GMEAN - Results

August 21, 2016

1 Tables of Friedman, Bonferroni-Dunn, Holm, Hochberg and Hommel Tests

Table 1: Average Rankings of the algorithms

Algorithm	Ranking
IRS	6.0
EUCLIDEAN	3.8000000000000003
CHEBYSHEV	6.0
KULLBACKLEIBLER	3.0
HELLINGER	1.4
TOTALVARIATION	1.7999999999999998
CHISQUARE	6.0

Friedman statistic considering reduction performance (distributed according to chi-square with 6 degrees of freedom: 26.399999999999984.
P-value computed by Friedman Test: 1.875029331631639E-4.

Iman and Davenport statistic considering reduction performance (distributed according to F-distribution with 6 and 24 degrees of freedom: 29.33333333333319.

P-value computed by Iman and Daveport Test: 6.416311197779681E-10.

Table 2: Holm / Hochberg Table for $\alpha = 0.05$

i	algorithm	$z = (R_0 - R_i)/SE$	p	Holm/Hochberg/Hommel
6	IRS	3.3668552516724395	7.603058428726023E-4	0.008333333333333333
5	CHEBYSHEV	3.3668552516724395	7.603058428726023E-4	0.01
4	CHISQUARE	3.3668552516724395	7.603058428726023E-4	0.0125
3	EUCLIDEAN	1.7566201313073602	0.0789825792637829	0.016666666666666666
2	KULLBACKLEIBLER	1.1710800875382399	0.24156658696897293	0.025
1	TOTALVARIATION	0.2927700218845599	0.7696979437812898	0.05

Bonferroni-Dunn's procedure rejects those hypotheses that have a p-value $\leq 0.008333333333333333$.
Holm's procedure rejects those hypotheses that have a p-value $\leq 0.016666666666666666$.
Hochberg's procedure rejects those hypotheses that have a p-value ≤ 0.0125.
Hommel's procedure rejects those hypotheses that have a p-value $\leq 0.016666666666666666$.

Table 3: Holm / Hochberg Table for $\alpha = 0.10$

i	algorithm	$z = (R_0 - R_i)/SE$	p	Holm/Hochberg/Hommel
6	IRS	3.3668552516724395	7.603058428726023E-4	0.016666666666666666
5	CHEBYSHEV	3.3668552516724395	7.603058428726023E-4	0.02
4	CHISQUARE	3.3668552516724395	7.603058428726023E-4	0.025
3	EUCLIDEAN	1.7566201313073602	0.0789825792637829	0.03333333333333333
2	KULLBACKLEIBLER	1.1710800875382399	0.24156658696897293	0.05
1	TOTALVARIATION	0.2927700218845599	0.7696979437812898	0.1

Bonferroni-Dunn's procedure rejects those hypotheses that have a p-value $\leq 0.016666666666666666$.
Holm's procedure rejects those hypotheses that have a p-value ≤ 0.03333333333333333.
Hochberg's procedure rejects those hypotheses that have a p-value ≤ 0.025.
Hommel's procedure rejects those hypotheses that have a p-value $\leq 0.016666666666666666$.
Nemenyi's procedure rejects those hypotheses that have a p-value $\leq 0.002380952380952381$.
Holm's procedure rejects those hypotheses that have a p-value $\leq 0.0033333333333333335$.

Table 4: Adjusted p-values

i	algorithm	unadjusted p	p_{Bonf}	p_{Holm}	p_{Hoch}	p_{Homm}
1	IRS	7.603058428726023E-4	0.004561835057235614	0.004561835057235614	0.003041223371490409	0.00304122337149
2	CHEBYSHEV	7.603058428726023E-4	0.004561835057235614	0.004561835057235614	0.003041223371490409	0.00304122337149
3	CHISQUARE	7.603058428726023E-4	0.004561835057235614	0.004561835057235614	0.003041223371490409	0.00304122337149
4	EUCLIDEAN	0.0789825792637829	0.4738954755826974	0.2369477377913487	0.2369477377913487	0.2369477377913
5	KULLBACKLEIBLER	0.24156658696897293	1.4493995218138376	0.48313317393794586	0.48313317393794586	0.4831331739379
6	TOTALVARIATION	0.7696979437812898	4.618187662687738	0.7696979437812898	0.7696979437812898	0.769697943781

Table 5: Holm / Shaffer Table for $\alpha = 0.05$

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm	Shaffer
21	IRS vs. HELLINGER	3.3668552516724395	7.603058428726023E-4	0.002380952380952381	0.00238095238095
20	CHEBYSHEV vs. HELLINGER	3.3668552516724395	7.603058428726023E-4	0.0025	0.00333333333333
19	HELLINGER vs. CHISQUARE	3.3668552516724395	7.603058428726023E-4	0.002631578947368421	0.00333333333333
18	IRS vs. TOTALVARIATION	3.07408522978788	0.0021114910066706385	0.002777777777777778	0.00333333333333
17	CHEBYSHEV vs. TOTALVARIATION	3.07408522978788	0.0021114910066706385	0.0029411764705882353	0.00333333333333
16	TOTALVARIATION vs. CHISQUARE	3.07408522978788	0.0021114910066706385	0.003125	0.00333333333333
15	IRS vs. KULLBACKLEIBLER	2.1957751641342	0.028108040147151837	0.0033333333333333335	0.00333333333333
14	CHEBYSHEV vs. KULLBACKLEIBLER	2.1957751641342	0.028108040147151837	0.0035714285714285718	0.00357142857142
13	KULLBACKLEIBLER vs. CHISQUARE	2.1957751641342	0.028108040147151837	0.0038461538461538464	0.00384615384615
12	EUCLIDEAN vs. HELLINGER	1.7566201313073602	0.0789825792637829	0.004166666666666667	0.00416666666666
11	IRS vs. EUCLIDEAN	1.6102351203650798	0.10734653699381101	0.004545454545454546	0.00454545454545
10	EUCLIDEAN vs. CHEBYSHEV	1.6102351203650798	0.10734653699381101	0.005	0.005
9	EUCLIDEAN vs. CHISQUARE	1.6102351203650798	0.10734653699381101	0.005555555555555556	0.00555555555555
8	EUCLIDEAN vs. TOTALVARIATION	1.4638501094228002	0.14323490752466958	0.00625	0.00625
7	KULLBACKLEIBLER vs. HELLINGER	1.1710800875382399	0.24156658696897293	0.007142857142857143	0.00714285714285
6	KULLBACKLEIBLER vs. TOTALVARIATION	0.8783100656536801	0.379775474840949	0.008333333333333333	0.00833333333333
5	EUCLIDEAN vs. KULLBACKLEIBLER	0.5855400437691202	0.5581846494226572	0.01	0.01
4	HELLINGER vs. TOTALVARIATION	0.2927700218845599	0.7696979437812898	0.0125	0.0125
3	IRS vs. CHEBYSHEV	0.0	1.0	0.016666666666666666	0.01666666666666
2	IRS vs. CHISQUARE	0.0	1.0	0.025	0.025
1	CHEBYSHEV vs. CHISQUARE	0.0	1.0	0.05	0.05

Shaffer's procedure rejects those hypotheses that have a p-value $\leq 0.002380952380952381$.
Bergmann's procedure rejects these hypotheses:

- IRS vs. HELLINGER
- IRS vs. TOTALVARIATION
- CHEBYSHEV vs. HELLINGER
- CHEBYSHEV vs. TOTALVARIATION
- HELLINGER vs. CHISQUARE
- TOTALVARIATION vs. CHISQUARE

Table 6: Holm / Shaffer Table for $\alpha = 0.10$

i	algorithms	$z = (R_0 - R_i)/SE$	p	Holm	Shaffer
21	IRS vs. HELLINGER	3.3668552516724395	7.603058428726023E-4	0.004761904761904762	0.004761904761904762
20	CHEBYSHEV vs. HELLINGER	3.3668552516724395	7.603058428726023E-4	0.005	0.006666666666666667
19	HELLINGER vs. CHISQUARE	3.3668552516724395	7.603058428726023E-4	0.005263157894736842	0.006666666666666667
18	IRS vs. TOTALVARIATION	3.07408522978788	0.0021114910066706385	0.005555555555555556	0.006666666666666667
17	CHEBYSHEV vs. TOTALVARIATION	3.07408522978788	0.0021114910066706385	0.0058823529411764705	0.006666666666666667
16	TOTALVARIATION vs. CHISQUARE	3.07408522978788	0.0021114910066706385	0.00625	0.006666666666666667
15	IRS vs. KULLBACKLEIBLER	2.1957751641342	0.028108040147151837	0.006666666666666667	0.006666666666666667
14	CHEBYSHEV vs. KULLBACKLEIBLER	2.1957751641342	0.028108040147151837	0.0071428571428571435	0.0071428571428571435
13	KULLBACKLEIBLER vs. CHISQUARE	2.1957751641342	0.028108040147151837	0.007692307692307693	0.007692307692307693
12	EUCLIDEAN vs. HELLINGER	1.7566201313073602	0.0789825792637829	0.008333333333333333	0.008333333333333333
11	IRS vs. EUCLIDEAN	1.6102351203650798	0.10734653699381101	0.009090909090909092	0.009090909090909092
10	EUCLIDEAN vs. CHEBYSHEV	1.6102351203650798	0.10734653699381101	0.01	0.01
9	EUCLIDEAN vs. CHISQUARE	1.6102351203650798	0.10734653699381101	0.011111111111111112	0.011111111111111112
8	EUCLIDEAN vs. TOTALVARIATION	1.4638501094228002	0.14323490752466958	0.0125	0.0125
7	KULLBACKLEIBLER vs. HELLINGER	1.1710800875382399	0.24156658696897293	0.014285714285714287	0.014285714285714287
6	KULLBACKLEIBLER vs. TOTALVARIATION	0.8783100656536801	0.379775474840949	0.016666666666666666	0.016666666666666666
5	EUCLIDEAN vs. KULLBACKLEIBLER	0.5855400437691202	0.5581846494226572	0.02	0.02
4	HELLINGER vs. TOTALVARIATION	0.2927700218845599	0.7696979437812898	0.025	0.025
3	IRS vs. CHEBYSHEV	0.0	1.0	0.03333333333333333	0.03333333333333333
2	IRS vs. CHISQUARE	0.0	1.0	0.05	0.05
1	CHEBYSHEV vs. CHISQUARE	0.0	1.0	0.1	0.1

Nemenyi's procedure rejects those hypotheses that have a p-value $\leq 0.004761904761904762$.

Holm's procedure rejects those hypotheses that have a p-value $\leq 0.006666666666666667$.
Shaffer's procedure rejects those hypotheses that have a p-value $\leq 0.004761904761904762$.
Bergmann's procedure rejects these hypotheses:

- IRS vs. HELLINGER
- IRS vs. TOTALVARIATION
- CHEBYSHEV vs. HELLINGER
- CHEBYSHEV vs. TOTALVARIATION
- HELLINGER vs. CHISQUARE
- TOTALVARIATION vs. CHISQUARE

Table 7: Adjusted p-values

i	hypothesis	unadjusted p	p_{Neme}	p_{Holm}	p_{Shaf}	p_{Berg}
1	IRS vs .HELLINGER	7.603058428726023E-4	0.01596642270032465	0.01596642270032465	0.01596642270032465	0.01596642270032465
2	CHEBYSHEV vs .HELLINGER	7.603058428726023E-4	0.01596642270032465	0.01596642270032465	0.01596642270032465	0.01596642270032465
3	HELLINGER vs .CHISQUARE	7.603058428726023E-4	0.01596642270032465	0.01596642270032465	0.01596642270032465	0.01596642270032465
4	IRS vs .TOTALVARIATION	0.0021114910066706385	0.04434131114008341	0.038006838120071496	0.03167236510005958	0.03167236510005958
5	CHEBYSHEV vs .TOTALVARIATION	0.0021114910066706385	0.04434131114008341	0.038006838120071496	0.03167236510005958	0.03167236510005958
6	TOTALVARIATION vs .CHISQUARE	0.0021114910066706385	0.04434131114008341	0.038006838120071496	0.03167236510005958	0.03167236510005958
7	IRS vs .KULLBACKLEIBLER	0.028108040147151837	0.5902688430901886	0.42162060220727754	0.42162060220727754	0.3091884416186702
8	CHEBYSHEV vs .KULLBACKLEIBLER	0.028108040147151837	0.5902688430901886	0.42162060220727754	0.42162060220727754	0.3091884416186702
9	KULLBACKLEIBLER vs .CHISQUARE	0.028108040147151837	0.5902688430901886	0.42162060220727754	0.42162060220727754	0.3091884416186702
10	EUCLIDEAN vs .HELLINGER	0.0789825792637829	1.658634164539441	0.9477909511653948	0.8688083719016119	0.7108432133740461
11	IRS vs .EUCLIDEAN	0.10734653699381101	2.2542772768700314	1.1808119069319212	1.1808119069319212	0.9661188329442991
12	EUCLIDEAN vs .CHEBYSHEV	0.10734653699381101	2.2542772768700314	1.1808119069319212	1.1808119069319212	0.9661188329442991
13	EUCLIDEAN vs .CHISQUARE	0.10734653699381101	2.2542772768700314	1.1808119069319212	1.1808119069319212	0.9661188329442991
14	EUCLIDEAN vs .TOTALVARIATION	0.14323490752466958	3.007933058018061	1.1808119069319212	1.1808119069319212	0.9661188329442991
15	KULLBACKLEIBLER vs .HELLINGER	0.24156658696897293	5.072898326348431	1.6909661087828105	1.6909661087828105	1.4493995218138376
16	KULLBACKLEIBLER vs .TOTALVARIATION	0.379775474840949	7.975284971659929	2.278652849045694	2.278652849045694	1.519101899363796
17	EUCLIDEAN vs .KULLBACKLEIBLER	0.5581846494226572	11.721877637875801	2.790923247113286	2.790923247113286	2.790923247113286
18	HELLINGER vs .TOTALVARIATION	0.7696979437812898	16.163656819407084	3.078791775125159	3.078791775125159	3.078791775125159
19	IRS vs .CHEBYSHEV	1.0	21.0	3.078791775125159	3.078791775125159	3.078791775125159
20	IRS vs .CHISQUARE	1.0	21.0	3.078791775125159	3.078791775125159	3.078791775125159
21	CHEBYSHEV vs .CHISQUARE	1.0	21.0	3.078791775125159	3.078791775125159	3.078791775125159