Search-based Similarity-driven Behavioural SPL Testing: Evaluation Results

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1 Soda vending machine

1.1 Optimal Configurations of the Algorithm

1. Hamming avg., global, $t = 10$ ($freq = 0.056$)
2. Hamming avg., global, $t = 100$ ($freq = 0.056$)
3. Hamming avg., global, $t = 2$ ($freq = 0.056$)
4. Hamming avg., global, $t = 1$ ($freq = 0.056$)
5. Jaccard avg., global, $t = 100$ ($freq = 0.037$)
6. Dice mul., global, $t = 100$ ($freq = 0.037$)
7. Hamming sing., global, $t = 1$ ($freq = 0.037$)
8. Dice avg., global, $t = 2$ ($freq = 0.037$)
9. Dice avg., global, $t = 1$ ($freq = 0.028$)
10. All-actions ($freq. = 0.028$)
11. Hamming sing., local, $t = 1$ ($freq = 0.028$)
12. Dice mul., global, $t = 2$ ($freq = 0.028$)
13. Hamming sing., global, $t = 10$ ($freq = 0.028$)
14. Jaccard avg., global, $t = 2$ ($freq = 0.028$)
15. Dice avg., global, $t = 2$ ($freq = 0.028$)
16. Jaccard avg., global, $t = 10$ ($freq = 0.028$)
17. Dice mul., global, $t = 1$ ($freq = 0.028$)
18. Hamming sing., global, $t = 100$ ($freq = 0.019$)
19. Levenshtein avg., local, $t = 10$ ($freq = 0.019$)
20. Dice avg., global, $t = 10$ ($freq = 0.019$)
21. Hamming mul., local, $t = 2$ ($freq = 0.019$)
22. Dice mul., global, $t = 10$ ($freq = 0.019$)
23. Levenshtein sing., local, $t = 1$ ($freq = 0.019$)
24. Jaccard sing., local, $t = 100$ ($freq = 0.019$)
25. Jaccard avg., global, $t = 1$ ($freq = 0.019$)
26. Dice avg., global, $t = 10$ ($freq = 0.019$)
27. Dice avg., global, $t = 100$ ($freq = 0.019$)
28. Hamming mul., local, $t = 1$ ($freq = 0.019$)

29. Dice mul., local, $t = 10$ ($freq = 0.009$)
30. Dice sing., local, $t = 2$ ($freq = 0.009$)
31. Dice avg., global, $t = 1$ ($freq = 0.009$)
32. Levenshtein sing., local, $t = 100$ ($freq = 0.009$)
33. Levenshtein mul., local, $t = 100$ ($freq = 0.009$)
34. Jaccard sing., local, $t = 1$ ($freq = 0.009$)
35. Levenshtein avg., local, $t = 1$ ($freq = 0.009$)
36. Hamming sing., local, $t = 100$ ($freq = 0.009$)
37. Levenshtein mul., local, $t = 2$ ($freq = 0.009$)
38. Levenshtein avg., local, $t = 2$ ($freq = 0.009$)
39. Hamming avg., local, $t = 1$ ($freq = 0.009$)
40. Jaccard avg., local, $t = 10$ ($freq = 0.009$)
41. Dice avg., global, $t = 100$ ($freq = 0.009$)
42. Dice sing., local, $t = 1$ ($freq = 0.009$)
43. Hamming avg., local, $t = 2$ ($freq = 0.009$)
44. Hamming sing., local, $t = 10$ ($freq = 0.009$)
45. Hamming avg., local, $t = 100$ ($freq = 0.009$)
46. Dice avg., local, $t = 100$ ($freq = 0.009$)
47. Dice avg., local, $t = 2$ ($freq = 0.009$)

1.2 Hypervolumes

		Dissimilar crit.														
		Hamming			**Jaccard**			**Dice**			**Antidice**			**Levenshtein**		
	t	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*
	1	0.917	0.917	0.917	0.917	0.829	0.833	0.833	0.833	0.833	0.917	0.963	0.750	0.976	0.917	0.828
Loc.	2	0.833	0.917	0.917	0.750	0.746	0.980	0.833	0.917	0.833	0.917	0.833	0.833	0.708	0.986	0.917
sort	10	0.917	0.833	0.833	0.833	0.917	0.833	0.823	0.968	0.824	0.823	0.833	0.917	0.825	0.917	0.833
	100	0.917	0.917	0.833	0.917	0.833	0.814	0.750	0.978	0.833	0.750	0.917	0.833	0.990	0.826	0.917
	1	0.917	0.917	0.750	0.833	0.917	0.833	0.833	0.917	0.833	0.833	0.917	0.917	0.833	0.833	0.833
Glob.	2	0.750	0.917	0.750	0.833	0.917	0.833	0.833	0.917	0.833	0.833	0.917	0.917	0.833	0.833	0.833
sort	10	0.917	0.917	0.750	0.833	0.917	0.833	0.833	0.917	0.833	0.833	0.917	0.917	0.833	0.833	0.833
	100	0.917	0.917	0.750	0.833	0.917	0.833	0.833	0.917	0.750	0.833	0.917	0.917	0.833	0.833	0.833
All-act. crit.		0.917														
Rand. crit.		0.767														

2 Minepump

2.1 Optimal Configurations of the Algorithm

1. Jaccard sing., global, $t = 2$ ($freq = 0.222$)
2. Jaccard avg., global, $t = 10$ ($freq = 0.222$)
3. Dice sing., global, $t = 1$ ($freq = 0.222$)
4. Jaccard sing., global, $t = 10$ ($freq = 0.111$)
5. Dice avg., global, $t = 1$ ($freq = 0.111$)
6. Jaccard sing., global, $t = 100$ ($freq = 0.111$)

2.2 Hypervolumes

		Dissimilar crit.														
		Hamming			**Jaccard**			**Dice**			**Antidice**			**Levenshtein**		
	t	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*
	1	0.855	0.873	0.858	0.912	0.883	0.947	0.963	0.845	0.773	0.859	0.846	0.844	0.795	0.925	0.894
Loc.	2	0.905	0.710	0.967	0.938	0.930	0.788	0.777	0.913	0.802	0.772	0.758	0.720	0.828	0.919	0.852
sort	10	0.838	0.950	0.769	0.874	0.869	0.756	0.861	0.766	0.865	0.965	0.758	0.956	0.688	0.854	0.892
	100	0.935	0.844	0.817	0.944	0.808	0.841	0.805	0.869	0.856	0.861	0.900	0.858	0.880	0.858	0.734
	1	0.998	0.970	0.833	0.984	0.949	0.860	0.967	0.965	0.810	1.000	1.000	0.878	0.998	0.954	0.811
Glob.	2	0.982	0.944	0.895	1.000	0.965	0.827	0.982	0.978	0.931	0.983	0.978	0.910	0.984	0.949	0.872
sort	10	0.977	0.935	0.781	1.000	1.000	0.912	0.967	0.999	0.935	0.981	0.967	0.879	0.981	0.967	0.895
	100	0.979	0.933	0.692	1.000	0.969	0.876	0.962	0.997	0.818	0.983	0.983	0.941	0.967	0.983	0.812
All-act. crit.		0.965														
Rand. crit.		0.821														

3 Card payment terminal

3.1 Optimal Configurations of the Algorithm

1. Dice sing., global, $t = 10$ ($freq = 0.029$)
2. Dice mul., global, $t = 2$ ($freq = 0.029$)
3. Dice avg., global, $t = 2$ ($freq = 0.029$)
4. Levenshtein sing., global, $t = 2$ ($freq = 0.029$)
5. Dice avg., global, $t = 100$ ($freq = 0.024$)
6. Dice avg., global, $t = 10$ ($freq = 0.024$)
7. Hamming avg., global, $t = 1$ ($freq = 0.024$)
8. Jaccard avg., global, $t = 2$ ($freq = 0.024$)
9. Dice mul., global, $t = 10$ ($freq = 0.024$)
10. Dice avg., global, $t = 2$ ($freq = 0.024$)
11. Hamming avg., global, $t = 2$ ($freq = 0.024$)
12. Dice avg., global, $t = 100$ ($freq = 0.024$)
13. Hamming sing., global, $t = 1$ ($freq = 0.024$)
14. Dice sing., global, $t = 10$ ($freq = 0.024$)
15. Dice avg., global, $t = 1$ ($freq = 0.024$)
16. Jaccard sing., global, $t = 10$ ($freq = 0.024$)
17. Dice avg., global, $t = 10$ ($freq = 0.024$)
18. Dice sing., global, $t = 100$ ($freq = 0.024$)
19. Jaccard sing., global, $t = 100$ ($freq = 0.024$)
20. Jaccard avg., global, $t = 10$ ($freq = 0.024$)
21. Dice sing., global, $t = 2$ ($freq = 0.024$)
22. Jaccard sing., global, $t = 2$ ($freq = 0.024$)
23. Jaccard avg., global, $t = 100$ ($freq = 0.018$)
24. Levenshtein sing., global, $t = 100$ ($freq = 0.018$)
25. Dice sing., global, $t = 1$ ($freq = 0.018$)
26. Levenshtein avg., global, $t = 1$ ($freq = 0.018$)
27. Levenshtein avg., global, $t = 10$ ($freq = 0.018$)

28. Dice avg., global, $t = 1$ ($freq = 0.018$)
29. Jaccard mul., global, $t = 1$ ($freq = 0.018$)
30. Hamming avg., global, $t = 10$ ($freq = 0.018$)
31. Hamming avg., global, $t = 100$ ($freq = 0.018$)
32. Levenshtein sing., global, $t = 10$ ($freq = 0.018$)
33. Levenshtein sing., local, $t = 100$ ($freq = 0.012$)
34. Jaccard sing., global, $t = 1$ ($freq = 0.012$)
35. Levenshtein mul., global, $t = 1$ ($freq = 0.012$)
36. Hamming sing., global, $t = 100$ ($freq = 0.012$)
37. Hamming sing., global, $t = 10$ ($freq = 0.012$)
38. Jaccard avg., global, $t = 1$ ($freq = 0.012$)
39. Dice mul., global, $t = 100$ ($freq = 0.012$)
40. Hamming sing., global, $t = 2$ ($freq = 0.012$)
41. Dice sing., global, $t = 1$ ($freq = 0.012$)
42. Levenshtein mul., local, $t = 100$ ($freq = 0.012$)
43. Dice sing., global, $t = 100$ ($freq = 0.012$)
44. Jaccard mul., global, $t = 100$ ($freq = 0.012$)
45. Dice sing., global, $t = 2$ ($freq = 0.012$)
46. Levenshtein mul., global, $t = 100$ ($freq = 0.012$)
47. Dice mul., global, $t = 2$ ($freq = 0.012$)
48. Dice mul., global, $t = 1$ ($freq = 0.012$)
49. Levenshtein mul., local, $t = 10$ ($freq = 0.006$)
50. Dice mul., local, $t = 1$ ($freq = 0.006$)
51. Levenshtein avg., global, $t = 100$ ($freq = 0.006$)
52. Levenshtein avg., global, $t = 2$ ($freq = 0.006$)
53. Hamming sing., local, $t = 1$ ($freq = 0.006$)
54. Levenshtein mul., global, $t = 2$ ($freq = 0.006$)
55. Jaccard mul., global, $t = 2$ ($freq = 0.006$)
56. All-actions ($freq. = 0.006$)
57. Levenshtein avg., local, $t = 100$ ($freq = 0.006$)
58. Dice avg., local, $t = 2$ ($freq = 0.006$)
59. Levenshtein sing., global, $t = 1$ ($freq = 0.006$)
60. Random ($freq. = 0.006$)
61. Hamming mul., global, $t = 1$ ($freq = 0.006$)
62. Dice mul., global, $t = 1$ ($freq = 0.006$)
63. Jaccard sing., local, $t = 1$ ($freq = 0.006$)
64. Hamming mul., global, $t = 100$ ($freq = 0.006$)

3.2 Hypervolumes

		Dissimilar crit.														
		Hamming			**Jaccard**			**Dice**			**Antidice**			**Levenshtein**		
	t	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*
	1	1.000	0.936	0.926	1.000	0.952	0.958	0.958	0.925	0.963	0.841	0.886	1.000	0.892	0.952	0.963
Loc.	2	0.905	0.958	0.903	0.969	0.917	0.958	0.958	1.000	0.952	0.889	0.903	0.952	0.963	0.967	0.981
sort	10	0.903	0.958	0.915	0.952	0.952	0.952	0.815	0.897	0.967	0.952	0.921	0.952	0.764	0.967	1.000
	100	0.963	0.963	0.963	0.886	0.917	0.917	0.878	0.967	0.917	0.758	0.897	0.915	1.000	1.000	1.000
	1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Glob.	2	1.000	1.000	0.628	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
sort	10	1.000	1.000	0.649	1.000	1.000	0.958	1.000	1.000	0.926	1.000	1.000	1.000	1.000	1.000	0.944
	100	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.936	1.000	1.000	1.000	1.000	1.000	1.000
All-act. crit.		1.000														
Rand. crit.		1.000														

4 Claroline

4.1 Optimal Configurations of the Algorithm

1. Hamming sing., global, $t = 100$ ($freq = 1.0$)

4.2 Hypervolumes

		Dissimilar crit.														
		Hamming			**Jaccard**			**Dice**			**Antidice**			**Levenshtein**		
	t	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*	*Avg.*	*Mul.*	*Sing.*
	1	0.690	0.688	0.662	0.690	0.673	0.705	0.690	0.693	0.709	0.668	0.711	0.692	0.691	0.691	0.722
Loc.	2	0.705	0.674	0.699	0.684	0.679	0.673	0.670	0.667	0.689	0.659	0.688	0.690	0.677	0.666	0.662
sort	10	0.661	0.702	0.681	0.700	0.721	0.685	0.679	0.720	0.669	0.651	0.667	0.674	0.696	0.691	0.681
	100	0.672	0.667	0.693	0.713	0.672	0.720	0.678	0.691	0.703	0.655	0.696	0.685	0.687	0.655	0.678
	1	0.724	0.736	0.710	0.727	0.694	0.697	0.710	0.695	0.683	0.699	0.666	0.672	0.717	0.684	0.693
Glob.	2	0.755	0.711	0.708	0.715	0.722	0.718	0.729	0.723	0.670	0.728	0.677	0.705	0.733	0.708	0.687
sort	10	0.804	0.740	0.733	0.730	0.723	0.696	0.738	0.690	0.683	0.746	0.701	0.692	0.771	0.701	0.714
	100	0.831	0.794	0.800	0.756	0.747	0.729	0.755	0.750	0.714	0.758	0.747	0.740	0.781	0.747	0.730
All-act. crit.		0.771														
Rand. crit.		0.706														