

Output tables for the test of Multiple comparisons.

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1 Average rankings of Friedman test

Average ranks obtained by applying the Friedman procedure

Algorithm	Ranking
Base	5.0625
ADASYN	2.5312
SMOTE	4.5781
Bord	4.4844
NCL	4.7031
SMOTE+TL	4.4531
SMOTE+ENN	4.7344
CCR	5.4531

Table 1: Average Rankings of the algorithms

Friedman statistic considering reduction performance (distributed according to chi-square with 7 degrees of freedom: 27.763021.

P-value computed by Friedman Test: 2.427271290019739E-4.

2 Post hoc comparisons

Results achieved on post hoc comparisons for $\alpha = 0.05$, $\alpha = 0.10$ and adjusted p-values.

2.1 P-values for $\alpha = 0.05$

i	algorithms	$z = (R_0 - R_i)/SE$	p	Shaffer
28	ADASYN vs. CCR	4.771402	0.000002	0.001786
27	Base vs. ADASYN	4.133514	0.000036	0.002381
26	ADASYN vs. SMOTE+ENN	3.597688	0.000321	0.002381
25	ADASYN vs. NCL	3.546657	0.00039	0.002381
24	ADASYN vs. SMOTE	3.342533	0.00083	0.002381
23	ADASYN vs. Bord	3.18944	0.001425	0.002381
22	ADASYN vs. SMOTE+TL	3.138409	0.001699	0.002381
21	SMOTE+TL vs. CCR	1.632993	0.10247	0.002381
20	Bord vs. CCR	1.581962	0.113658	0.0025
19	SMOTE vs. CCR	1.428869	0.153042	0.002632
18	NCL vs. CCR	1.224745	0.220671	0.002778
17	SMOTE+ENN vs. CCR	1.173714	0.24051	0.002941
16	Base vs. SMOTE+TL	0.995105	0.319685	0.003125
15	Base vs. Bord	0.944074	0.345132	0.003333
14	Base vs. SMOTE	0.790981	0.428955	0.003571
13	Base vs. CCR	0.637888	0.523547	0.003846
12	Base vs. NCL	0.586857	0.5573	0.004167
11	Base vs. SMOTE+ENN	0.535826	0.592079	0.004545
10	SMOTE+TL vs. SMOTE+ENN	0.459279	0.646034	0.005
9	Bord vs. SMOTE+ENN	0.408248	0.683091	0.005556
8	NCL vs. SMOTE+TL	0.408248	0.683091	0.00625
7	Bord vs. NCL	0.357217	0.720929	0.007143
6	SMOTE vs. SMOTE+ENN	0.255155	0.798603	0.008333
5	SMOTE vs. NCL	0.204124	0.838256	0.01
4	SMOTE vs. SMOTE+TL	0.204124	0.838256	0.0125
3	SMOTE vs. Bord	0.153093	0.878325	0.016667
2	Bord vs. SMOTE+TL	0.051031	0.959301	0.025
1	NCL vs. SMOTE+ENN	0.051031	0.959301	0.05

Table 2: P-values Table for $\alpha = 0.05$

Shaffer's procedure rejects those hypotheses that have an unadjusted p-value ≤ 0.001786 .

2.2 P-values for $\alpha = 0.10$

i	algorithms	$z = (R_0 - R_i)/SE$	p	Shaffer
28	ADASYN vs. CCR	4.771402	0.000002	0.003571
27	Base vs. ADASYN	4.133514	0.000036	0.004762
26	ADASYN vs. SMOTE+ENN	3.597688	0.000321	0.004762
25	ADASYN vs. NCL	3.546657	0.00039	0.004762
24	ADASYN vs. SMOTE	3.342533	0.00083	0.004762
23	ADASYN vs. Bord	3.18944	0.001425	0.004762
22	ADASYN vs. SMOTE+TL	3.138409	0.001699	0.004762
21	SMOTE+TL vs. CCR	1.632993	0.10247	0.004762
20	Bord vs. CCR	1.581962	0.113658	0.005
19	SMOTE vs. CCR	1.428869	0.153042	0.005263
18	NCL vs. CCR	1.224745	0.220671	0.005556
17	SMOTE+ENN vs. CCR	1.173714	0.24051	0.005882
16	Base vs. SMOTE+TL	0.995105	0.319685	0.00625
15	Base vs. Bord	0.944074	0.345132	0.006667
14	Base vs. SMOTE	0.790981	0.428955	0.007143
13	Base vs. CCR	0.637888	0.523547	0.007692
12	Base vs. NCL	0.586857	0.5573	0.008333
11	Base vs. SMOTE+ENN	0.535826	0.592079	0.009091
10	SMOTE+TL vs. SMOTE+ENN	0.459279	0.646034	0.01
9	Bord vs. SMOTE+ENN	0.408248	0.683091	0.01111
8	NCL vs. SMOTE+TL	0.408248	0.683091	0.0125
7	Bord vs. NCL	0.357217	0.720929	0.014286
6	SMOTE vs. SMOTE+ENN	0.255155	0.798603	0.016667
5	SMOTE vs. NCL	0.204124	0.838256	0.02
4	SMOTE vs. SMOTE+TL	0.204124	0.838256	0.025
3	SMOTE vs. Bord	0.153093	0.878325	0.033333
2	Bord vs. SMOTE+TL	0.051031	0.959301	0.05
1	NCL vs. SMOTE+ENN	0.051031	0.959301	0.1

Table 3: P-values Table for $\alpha = 0.10$

Shaffer's procedure rejects those hypotheses that have an unadjusted p-value ≤ 0.003571 .

2.3 Adjusted p-values

i	hypothesis	unadjusted p	p_{Shof}
1	ADASYN vs .CCR	0.000002	0.000051
2	Base vs .ADASYN	0.000036	0.00075
3	ADASYN vs .SMOTE+ENN	0.000321	0.006742
4	ADASYN vs .NCL	0.00039	0.008193
5	ADASYN vs .SMOTE	0.00083	0.017434
6	ADASYN vs .Bord	0.001425	0.029935
7	ADASYN vs .SMOTE+TL	0.001699	0.035672
8	SMOTE+TL vs .CCR	0.10247	2.151879
9	Bord vs .CCR	0.113658	2.151879
10	SMOTE vs .CCR	0.153042	2.44867
11	NCL vs .CCR	0.220671	3.530742
12	SMOTE+ENN vs .CCR	0.24051	3.848155
13	Base vs .SMOTE+TL	0.319685	5.114962
14	Base vs .Bord	0.345132	5.176976
15	Base vs .SMOTE	0.428955	5.576416
16	Base vs .CCR	0.523547	6.806106
17	Base vs .NCL	0.5573	6.806106
18	Base vs .SMOTE+ENN	0.592079	6.806106
19	SMOTE+TL vs .SMOTE+ENN	0.646034	6.806106
20	Bord vs .SMOTE+ENN	0.683091	6.806106
21	NCL vs .SMOTE+TL	0.683091	6.806106
22	Bord vs .NCL	0.720929	6.806106
23	SMOTE vs .SMOTE+ENN	0.798603	6.806106
24	SMOTE vs .NCL	0.838256	6.806106
25	SMOTE vs .SMOTE+TL	0.838256	6.806106
26	SMOTE vs .Bord	0.878325	6.806106
27	Bord vs .SMOTE+TL	0.959301	6.806106
28	NCL vs .SMOTE+ENN	0.959301	6.806106

Table 4: Adjusted p -values