## 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

Ranking	1.9219	5.8438	5.5312	5.0312	2.7031	L 4.8125	IN 3.8125	00100
Algorithm	Base	ADASYN	SMOTE	Bord	NCL	SMOTE+TL	SMOTE+ENN	בככ

Table 1: Average Rankings of the algorithms

Friedman statistic considering reduction performance (distributed according to chi-square with 7 degrees of freedom: 90.648438.

## 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	$z = (R_0 - R_i)/SE$	d	Shaffer
28	Base vs. CCR	7.220892	0	0.001786
27	Base vs. ADASYN	6.404395	0	0.002381
26	NCL vs. CCR	5.945116	0	0.002381
25	Base vs. SMOTE	5.894085	0	0.002381
24	ADASYN vs. NCL	5.128619	0	0.002381
23	Base vs. Bord	5.077588	0	0.002381
22	Base vs. SMOTE+TL	4.720371	0.000002	0.002381
21	SMOTE vs. NCL	4.618309	0.000004	0.002381
20	SMOTE+ENN vs. CCR	4.133514	0.000036	0.003125
19	Bord vs. NCL	3.801812	0.000144	0.003125
18	NCL vs. SMOTE+TL	3.444595	0.000572	0.003125
17	ADASYN vs. SMOTE+ENN	3.317017	0.00091	0.003125
16	Base vs. SMOTE+ENN	3.087378	0.002019	0.003125
15	SMOTE vs. SMOTE+ENN	2.806707	0.005005	0.003333
14	SMOTE+TL vs. CCR	2.500521	0.012401	0.003571
13	Bord vs. CCR	2.143304	0.032089	0.003846
12	Bord vs. SMOTE+ENN	1.99021	0.046568	0.004167
11	NCL vs. SMOTE+ENN	1.811602	0.070048	0.004545
10	ADASYN vs. SMOTE+TL	1.684024	0.092177	0.005
6	SMOTE+TL vs. SMOTE+ENN	1.632993	0.10247	0.005556
œ	ADASYN vs. Bord	1.326807	0.184573	0.00625
7	SMOTE vs. CCR	1.326807	0.184573	0.007143
9	Base vs. NCL	1.275776	0.202035	0.008333
2	SMOTE vs. SMOTE+TL	1.173714	0.24051	0.01
4	ADASYN vs. CCR	0.816497	0.414216	0.0125
က	SMOTE vs. Bord	0.816497	0.414216	0.016667
2	ADASYN vs. SMOTE	0.51031	0.609834	0.025
1	Bord vs. SMOTE+TL	0.357217	0.720929	0.05

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

$z = (R_0 - R_i)/SE \qquad p \qquad SI$ $7.220892 \qquad 0 \qquad 0.0$ $6.404395 \qquad 0 \qquad 0.0$ $6.945116 \qquad 0 \qquad 0.0$ $5.945116 \qquad 0 \qquad 0.0$ $5.0284085 \qquad 0 \qquad 0.0$ $6.077588 \qquad 0 \qquad 0.0$ $4.720371 \qquad 0.000002 \qquad 0.0$ $4.133514 \qquad 0.000036 \qquad 0.1$ $1.3801812 \qquad 0.0000144 \qquad 0.0$ $1.381182 \qquad 0.000144 \qquad 0.0$ $1.3807378 \qquad 0.000572 \qquad 0.0$ $1.3807378 \qquad 0.002019 \qquad 0.0$ $1.3807378 \qquad 0.002019 \qquad 0.0$ $1.3807378 \qquad 0.002019 \qquad 0.0$ $1.380707 \qquad 0.032089 \qquad 0.0$ $1.99021 \qquad 0.032089 \qquad 0.0$ $1.99021 \qquad 0.032089 \qquad 0.0$ $1.326807 \qquad 0.032187 \qquad 0.024519 \qquad 0.0$ $1.326807 \qquad 0.124573 \qquad 0.0$ $1.326807 \qquad 0.184573 \qquad 0.0$ $1.37576 \qquad 0.124051 \qquad 0.0$ $1.375776 \qquad 0.1244216 \qquad 0.0$ $0.816497 \qquad 0.14216 \qquad 0.0$ $0.816497 \qquad 0.414216 \qquad 0.0$	er	571	762	762	762	762	762	762	762	25	25	25	25	25	299	392	392	333	91	_	111	25	988	299	01	2	333	,0	
$z = (R_0 - R_i)/SE$ $7.220892$ $6.404395$ $5.945116$ $5.894085$ $5.128619$ $5.077588$ $4.720371$ $4.618309$ $4.133514$ $3.801812$ $3.801812$ $3.444595$ $3.317017$ $3.087378$ $2.806707$ $2.50021$ $2.444595$ $3.117017$ $1.3204$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$ $1.320807$	Shaff	0.003	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.006	0.006	0.006	0.006	0.006	0.006	0.0076	0.0076	0.0083	0.0090	0.01	0.0111	0.012	0.0142	0.0166	0.05	0.02	0.0333	0.0	0.1
N	d	0	0	0	0	0	0	0.000002	0.000004	0.000036	0.000144	0.000572	0.00091	0.002019	0.005005	0.012401	0.032089	0.046568	0.070048	0.092177	0.10247	0.184573	0.184573	0.202035	0.24051	0.414216	0.414216	0.609834	0.720929
Base vs. CGR Base vs. ADASYN NCL vs. CGR Base vs. SMOTE Base vs. MOTE Base vs. NCL Base vs. SMOTE+TL SMOTE vs. NCL SMOTE+TL SMOTE+TL SMOTE+TL SMOTE+TL SMOTE+TL SMOTE+TL SMOTE+TL SMOTE+ENN SMOTE+TL SMOTE+ENN SMOTE+ENN SMOTE+TL SMOTE+ENN ADASYN vs. SMOTE+ENN ADASYN vs. SMOTE+ENN SMOTE vs. CGR Bord vs. SMOTE+ENN ADASYN vs. SMOTE+ENN ADASYN vs. SMOTE+TL SMOTE vs. CGR Base vs. NCL SMOTE vs. CGR SMOTE vs. SMOTE+TL ADASYN vs. SMOTE		7.220892	6.404395	5.945116	5.894085	5.128619	5.077588	4.720371	4.618309	4.133514	3.801812	3.444595	3.317017	3.087378	2.806707	2.500521	2.143304	1.99021	1.811602	1.684024	1.632993	1.326807	1.326807	1.275776	1.173714	0.816497	0.816497	0.51031	0.357217
	algorithms	Base vs. CCR	Base vs. ADASYN	NCL vs. CCR	Base vs. SMOTE	ADASYN vs. NCL	Base vs. Bord	Base vs. SMOTE+TL	SMOTE vs. NCL	SMOTE+ENN vs. CCR	Bord vs. NCL	NCL vs. SMOTE+TL	ADASYN vs. SMOTE+ENN	Base vs. SMOTE+ENN	SMOTE vs. SMOTE+ENN	SMOTE+TL vs. CCR	Bord vs. CCR	Bord vs. SMOTE+ENN	NCL vs. SMOTE+ENN	ADASYN vs. SMOTE+TL	SMOTE+TL vs. SMOTE+ENN	ADASYN vs. Bord	SMOTE vs. CCR	Base vs. NCL	SMOTE vs. SMOTE+TL	ADASYN vs. CCR	SMOTE vs. Bord	ADASYN vs. SMOTE	Bord vs. SMOTE+TL
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Table 3: P-values Table for  $\alpha = 0.10$ 

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

-	hypothesis	unadjusted $p$	$p_{Shaf}$
1	Base vs .CCR	0	0
2	Base vs .ADASYN	0	0
3	NCL vs.CCR	0	0
4	Base vs.SMOTE	0	0
IJ	ADASYN vs. NCL	0	0.00000
9	Base vs .Bord	0	0.000008
7	Base vs .SMOTE+TL	0.000002	0.000049
œ	SMOTE vs .NCL	0.000004	0.000081
6	SMOTE+ENN vs.CCR	0.000036	0.000572
10	Bord vs .NCL	0.000144	0.002298
11	NCL vs .SMOTE+TL	0.000572	0.009151
12	ADASYN vs .SMOTE+ENN	0.00091	0.014557
13	Base vs .SMOTE+ENN	0.002019	0.032309
14	SMOTE vs .SMOTE+ENN	0.005005	0.075076
15	SMOTE+TL vs .CCR	0.012401	0.161214
16	Bord vs .CCR	0.032089	0.417154
17	Bord vs.SMOTE+ENN	0.046568	0.558813
18	NCL vs .SMOTE+ENN	0.070048	0.770525
19	ADASYN vs .SMOTE+TL	0.092177	0.92177
20	SMOTE+TL vs .SMOTE+ENN	0.10247	0.922234
21	ADASYN vs .Bord	0.184573	1.47658
22	SMOTE vs.CCR	0.184573	1.47658
23	Base vs .NCL	0.202035	1.47658
24	SMOTE vs .SMOTE+TL	0.24051	1.47658
25	ADASYN vs. CCR	0.414216	1.656865
26	SMOTE vs .Bord	0.414216	1.656865
27	ADASYN vs.SMOTE	0.609834	1.656865
28	Bord vs .SMOTE+TL	0.720929	1.656865

Table 4: Adjusted p-values