## Output tables for the test of Multiple comparisons.

June 12, 2017

## 1 Average rankings of Friedman test

Average ranks obtained by applying the Friedman procedure

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Ranking	1.9219	5.4375	5.5312	4.75	3.1094	4.9375	3.9062	6.4062
Algorithm	Base	ADASYN	SMOTE	Bord	NCL	SMOTE+TL	SMOTE+ENN	CCR

Table 1: Average Rankings of the algorithms

Friedman statistic considering reduction performance (distributed according to chi-square with 7 degrees of freedom: 78.736979.

## 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 $\alpha = 0.05$

. 2	algorithms	$z = (R_0 - R_i)/SE$	d	Shaffer
28	Base vs. CCR	7.322954	0	0.001786
27	Base vs. SMOTE	5.894085	0	0.002381
26	Base vs. ADASYN	5.740992	0	0.002381
25	NCL vs. CCR	5.383774	0	0.002381
24	Base vs. SMOTE+TL	4.924495	0.000001	0.002381
23	Base vs. Bord	4.618309	0.000004	0.002381
22	SMOTE+ENN vs. CCR	4.082483	0.000045	0.002381
21	SMOTE vs. NCL	3.954905	0.000077	0.002381
20	ADASYN vs. NCL	3.801812	0.000144	0.003125
19	Base vs. SMOTE+ENN	3.240471	0.001193	0.003125
18	NCL vs. SMOTE+TL	2.985316	0.002833	0.003125
17	Bord vs. CCR	2.704645	0.006838	0.003125
16	Bord vs. NCL	2.679129	0.007381	0.003125
15	SMOTE vs. SMOTE+ENN	2.653614	0.007963	0.003333
14	ADASYN vs. SMOTE+ENN	2.500521	0.012401	0.003571
13	SMOTE+TL vs. CCR	2.398459	0.016464	0.003846
12	Base vs. NCL	1.939179	0.052479	0.004167
11	SMOTE+TL vs. SMOTE+ENN	1.684024	0.092177	0.004545
10	ADASYN vs. CCR	1.581962	0.113658	0.005
6	SMOTE vs. CCR	1.428869	0.153042	0.005556
œ	Bord vs. SMOTE+ENN	1.377838	0.168253	0.00625
7	NCL vs. SMOTE+ENN	1.301291	0.193159	0.007143
9	SMOTE vs. Bord	1.275776	0.202035	0.008333
v	ADASYN vs. Bord	1.122683	0.261572	0.01
4	SMOTE vs. SMOTE+TL	0.96959	0.332251	0.0125
က	ADASYN vs. SMOTE+TL	0.816497	0.414216	0.016667
2	Bord vs. SMOTE+TL	0.306186	0.759463	0.025
П	ADASYN vs. SMOTE	0.153093	0.878325	0.05

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

i	algorithms	$z = (R_0 - R_i)/SE$	d	Shaffer
28	Base vs. CCR	7.322954	0	0.003571
27	Base vs. SMOTE	5.894085	0	0.004762
56	Base vs. ADASYN	5.740992	0	0.004762
25	NCL vs. CCR	5.383774	0	0.004762
24	Base vs. SMOTE+TL	4.924495	0.000001	0.004762
23	Base vs. Bord	4.618309	0.000004	0.004762
22	SMOTE+ENN vs. CCR	4.082483	0.000045	0.004762
21	SMOTE vs. NCL	3.954905	0.000077	0.004762
20	ADASYN vs. NCL	3.801812	0.000144	0.00625
19	Base vs. SMOTE+ENN	3.240471	0.001193	0.00625
18	NCL vs. SMOTE+TL	2.985316	0.002833	0.00625
17	Bord vs. CCR	2.704645	0.006838	0.00625
16	Bord vs. NCL	2.679129	0.007381	0.00625
15	SMOTE vs. SMOTE+ENN	2.653614	0.007963	0.006667
14	ADASYN vs. SMOTE+ENN	2.500521	0.012401	0.007143
13	SMOTE+TL vs. CCR	2.398459	0.016464	0.007692
12	Base vs. NCL	1.939179	0.052479	0.008333
11	SMOTE+TL vs. SMOTE+ENN	1.684024	0.092177	0.009091
10	ADASYN vs. CCR	1.581962	0.113658	0.01
6	SMOTE vs. CCR	1.428869	0.153042	0.011111
∞	Bord vs. SMOTE+ENN	1.377838	0.168253	0.0125
7	NCL vs. SMOTE+ENN	1.301291	0.193159	0.014286
9	SMOTE vs. Bord	1.275776	0.202035	0.016667
5	ADASYN vs. Bord	1.122683	0.261572	0.02
4	SMOTE vs. SMOTE+TL	0.96959	0.332251	0.025
က	ADASYN vs. SMOTE+TL	0.816497	0.414216	0.033333
2	Bord vs. SMOTE+TL	0.306186	0.759463	0.05
1	ADASYN vs. SMOTE	0.153093	0.878325	0.1

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

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

Base vs. CCR Base vs. SMOTE Base vs. SMOTE Base vs. SMOTE+TL Base vs. SMOTE+TL Base vs. SMOTE+TL Base vs. NCL ADASYN vs. NCL Base vs. NCL Base vs. NCL Bord vs. CRR SMOTE+TL vs. SMOTE+ENN ADASYN vs. SMOTE+ENN ADASYN vs. CRR Base vs. NCL SMOTE vs. CRR Base vs. NCL SMOTE+TL vs. CRR Base vs. NCL SMOTE+TL vs. SMOTE+ENN ADASYN vs. SOR SMOTE vs. CRR Bord vs. SMOTE+ENN SMOTE vs. SMOTE+TL ADASYN vs. Bord SMOTE vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE+TL BORD SMOTE BORD SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL	i	hypothesis	unadjusted $p$	$p_{Shaf}$
Base vs . SMOTE Base vs . ADASYN NCL vs . CCR Base vs . SMOTE+TL Base vs . SMOTE+TL Base vs . SMOTE+ENN SMOTE vs . NCL ADASYN vs . NCL Base vs . SMOTE+ENN NCL vs . SMOTE+ENN SMOTE vs . NCL SMOTE vs . SMOTE+ENN SMOTE vs . SMOTE+ENN SMOTE vs . CCR Base vs . SMOTE+ENN SMOTE vs . CCR SMOTE vs . CCR Base vs . CCR SMOTE vs . SMOTE+ENN SMOTE vs . SMOTE+ENN SMOTE vs . SMOTE+TL ADASYN vs . SMOTE+TL Bord vs . SMOTE+TL ADASYN vs . SMOTE+TL ADASYN vs . SMOTE+TL ADASYN vs . SMOTE+TL	1	Base vs .CCR	0	0
Base vs. ADASYN NCL vs. CCR Base vs. SMOTE+TL Base vs. Bord SMOTE+ENN vs. CCR SMOTE+ENN SMOTE+ENN NCL vs. NCL Base vs. SMOTE+ENN NCL vs. SMOTE+TL Bord vs. CCR Bord vs. CCR SMOTE+TL SMOTE+TL SMOTE+ENN SMOTE+TL vs. CCR Base vs. SMOTE+ENN SMOTE+TL vs. CCR SMOTE vs. SMOTE+ENN SMOTE vs. SMOTE+ENN SMOTE vs. SMOTE+TL ADASYN vs. SMOTE+TL Bord vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL	7	Base vs .SMOTE	0	0
NCL vs. CCR Base vs. SMOTE+TL Base vs. SMOTE+TL Base vs. SMOTE+TL ADASYN vs. NCL ADASYN vs. NCL Bord vs. NCL Bord vs. CCR SMOTE+TL Bord vs. CCR SMOTE+TL Bord vs. CCR SMOTE+TL SMOTE+ENN ADASYN vs. SMOTE+ENN ADASYN vs. SMOTE+ENN ADASYN vs. SMOTE+ENN ADASYN vs. SMOTE+ENN SMOTE vs. CCR SMOTE vs. CCR SMOTE vs. CCR SMOTE vs. CCR ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL	3	Base vs .ADASYN	0	0
Base vs. SMOTE+TL Base vs. Bord SMOTE+ENN vs. CCR SMOTE vs. NCL ADASYN vs. NCL Base vs. SMOTE+ENN NCL vs. SMOTE+ENN NCL vs. SMOTE+ENN SMOTE vs. CCR Bord vs. CCR Bord vs. NCL SMOTE+TL vs. CCR Base vs. NCL SMOTE+TL vs. CCR Base vs. NCL SMOTE+TL vs. CCR SMOTE+TL vs. CCR SMOTE vs. CCR SMOTE vs. CCR SMOTE vs. CCR Bord vs. SMOTE+ENN NCL vs. SMOTE+ENN SMOTE vs. Bord ADASYN vs. Bord SMOTE vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL	4	NCL vs.CCR	0	0.000002
Base vs. Bord SMOTE+ENN vs. CCR SMOTE vs. NCL ADASYN vs. NCL Base vs. SMOTE+ENN NCL vs. SMOTE+ENN Bord vs. CCR Bord vs. CCR Bord vs. CCR SMOTE vs. SMOTE+ENN SMOTE vs. SMOTE+ENN ADASYN vs. CCR Base vs. NCL SMOTE+TL vs. CCR Bord vs. CCR SMOTE+TVs. SMOTE+ENN NCL vs. SMOTE+ENN SMOTE vs. CCR Bord vs. SMOTE+ENN SMOTE vs. Bord ADASYN vs. Bord SMOTE vs. SMOTE+TL ADASYN vs. SMOTE+TL	20	Base vs .SMOTE+TL	0.000001	0.000018
SMOTE+ENN vs. CCR SMOTE vs. NCL ADASYN vs. NCL Base vs. SMOTE+ENN NCL vs. SMOTE+TL Bord vs. CCR Bord vs. CCR SMOTE+ENN ADASYN vs. SMOTE+ENN SMOTE+TL vs. CCR Base vs. NCL SMOTE+TL vs. CCR Base vs. NCL SMOTE+TL vs. CCR SMOTE+TL vs. CCR SMOTE vs. CCR SMOTE vs. CCR Bord vs. SMOTE+ENN SMOTE vs. SMOTE+TL ADASYN vs. SMOTE+TL Bord vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE+TL	9	Base vs .Bord	0.000004	0.000081
SMOTE vs. NCL ADASYN vs. NCL Base vs. SMOTE+TL Bord vs. CCR Bord vs. CCR Bord vs. CCR SMOTE+ENN ADASYN vs. SMOTE+ENN SMOTE+TL vs. CCR Base vs. NCL SMOTE+TL vs. CCR Base vs. NCL SMOTE+TL vs. CCR SMOTE+TL vs. CCR SMOTE vs. CCR SMOTE vs. CCR SMOTE vs. CCR ADASYN vs. Bord SMOTE vs. SMOTE+ENN SMOTE vs. SMOTE+TL ADASYN vs. SMOTE+TL Bord vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL	7	SMOTE+ENN vs.CCR	0.000045	0.000936
ADASYN vsNCL Base vsSMOTE+ENN NCL vsSMOTE+FLL Bord vsCCR Bord vsCCR SMOTE vsSMOTE+ENN SMOTE+TL vsCCR Base vsNCL SMOTE+TL vsCCR Base vsNCL SMOTE+TL vsCCR SMOTE+TL vsCCR SMOTE+TL vsCCR SMOTE vsSMOTE+ENN SMOTE vsSMOTE+ENN SMOTE vsSMOTE+TL ADASYN vsSMOTE+TL Bord vsSMOTE+TL Bord vsSMOTE+TL ADASYN vsSMOTE+TL ADASYN vsSMOTE+TL	œ	SMOTE vs.NCL	0.000077	0.001608
Base vs .SMOTE+ENN NCL vs .SMOTE+TL Bord vs .CCR Bord vs .NCL SMOTE vs .SMOTE+ENN ADASYN vs .SMOTE+ENN SMOTE+TL vs .CCR Base vs .NCL SMOTE+TL vs .CCR SMOTE+TL vs .CCR SMOTE vs .CCR SMOTE vs .CCR SMOTE vs .CCR SMOTE vs .CCR ADASYN vs .Bord ADASYN vs .Bord SMOTE vs .SMOTE+TL ADASYN vs .SMOTE+TL	6	ADASYN vs. NCL	0.000144	0.002298
NCL vs. SMOTE+TL Bord vs. CCR Bord vs. CCR SMOTE vs. SMOTE+ENN ADASYN vs. SMOTE+ENN SMOTE+TL vs. CCR Base vs. NCL SMOTE+TL vs. CCR Bord vs. SMOTE+ENN NCL vs. SMOTE+ENN SMOTE vs. CCR ADASYN vs. Bord ADASYN vs. Bord ADASYN vs. SMOTE+TL	10	Base vs .SMOTE+ENN	0.001193	0.019093
Bord vs. CCR Bord vs. NCL SMOTE vs. SMOTE+ENN ADASYN vs. SMOTE+ENN SMOTE+TL vs. CCR Base vs. NCL SMOTE+TL vs. CCR BORD vs. CCR SMOTE vs. CCR BORD vs. CCR SMOTE vs. CCR SMOTE vs. CCR SMOTE vs. SMOTE+ENN SMOTE vs. SMOTE+TL ADASYN vs. SMOTE+TL BORD vs. SMOTE+TL ADASYN vs. SMOTE+TL	11	NCL vs.SMOTE+TL	0.002833	0.045326
Bord vs. NCL SMOTE vs. SMOTE+ENN ADASYN vs. SMOTE+ENN SMOTE+TL vs. CCR Base vs. NCL SMOTE+TL vs. CCR BASEV vs. CCR SMOTE+T vs. CCR SMOTE vs. CCR SMOTE vs. CCR SMOTE vs. CCR SMOTE vs. SMOTE+ENN SMOTE vs. SMOTE+TL ADASYN vs. SMOTE+TL BORD vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL	12	Bord vs .CCR	0.006838	0.109404
SMOTE vs. SMOTE+ENN ADASYN vs. SMOTE+ENN SMOTE+TL vs. CCR Base vs. NCL SMOTE+TL vs. CCR BADASYN vs. CCR SMOTE vs. CCR SMOTE vs. CCR SMOTE vs. CCR SMOTE vs. CR SMOTE vs. Bord ADASYN vs. SMOTE+TL	13	Bord vs .NCL	0.007381	0.118102
ADASYN vs. SMOTE+ENN SMOTE+TL vs. CCR Base vs. NCL SMOTE+TL vs. SMOTE+ENN ADASYN vs. CCR SMOTE vs. CCR Bord vs. SMOTE+ENN NCL vs. SMOTE+ENN SMOTE vs. Bord ADASYN vs. Bord SMOTE vs. SMOTE+TL ADASYN vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL	14	SMOTE vs .SMOTE+ENN	0.007963	0.119452
SMOTE+TL vs. CCR Base vs. NCL SMOTE+TL vs. SMOTE+ENN ADASYN vs. CCR SMOTE vs. CCR Bord vs. SMOTE+ENN NCL vs. SMOTE+ENN SMOTE vs. Bord ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL	15	ADASYN vs .SMOTE+ENN	0.012401	0.161214
Base vs. NCL SMOTE+TL vs. SMOTE+ENN ADASYN vs. CCR SMOTE vs. CCR SMOTE vs. CCR Bord vs. SMOTE+ENN NCL vs. SMOTE+ENN SMOTE vs. Bord ADASYN vs. Bord SMOTE vs. SMOTE+TL ADASYN vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL	16	SMOTE+TL vs .CCR	0.016464	0.214035
SMOTE+TL vs. SMOTE+ENN ADASYN vs. CCR SMOTE vs. CCR Bord vs. SMOTE+ENN NCL vs. SMOTE+ENN SMOTE vs. Bord ADASYN vs. SMOTE+TL ADASYN vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE+TL	17	Base vs .NCL	0.052479	0.629754
ADASYN vs. CCR SMOTE vs. CCR Bord vs. SMOTE vs. CCR NCL vs. SMOTE+ENN SMOTE vs. Bord ADASYN vs. Bord SMOTE vs. SMOTE+TL ADASYN vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE+TL	18	SMOTE+TL vs .SMOTE+ENN	0.092177	1.013947
SMOTE vs. CCR Bord vs. SMOTE+ENN NCL vs. SMOTE+ENN SMOTE vs. Bord ADASYN vs. Bord SMOTE vs. SMOTE+TL ADASYN vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE+TL	19	ADASYN vs. CCR	0.113658	1.136582
Bord vs .SMOTE+ENN NCL vs .SMOTE+ENN SMOTE vs .Bord ADASYN vs .Bord SMOTE vs .SMOTE+TL ADASYN vs .SMOTE+TL Bord vs .SMOTE+TL ADASYN vs .SMOTE+TL	20	SMOTE vs.CCR	0.153042	1.377377
NCL vs. :SMOTE+ENN SMOTE vs. :Bord ADASYN vs. :Bord SMOTE vs. :SMOTE+TL ADASYN vs. :SMOTE+TL Bord vs. :SMOTE+TL ADASYN vs. :SMOTE	21	Bord vs .SMOTE+ENN	0.168253	1.377377
SMOTE vs. Bord ADASYN vs. Bord SMOTE vs. SMOTE+TL ADASYN vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE	22	NCL vs .SMOTE+ENN	0.193159	1.377377
ADASYN vs. Bord SMOTE vs. SMOTE+TL ADASYN vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE	23	SMOTE vs .Bord	0.202035	1.377377
SMOTE vs. SMOTE+TL ADASYN vs. SMOTE+TL Bord vs. SMOTE+TL ADASYN vs. SMOTE	24	ADASYN vs. Bord	0.261572	1.377377
ADASYN vs .SMOTE+TL Bord vs .SMOTE+TL ADASYN vs .SMOTE	25	SMOTE vs .SMOTE+TL	0.332251	1.377377
Bord vs. SMOTE+TL ADASYN vs. SMOTE	56	ADASYN vs .SMOTE+TL	0.414216	1.377377
ADASYN vs. SMOTE	27	Bord vs .SMOTE+TL	0.759463	1.518926
	28	ADASYN vs. SMOTE	0.878325	1.518926

Table 4: Adjusted p-values