	0.6228
sens-3-gram	0.5820	0.6438	0.5751	0.6349	0.5381	0.5579	0.4890	0.6334	0.6303	0.5511	0.5511	0.6444
sens-4-gram	0.6034	0.5234	0.5249	0.5354	0.5522	0.5027	0.5595	0.4870	0.5741	0.5453	0.5453	0.5892
shoppers	0.8111	0.8467	0.8137	0.7916	0.8088	0.7377	0.7963	0.7964	0.7690	0.8703	0.8703	0.8401
sick	0.9236	0.9761	0.9740	0.8879	0.7985	0.9240	0.9522	0.9265	0.9316	0.9026	0.9026	0.9886
steel-b	0.8507	0.7968	0.7968	0.7799	0.8030	0.8165	0.8327	0.8296	0.8217	0.8349	0.8349	0.8200
steel-k	0.9785	0.9650	0.9675	0.9788	0.9709	0.9745	0.9468	0.9732	0.9727	0.9712	0.9712	0.9743
steel-p	0.6940	0.7706	0.5717	0.8263	0.7781	0.5547	0.7601	0.7648	0.7898	0.8637	0.8637	0.8027
steel-z	0.9943	0.9698	0.9870	0.9951	0.9634	0.9846	0.9547	0.9789	0.9972	0.9596	0.9596	0.9915
usllago10%	0.5059	0.5694	0.5468	0.5134	0.3955	0.4083	0.5568	0.5133	0.5630	0.5630	0.5630	0.6493
wilt	0.9524	0.9947	0.9673	0.9505	0.9488	0.9709	0.9732	0.9957	0.9613	0.9976	0.9976	0.9818
Mean	0.7403	0.7237	0.7087	0.7132	0.6876	0.6977	0.7002	0.7080	0.7053	0.7018	0.7018	0.7790

Table 19: Wilcoxon test for auROC metrics and all the methods using a C4.5 tree

	C4.5	SMOTE-ENN	SVM-Balance	MSYN	CBISO	SMOTE-IPF	Selected-SMOTE	SMOBD	TRIM-SMOTE	NDO_Sampling	ANS	eSMOTE
Mean	0.7403	0.7237	0.7087	0.7132	0.6876	0.6977	0.7002	0.7080	0.7053	0.7159	0.7018	0.7790
Ranks	6.2889	5.9444	6.4556	6.1556	7.9778	7.6222	7.3333	6.6778	6.6111	6.9000	6.8111	3.2222
C4.5												
	w/1	25/20	22/23	25/20	15/30	16/28	20/25	20/25	24/21	18/26	20/25	32/13
	p	0.9325	0.5610	0.9057	0.0096	0.0422	0.1847	0.4597	0.7306	0.2938	0.3402	0.0004
	R <sup>+</sup> /R <sup>-</sup>	525.0/510.0	466.0/569.0	507.0/528.0	288.0/747.0	337.5/697.5	400.0/635.0	452.0/583.0	487.0/548.0	424.5/610.5	433.0/602.0	831.0/204.0
SMOTE-ENN	w/1	20/24	17/26	21/22	17/26	14/28	16/27	17/26	20/24	18/24	18/26	33/12
	p	0.3972	0.0348	0.6036	0.0764	0.0113	0.0764	0.1550	0.0845	0.2164	0.1362	0.0010
	R <sup>+</sup> /R <sup>-</sup>	442.5/592.5	330.5/704.5	471.5/563.5	293.0/742.0	293.0/742.0	360.5/674.5	391.5/643.5	481.5/553.5	408.0/627.0	385.5/649.5	808.0/227.0
SVM-Balance	w/1	16/27	16/27	21/22	15/28	15/28	18/24	21/22	20/23	20/22	20/23	38/7
	p	0.8390	0.0764	0.8390	0.0625	0.0625	0.3430	0.7952	0.3880	0.6639	0.7520	0.0000
	R <sup>+</sup> /R <sup>-</sup>	499.5/535.5	360.5/674.5	499.5/535.5	352.5/682.5	352.5/682.5	433.5/601.5	494.5/540.5	469.5/565.5	479.0/556.0	489.5/545.5	928.0/107.0
MSYN	w/1	16/25	16/25	14/29	16/25	14/29	18/25	19/23	23/21	16/26	19/23	32/13
	p	0.0773	0.0773	0.0971	0.2938	0.0971	0.2938	0.6886	0.9550	0.5090	0.5610	0.0001
	R <sup>+</sup> /R <sup>-</sup>	361.0/674.0	361.0/674.0	370.5/664.5	424.5/553.0	424.5/553.0	424.5/610.5	482.0/553.0	512.5/522.5	459.0/576.0	466.0/569.0	856.0/179.0
CBISO	w/1	28/14	28/14	28/14	28/14	28/14	22/21	26/16	29/15	27/15	24/19	39/6
	p	0.2293	0.2293	0.2293	0.8214	0.8214	0.8214	0.0937	0.1193	0.1029	0.1550	0.0000
	R <sup>+</sup> /R <sup>-</sup>	624.0/411.0	624.0/411.0	624.0/411.0	537.5/497.5	537.5/497.5	537.5/497.5	666.0/369.0	655.5/379.5	662.0/373.0	643.5/391.5	943.0/92.0
SMOTE-IPF	w/1	24/18	24/18	22/19	24/18	24/18	22/19	24/18	24/18	26/15	22/22	40/5
	p	0.7995	0.7995	0.7995	0.2164	0.2164	0.7995	0.3233	0.3233	0.0683	0.7434	0.0000
	R <sup>+</sup> /R <sup>-</sup>	540.0/495.0	540.0/495.0	540.0/495.0	627.0/408.0	627.0/408.0	627.0/408.0	605.0/430.0	605.0/430.0	679.0/356.0	546.5/488.5	948.0/87.0
Selected-SMOTE	w/1	23/19	23/19	23/19	23/19	23/19	23/19	23/19	24/18	22/20	25/18	38/7
	p	0.3695	0.3695	0.3695	0.1962	0.1962	0.3695	0.1962	0.1962	0.2293	0.3848	0.0000
	R <sup>+</sup> /R <sup>-</sup>	597.0/438.0	597.0/438.0	597.0/438.0	632.0/403.0	632.0/403.0	632.0/403.0	632.0/403.0	632.0/403.0	624.0/411.0	594.5/440.5	922.0/113.0
SMOBD	w/1	19/23	19/23	19/23	19/23	19/23	19/23	19/23	21/22	19/23	21/22	34/11
	p	0.8655	0.8655	0.8655	0.8655	0.8655	0.8655	0.8655	0.8655	0.8522	0.8302	0.0000
	R <sup>+</sup> /R <sup>-</sup>	534.0/501.0	534.0/501.0	534.0/501.0	532.5/502.5	532.5/502.5	532.5/502.5	532.5/502.5	532.5/502.5	534.0/501.0	498.5/536.5	886.0/149.0
TRIM-SMOTE	w/1	23/20	23/20	23/20	23/20	23/20	23/20	23/20	23/20	23/20	23/20	37/8
	p	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.9640	0.0000
	R <sup>+</sup> /R <sup>-</sup>	513.5/521.5	513.5/521.5	513.5/521.5	513.5/521.5	513.5/521.5	513.5/521.5	513.5/521.5	513.5/521.5	513.5/521.5	521.5/513.5	882.0/153.0
NDO_Sampling	w/1	24/19	24/19	24/19	24/19	24/19	24/19	24/19	24/19	24/19	24/19	36/9
	p	0.9191	0.9191	0.9191	0.9191	0.9191	0.9191	0.9191	0.9191	0.9191	0.9191	0.0000
	R <sup>+</sup> /R <sup>-</sup>	526.5/508.5	526.5/508.5	526.5/508.5	526.5/508.5	526.5/508.5	526.5/508.5	526.5/508.5	526.5/508.5	526.5/508.5	526.5/508.5	898.0/137.0
ANS	w/1	36/9	36/9	36/9	36/9	36/9	36/9	36/9	36/9	36/9	36/9	0.0000
	p	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	R <sup>+</sup> /R <sup>-</sup>	894.0/141.0	894.0/141.0	894.0/141.0	894.0/141.0	894.0/141.0	894.0/141.0	894.0/141.0	894.0/141.0	894.0/141.0	894.0/141.0	0.0000
Iman-Davenport	p-value: 0.0000											

Table 20: Results for auROC metrics and all the methods using a Random Forest

Dataset	RF	SMOTEENN	SVM_Balance	MSYN	CBSO	SMOTE_IPF	SelectedSMOTE	SMOBD	TRIM_SMOTE	NDO_Sampling	ANS	eSMOTE
ads	0.9850	0.9811	0.9858	0.9581	0.9741	0.9843	0.9837	0.9845	0.9852	0.9839	0.9751	0.9779
adult	0.8900	0.8887	0.8608	0.8967	0.8900	0.8900	0.9030	0.8921	0.8917	0.9065	0.8866	0.9068
AID604	0.9705	0.9696	0.9695	0.9856	0.9751	0.9994	0.9509	0.9623	0.9705	0.9642	0.9704	0.9874
AID688red	0.4900	0.5431	0.5765	0.4927	0.5300	0.5879	0.4908	0.5879	0.4947	0.5448	0.4976	0.5187
AID746red	0.7441	0.7385	0.7555	0.7107	0.7783	0.7529	0.7930	0.7854	0.6968	0.7865	0.7194	0.8183
aps-failure	0.9820	0.9899	0.9918	0.9899	0.9899	0.9899	0.9899	0.9899	0.9899	0.9899	0.9854	0.9908
arabidopsis1%	0.4999	0.6677	0.6234	0.6219	0.7839	0.6408	0.6023	0.6419	0.6219	0.6611	0.5541	0.9452
bank	0.9274	0.9282	0.9303	0.9253	0.9324	0.9304	0.9301	0.9314	0.9210	0.9318	0.9243	0.9402
bio	0.9492	0.9895	0.9890	0.9668	0.9901	0.9863	0.9870	0.9898	0.9748	0.9898	0.9785	0.9937
block1%	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
ccds10%	0.7130	0.5727	0.8227	0.7816	0.8200	0.7984	0.8034	0.7953	0.7941	0.8059	0.7776	0.8595
census10%	0.8924	0.9190	0.9104	0.9092	0.9085	0.9158	0.9083	0.9073	0.9077	0.9112	0.9059	0.9316
chrom1910%	0.9442	0.9713	0.9713	0.9440	0.9440	0.9715	0.9714	0.9715	0.9442	0.9438	0.9442	0.9685
deposit	0.9152	0.9187	0.9194	0.9099	0.9182	0.9233	0.9037	0.9023	0.9069	0.9031	0.9177	0.9278
dna0.1%	0.5000	0.7992	0.7256	0.5342	0.6397	0.4987	0.5339	0.4993	0.4991	0.5334	0.5000	0.9217
euthyroid	0.9901	0.9838	0.9650	0.9737	0.9884	0.9883	0.9867	0.9738	0.9702	0.9862	0.9551	0.9873
hiv1-proteas	0.9458	0.9439	0.9343	0.9338	0.9301	0.9317	0.9244	0.9325	0.9381	0.9311	0.9370	0.9497
hiva	0.6596	0.7054	0.6993	0.6741	0.6937	0.7264	0.7223	0.7210	0.7052	0.7676	0.7159	0.6570
htru2	0.9555	0.9612	0.9605	0.9577	0.9509	0.9631	0.9594	0.9582	0.9615	0.9595	0.9629	0.9667
kdccup9810%	0.5397	0.5093	0.5195	0.5750	0.5894	0.5605	0.5799	0.5884	0.5835	0.5535	0.5917	0.6101
linkage1%	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
musk	0.9825	0.9764	0.9828	0.9812	0.9926	0.9863	0.9874	0.9840	0.9861	0.9730	0.9903	0.9777
opn310k10%	0.8303	0.8396	0.8403	0.8372	0.8345	0.8292	0.8467	0.8209	0.8334	0.8232	0.8150	0.8507
ozone8hr	0.7256	0.8056	0.7632	0.7906	0.8170	0.7811	0.7592	0.7570	0.7236	0.8088	0.7566	0.8027
p53-mutants	0.8638	0.9887	0.9928	0.9897	0.9935	0.9936	0.9936	0.9901	0.9885	0.9913	0.9602	0.9892
polish-list	0.9245	0.8631	0.6942	0.8970	0.9032	0.8945	0.8994	0.8729	0.9110	0.8510	0.9050	0.9137
polish-2nd	0.7649	0.8321	0.6828	0.8282	0.7988	0.8298	0.8490	0.7801	0.8263	0.8336	0.8354	0.8653
polish-3rd	0.7916	0.7891	0.7016	0.7649	0.7732	0.8191	0.7575	0.7898	0.8478	0.7671	0.8163	0.8029
polish-4th	0.9027	0.8578	0.8007	0.8752	0.8780	0.8862	0.8734	0.8530	0.8894	0.8568	0.8822	0.8767
polish-5th	0.8920	0.9181	0.8338	0.9118	0.8870	0.9164	0.9153	0.9234	0.9250	0.8977	0.9126	0.9076
secom	0.6476	0.6692	0.5894	0.6534	0.6031	0.6613	0.7092	0.6479	0.7603	0.6524	0.6719	0.6675
seismic	0.7375	0.7663	0.7577	0.7455	0.7342	0.6942	0.7277	0.7470	0.7431	0.7215	0.6970	0.7931
semeion	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
sens-1-gram	0.6330	0.6789	0.6469	0.6881	0.6894	0.7091	0.6738	0.6916	0.6133	0.6757	0.6402	0.6644
sens-2-gram	0.7415	0.7578	0.7355	0.8028	0.7332	0.6980	0.6980	0.7714	0.7319	0.7279	0.7109	0.7889
sens-3-gram	0.7413	0.7567	0.7775	0.7579	0.7481	0.7406	0.7406	0.7481	0.7794	0.7563	0.7655	0.7832
sens-4-gram	0.6460	0.6855	0.6600	0.6671	0.6735	0.6329	0.6228	0.6593	0.6669	0.6423	0.6926	0.6569
shoppers	0.9175	0.9265	0.9222	0.9218	0.9255	0.9232	0.9285	0.9252	0.9238	0.9290	0.9317	0.9275
sick	0.9972	0.9965	0.9885	0.9978	0.9975	0.9960	0.9962	0.9972	0.9942	0.9958	0.9953	0.9939
steel-b	0.9016	0.9084	0.8894	0.9187	0.9112	0.9162	0.9127	0.9294	0.9180	0.9148	0.9181	0.9137
steel-k	0.9860	0.9858	0.9861	0.9860	0.9860	0.9874	0.9859	0.9860	0.9978	0.9858	0.9862	0.9864
steel-p	0.9436	0.9661	0.9709	0.9630	0.9745	0.9682	0.9667	0.9691	0.9623	0.9724	0.9762	0.9682
steel-z	0.9976	0.9956	0.9978	0.9970	0.9997	0.9988	0.9988	0.9986	0.9986	0.9969	0.9975	0.9958
usllago10%	0.5241	0.5931	0.7729	0.8013	0.8221	0.6719	0.7723	0.6803	0.5112	0.6715	0.5112	0.9047
wilt	0.9952	0.9945	0.9942	0.9940	0.9953	0.9946	0.9961	0.9953	0.9953	0.9959	0.9951	0.9893
Mean	0.8351	0.8567	0.8465	0.8560	0.8646	0.8592	0.8563	0.8563	0.8494	0.8554	0.8458	0.8864

Table 21: Wilcoxon test for auROC metrics and all the methods using a Random Forest

	RF	SMOTE-ENN	SVM-Balance	MSYN	CBSO	SMOTE-IPF	Selected-SMOTE	SMOBD	TRIM-SMOTE	NDO_Sampling	ANS	eSMOTE
Mean	0.8351	0.8567	0.8465	0.8560	0.8646	0.8592	0.8563	0.8563	0.8494	0.8554	0.8458	0.8864
Ranks	8.3000	6.5000	7.0333	7.0889	5.6778	5.4667	6.6222	6.3000	6.6667	6.8111	7.0778	4.4556
RF	w/1	27/15	27/15	29/13	30/12	30/12	28/14	30/11	27/15	25/17	25/16	33/9
	p	0.0038	0.1599	0.0039	0.0026	0.0002	0.0069	0.0010	0.0265	0.0192	0.0439	0.0000
	R <sup>+</sup> /R <sup>-</sup>	774.0/261.0	642.0/393.0	773.0/262.0	784.0/251.0	842.0/193.0	757.0/278.0	810.0/225.0	714.0/321.0	725.0/310.0	696.0/339.0	936.0/99.0
SMOTE-ENN	w/1	16/26	16/25	16/25	22/19	25/16	23/19	24/17	18/24	19/21	19/23	31/11
	p	0.0298	0.1566	0.9775	0.9775	0.1962	0.9955	0.8522	0.2293	0.4910	0.1702	0.0014
	R <sup>+</sup> /R <sup>-</sup>	325.0/710.0	392.0/643.0	515.0/520.0	632.0/403.0	518.0/517.0	518.0/517.0	534.0/501.0	411.0/624.0	456.5/578.5	396.0/639.0	801.0/234.0
SVM-Balance	w/1	17/25	17/25	17/25	26/16	30/12	21/21	24/18	23/19	22/20	20/22	31/11
	p	0.6557	0.6557	0.6557	0.0363	0.0087	0.4735	0.1377	0.9865	0.2861	0.7821	0.0000
	R <sup>+</sup> /R <sup>-</sup>	557.0/478.0	703.0/332.0	750.0/285.0	581.0/454.0	581.0/454.0	581.0/454.0	649.0/386.0	519.0/516.0	612.0/423.0	493.0/542.0	888.0/147.0
MSYN	w/1	28/13	28/13	28/13	24/16	28/13	22/20	23/18	21/20	19/22	24/18	30/12
	p	0.0763	0.0543	0.7137	0.0763	0.0543	0.7137	0.7137	0.7735	0.9415	0.9685	0.0001
	R <sup>+</sup> /R <sup>-</sup>	674.5/360.5	688.0/347.0	550.0/485.0	550.0/485.0	550.0/485.0	550.0/485.0	550.0/485.0	543.0/492.0	511.0/524.0	514.0/521.0	857.0/178.0
CBSO	w/1	14/28	14/28	14/28	14/26	18/24	18/24	14/26	18/24	15/26	18/24	29/13
	p	0.8302	0.0718	0.2449	0.3178	0.3178	0.2449	0.2449	0.3178	0.1127	0.1347	0.0017
	R <sup>+</sup> /R <sup>-</sup>	536.5/498.5	358.0/677.0	414.5/620.5	429.0/606.0	429.0/606.0	429.0/606.0	429.0/606.0	429.0/606.0	377.0/658.0	385.0/650.0	796.0/239.0
SMOTE-IPF	w/1	17/24	17/24	17/24	20/21	20/21	18/24	20/21	18/24	15/26	13/29	24/18
	p	0.3123	0.3123	0.3123	0.3288	0.3288	0.0982	0.3288	0.0982	0.1633	0.0038	0.0543
	R <sup>+</sup> /R <sup>-</sup>	428.0/607.0	431.0/604.0	431.0/604.0	431.0/604.0	431.0/604.0	428.0/607.0	431.0/604.0	371.0/664.0	394.0/641.0	261.0/774.0	688.0/347.0
Selected-SMOTE	w/1	21/21	21/21	21/21	0.9775	0.9775	0.7648	0.9775	0.7648	0.8082	0.1407	30/12
	p	515.0/520.0	515.0/520.0	515.0/520.0	491.0/544.0	491.0/544.0	491.0/544.0	491.0/544.0	491.0/544.0	539.0/496.0	387.0/648.0	809.0/226.0
	R <sup>+</sup> /R <sup>-</sup>	539.0/496.0	539.0/496.0	539.0/496.0	539.0/496.0	539.0/496.0	539.0/496.0	539.0/496.0	539.0/496.0	539.0/496.0	387.0/648.0	809.0/226.0
SMOBD	w/1	18/23	18/23	18/23	18/23	18/23	18/23	18/23	18/23	18/23	18/23	28/14
	p	0.6234	0.6234	0.6234	0.6234	0.6234	0.6234	0.6234	0.6234	0.6234	0.6234	0.0039
	R <sup>+</sup> /R <sup>-</sup>	561.0/474.0	561.0/474.0	561.0/474.0	561.0/474.0	561.0/474.0	561.0/474.0	561.0/474.0	561.0/474.0	561.0/474.0	426.0/609.0	773.0/262.0
NDO_Sampling	w/1	20/22	20/22	20/22	20/22	20/22	20/22	20/22	20/22	20/22	20/22	30/12
	p	0.2382	0.2382	0.2382	0.2382	0.2382	0.2382	0.2382	0.2382	0.2382	0.2382	0.0004
	R <sup>+</sup> /R <sup>-</sup>	413.0/622.0	413.0/622.0	413.0/622.0	413.0/622.0	413.0/622.0	413.0/622.0	413.0/622.0	413.0/622.0	413.0/622.0	413.0/622.0	831.0/204.0
ANS	w/1	29/13	29/13	29/13	29/13	29/13	29/13	29/13	29/13	29/13	29/13	0.0004
	p	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0
	R <sup>+</sup> /R <sup>-</sup>	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0	830.0/205.0
Iman-Davenport	p-value: 0.0001											