

MINEX

Performance and Interoperability of the INCITS 378 Fingerprint Template

Supplement F: Matching Same-image Templates

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(a) FMR = 0.01

A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
0.000	0.001	0.002	0.001	0.003	0.002	0.002	0.003	0.003	0.005	0.005	0.004	0.004	0.003	0.003	3
0.001	0.000	0.001	0.000	0.003	0.001	0.000	0.007	0.004	0.004	0.006	0.003	0.003	0.002	0.003	2
0.002	0.001	0.000	0.001	0.004	0.000	0.002	0.014	0.006	0.017	0.006	0.004	0.002	0.002	0.004	7
0.001	0.000	0.001	0.000	0.003	0.001	0.001	0.006	0.003	0.006	0.005	0.002	0.002	0.002	0.002	1
0.003	0.004	0.004	0.003	0.004	0.004	0.003	0.009	0.007	0.009	0.007	0.005	0.004	0.002	0.005	8
0.002	0.001	0.000	0.001	0.004	0.000	0.002	0.015	0.006	0.016	0.006	0.005	0.002	0.002	0.004	6
0.002	0.001	0.002	0.001	0.003	0.002	0.000	0.010	0.006	0.006	0.007	0.005	0.002	0.003	0.003	4
0.003	0.007	0.014	0.006	0.008	0.014	0.009	0.000	0.012	0.010	0.009	0.007	0.021	0.010	0.009	13
0.003	0.005	0.006	0.004	0.007	0.006	0.006	0.013	0.000	0.015	0.009	0.005	0.013	0.004	0.007	10
0.005	0.005	0.019	0.007	0.010	0.019	0.007	0.012	0.017	0.000	0.013	0.007	0.022	0.009	0.011	14
0.005	0.006	0.007	0.005	0.007	0.007	0.007	0.010	0.009	0.013	0.004	0.012	0.012	0.009	0.008	12
0.005	0.003	0.005	0.003	0.005	0.005	0.006	0.008	0.006	0.007	0.012	0.000	0.010	0.002	0.006	9
0.004	0.003	0.002	0.002	0.004	0.002	0.004	0.022	0.013	0.021	0.011	0.010	0.000	0.004	0.007	11
0.003	0.003	0.002	0.002	0.002	0.002	0.003	0.011	0.004	0.008	0.008	0.001	0.004	0.000	0.004	5
0.003	0.003	0.005	0.002	0.005	0.005	0.004	0.010	0.007	0.010	0.008	0.005	0.007	0.004		
Rank	2	3	8	6	7	4	14	10	13	12	9	11	5		

(b) FMR = 0.001

A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
0.000	0.002	0.003	0.001	0.003	0.003	0.003	0.005	0.005	0.007	0.005	0.007	0.006	0.004	0.004	2
0.002	0.000	0.002	0.001	0.004	0.002	0.001	0.014	0.008	0.008	0.007	0.005	0.004	0.004	0.004	3
0.003	0.002	0.000	0.001	0.005	0.000	0.003	0.031	0.012	0.035	0.009	0.008	0.003	0.003	0.008	8
0.001	0.001	0.001	0.000	0.003	0.001	0.001	0.011	0.006	0.011	0.005	0.004	0.003	0.003	0.004	1
0.003	0.004	0.005	0.003	0.002	0.005	0.004	0.014	0.010	0.014	0.008	0.007	0.005	0.002	0.006	6
0.003	0.000	0.000	0.001	0.005	0.000	0.003	0.031	0.012	0.034	0.009	0.008	0.003	0.003	0.008	7
0.003	0.001	0.003	0.001	0.004	0.003	0.000	0.019	0.011	0.010	0.010	0.008	0.004	0.004	0.006	4
0.005	0.014	0.030	0.011	0.014	0.030	0.018	0.000	0.021	0.018	0.014	0.013	0.043	0.019	0.018	13
0.005	0.009	0.012	0.007	0.011	0.012	0.011	0.023	0.000	0.026	0.012	0.010	0.026	0.008	0.012	11
0.008	0.009	0.039	0.013	0.017	0.038	0.012	0.022	0.028	0.000	0.019	0.012	0.042	0.016	0.020	14
0.005	0.007	0.009	0.005	0.008	0.009	0.010	0.014	0.012	0.017	0.004	0.016	0.017	0.010	0.010	10
0.007	0.005	0.009	0.004	0.007	0.009	0.009	0.015	0.010	0.012	0.017	0.000	0.018	0.003	0.009	9
0.007	0.005	0.003	0.004	0.005	0.003	0.004	0.044	0.026	0.040	0.017	0.017	0.000	0.006	0.013	12
0.004	0.004	0.003	0.003	0.002	0.003	0.004	0.021	0.007	0.014	0.010	0.003	0.006	0.000	0.006	5
0.004	0.005	0.008	0.004	0.006	0.008	0.006	0.019	0.012	0.018	0.010	0.008	0.013	0.006	0.006	
Rank	2	3	9	6	8	4	14	11	13	10	7	12	5		

Table 1: Scenario 4 Interoperability, Matcher A

POEBVA and MIN:A. The fraction of same-image templates produced by the vendors identified in the rows and columns that fail to exceed the threshold that produced a FMR of 0.01 and 0.001 using matcher A. Cells are colored green when the value is less than 0.002.

(a) FMR = 0.01

B	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.001	0.002	0.001	0.004	0.002	0.002	0.003	0.002	0.002	0.005	0.003	0.004	0.002	0.002	3
B	0.001	0.000	0.001	0.000	0.002	0.001	0.000	0.008	0.003	0.003	0.006	0.001	0.002	0.001	0.002	2
C	0.002	0.001	0.000	0.001	0.003	0.000	0.001	0.021	0.008	0.009	0.008	0.004	0.001	0.002	0.004	9
D	0.001	0.000	0.001	0.000	0.002	0.001	0.001	0.007	0.003	0.003	0.005	0.002	0.002	0.001	0.002	1
E	0.004	0.002	0.003	0.002	0.000	0.003	0.002	0.013	0.007	0.005	0.009	0.003	0.003	0.001	0.004	7
F	0.002	0.001	0.000	0.001	0.003	0.000	0.001	0.021	0.008	0.009	0.008	0.004	0.001	0.001	0.003	8
G	0.002	0.000	0.001	0.001	0.002	0.001	0.000	0.012	0.005	0.003	0.007	0.003	0.001	0.001	0.004	4
H	0.003	0.008	0.021	0.007	0.013	0.021	0.012	0.000	0.008	0.006	0.011	0.006	0.028	0.013	0.011	14
I	0.004	0.003	0.008	0.005	0.007	0.008	0.005	0.008	0.000	0.007	0.008	0.003	0.014	0.004	0.006	11
J	0.002	0.003	0.009	0.003	0.005	0.009	0.003	0.006	0.007	0.000	0.008	0.003	0.013	0.004	0.005	10
K	0.005	0.006	0.008	0.005	0.009	0.008	0.007	0.011	0.008	0.008	0.004	0.010	0.012	0.007	0.008	13
L	0.003	0.001	0.004	0.002	0.003	0.004	0.003	0.006	0.003	0.003	0.010	0.000	0.007	0.001	0.004	6
M	0.004	0.002	0.001	0.002	0.003	0.001	0.001	0.028	0.014	0.013	0.012	0.007	0.000	0.002	0.006	12
N	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.013	0.004	0.004	0.007	0.001	0.002	0.000	0.003	5
Mean	0.002	0.002	0.004	0.002	0.004	0.004	0.003	0.011	0.006	0.005	0.008	0.004	0.006	0.003		
Rank	3	1	9	2	7	8	4	14	11	10	13	6	12	5		

(b) FMR = 0.001

B	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.002	0.005	0.002	0.006	0.005	0.004	0.005	0.003	0.003	0.005	0.004	0.007	0.004	0.004	3
B	0.002	0.000	0.001	0.000	0.003	0.001	0.000	0.016	0.007	0.004	0.007	0.003	0.003	0.002	0.003	2
C	0.005	0.001	0.000	0.001	0.004	0.000	0.002	0.039	0.016	0.015	0.013	0.006	0.002	0.002	0.008	9
D	0.002	0.000	0.001	0.000	0.003	0.001	0.001	0.014	0.006	0.005	0.006	0.003	0.002	0.002	0.003	1
E	0.006	0.003	0.004	0.003	0.000	0.004	0.003	0.024	0.012	0.008	0.012	0.005	0.003	0.001	0.006	7
F	0.005	0.001	0.000	0.001	0.004	0.000	0.002	0.040	0.016	0.015	0.013	0.006	0.001	0.002	0.008	8
G	0.004	0.000	0.002	0.001	0.003	0.002	0.000	0.024	0.010	0.005	0.010	0.005	0.002	0.002	0.005	5
H	0.005	0.016	0.039	0.014	0.024	0.040	0.024	0.000	0.014	0.010	0.017	0.010	0.051	0.022	0.020	14
I	0.005	0.007	0.016	0.007	0.012	0.016	0.010	0.014	0.000	0.011	0.010	0.005	0.029	0.007	0.011	11
J	0.003	0.004	0.015	0.005	0.008	0.015	0.005	0.010	0.011	0.000	0.009	0.005	0.021	0.006	0.008	10
K	0.005	0.007	0.013	0.006	0.012	0.013	0.010	0.017	0.010	0.009	0.004	0.015	0.020	0.010	0.011	12
L	0.004	0.003	0.006	0.003	0.005	0.006	0.005	0.010	0.005	0.005	0.015	0.000	0.012	0.002	0.006	6
M	0.007	0.003	0.002	0.002	0.003	0.001	0.002	0.051	0.029	0.021	0.020	0.012	0.000	0.003	0.011	13
N	0.004	0.002	0.002	0.002	0.001	0.002	0.002	0.022	0.007	0.006	0.010	0.002	0.003	0.000	0.005	4
Mean	0.004	0.003	0.008	0.003	0.006	0.008	0.005	0.020	0.010	0.008	0.011	0.006	0.011	0.005		
Rank	3	2	9	1	7	8	5	14	11	10	12	6	13	4		

Table 2: Scenario 4 Interoperability, Matcher B

POEBVA and MIN:A . The fraction of same-image templates produced by the vendors identified in the rows and columns that fail to exceed the threshold that produced a FMR of 0.01 and 0.001 using matcher B. Cells are colored green when the value is less than 0.002.

(a) FMR = 0.01

C	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.002	0.004	0.004	0.003	0.002	0.002	0.002	1
B	0.001	0.000	0.001	0.000	0.002	0.001	0.000	0.007	0.003	0.005	0.005	0.002	0.002	0.002	0.002	3
C	0.001	0.001	0.000	0.001	0.002	0.000	0.001	0.013	0.005	0.017	0.006	0.003	0.001	0.001	0.004	9
D	0.001	0.000	0.000	0.000	0.001	0.000	0.001	0.005	0.002	0.007	0.005	0.002	0.002	0.001	0.002	2
E	0.001	0.002	0.002	0.001	0.000	0.002	0.001	0.006	0.004	0.006	0.005	0.002	0.002	0.000	0.003	6
F	0.001	0.001	0.000	0.000	0.002	0.000	0.001	0.013	0.005	0.017	0.006	0.003	0.001	0.001	0.004	8
G	0.001	0.000	0.001	0.001	0.002	0.001	0.000	0.008	0.003	0.005	0.005	0.004	0.001	0.002	0.002	4
H	0.003	0.008	0.013	0.005	0.006	0.013	0.008	0.000	0.009	0.009	0.009	0.006	0.019	0.008	0.008	14
I	0.002	0.004	0.005	0.003	0.003	0.005	0.003	0.009	0.000	0.013	0.006	0.004	0.010	0.002	0.005	10
J	0.003	0.004	0.016	0.006	0.005	0.016	0.004	0.008	0.012	0.000	0.009	0.005	0.017	0.006	0.008	13
K	0.004	0.005	0.006	0.005	0.005	0.006	0.005	0.009	0.007	0.010	0.004	0.009	0.008	0.006	0.006	12
L	0.003	0.002	0.003	0.002	0.002	0.003	0.004	0.006	0.004	0.006	0.009	0.000	0.008	0.001	0.004	7
M	0.002	0.002	0.001	0.002	0.002	0.001	0.001	0.017	0.009	0.019	0.008	0.007	0.000	0.002	0.005	11
N	0.002	0.002	0.001	0.001	0.000	0.001	0.001	0.008	0.003	0.007	0.007	0.001	0.002	0.000	0.003	5
Mean	0.002	0.002	0.004	0.002	0.002	0.004	0.002	0.008	0.005	0.009	0.006	0.004	0.005	0.002		
Rank	1	3	8	2	6	9	4	13	10	14	12	7	11	5		

(b) FMR = 0.001

C	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.001	0.002	0.001	0.002	0.002	0.002	0.005	0.003	0.006	0.005	0.004	0.003	0.003	0.003	1
B	0.001	0.000	0.001	0.000	0.003	0.001	0.000	0.012	0.005	0.007	0.006	0.003	0.004	0.003	0.003	3
C	0.002	0.001	0.000	0.001	0.003	0.000	0.002	0.021	0.008	0.029	0.007	0.005	0.002	0.002	0.006	9
D	0.001	0.001	0.001	0.000	0.002	0.001	0.001	0.009	0.004	0.011	0.005	0.003	0.003	0.002	0.003	2
E	0.002	0.003	0.003	0.002	0.000	0.003	0.002	0.011	0.006	0.010	0.006	0.003	0.003	0.001	0.004	6
F	0.002	0.001	0.000	0.001	0.003	0.000	0.002	0.021	0.008	0.029	0.007	0.005	0.002	0.002	0.006	8
G	0.002	0.000	0.002	0.001	0.002	0.002	0.000	0.013	0.006	0.008	0.006	0.006	0.002	0.002	0.004	4
H	0.005	0.012	0.022	0.009	0.010	0.022	0.013	0.000	0.015	0.014	0.012	0.010	0.029	0.014	0.013	14
I	0.003	0.006	0.008	0.004	0.006	0.008	0.006	0.015	0.000	0.020	0.008	0.006	0.014	0.004	0.008	10
J	0.006	0.007	0.027	0.010	0.009	0.026	0.007	0.013	0.019	0.000	0.012	0.008	0.027	0.010	0.013	13
K	0.005	0.006	0.007	0.005	0.006	0.007	0.007	0.012	0.008	0.013	0.004	0.012	0.010	0.008	0.008	11
L	0.004	0.003	0.005	0.003	0.003	0.005	0.005	0.010	0.006	0.009	0.012	0.000	0.011	0.001	0.006	7
M	0.003	0.003	0.002	0.003	0.003	0.002	0.002	0.027	0.013	0.029	0.010	0.011	0.000	0.003	0.008	12
N	0.003	0.003	0.002	0.002	0.001	0.002	0.002	0.013	0.004	0.012	0.008	0.001	0.003	0.000	0.004	5
Mean	0.003	0.003	0.006	0.003	0.004	0.006	0.004	0.013	0.008	0.014	0.008	0.006	0.008	0.004		
Rank	1	3	9	2	5	8	4	13	10	14	11	7	12	6		

Table 3: Scenario 4 Interoperability, Matcher C

POEBVA and MIN:A . The fraction of same-image templates produced by the vendors identified in the rows and columns that fail to exceed the threshold that produced a FMR of 0.01 and 0.001 using matcher C. Cells are colored green when the value is less than 0.002.

(a) FMR = 0.01

D	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.002	0.002	0.001	0.004	0.002	0.003	0.004	0.003	0.004	0.005	0.004	0.004	0.003	0.003	3
B	0.002	0.000	0.001	0.000	0.003	0.001	0.000	0.007	0.006	0.004	0.006	0.003	0.002	0.003	0.003	2
C	0.002	0.001	0.000	0.001	0.004	0.000	0.003	0.014	0.008	0.014	0.007	0.006	0.002	0.002	0.005	7
D	0.001	0.000	0.001	0.000	0.003	0.001	0.001	0.006	0.004	0.005	0.005	0.002	0.002	0.002	0.002	1
E	0.004	0.003	0.004	0.003	0.000	0.004	0.003	0.013	0.009	0.008	0.009	0.005	0.004	0.001	0.005	8
F	0.002	0.001	0.000	0.001	0.004	0.000	0.002	0.014	0.008	0.014	0.007	0.006	0.002	0.002	0.005	6
G	0.003	0.000	0.003	0.001	0.003	0.002	0.000	0.010	0.008	0.006	0.008	0.006	0.002	0.003	0.004	4
H	0.004	0.007	0.014	0.006	0.013	0.014	0.010	0.000	0.012	0.008	0.012	0.006	0.019	0.011	0.010	14
I	0.003	0.006	0.008	0.004	0.009	0.008	0.008	0.012	0.000	0.015	0.010	0.008	0.017	0.006	0.008	11
J	0.004	0.004	0.014	0.005	0.008	0.014	0.006	0.008	0.015	0.000	0.011	0.007	0.019	0.008	0.009	13
K	0.005	0.006	0.007	0.005	0.009	0.007	0.008	0.012	0.010	0.011	0.004	0.013	0.013	0.009	0.009	12
L	0.004	0.003	0.006	0.002	0.005	0.006	0.006	0.006	0.008	0.007	0.013	0.000	0.011	0.003	0.006	9
M	0.004	0.002	0.002	0.002	0.004	0.002	0.002	0.019	0.017	0.019	0.013	0.011	0.000	0.004	0.007	10
N	0.003	0.003	0.002	0.002	0.001	0.002	0.003	0.011	0.006	0.008	0.009	0.003	0.004	0.000	0.004	5
Mean	0.003	0.003	0.005	0.002	0.005	0.005	0.004	0.010	0.008	0.009	0.009	0.006	0.007	0.004		
Rank	3	2	7	1	8	6	4	14	11	13	12	9	10	5		

(b) FMR = 0.001

D	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.002	0.004	0.002	0.006	0.004	0.005	0.008	0.006	0.006	0.005	0.006	0.007	0.005	0.005	3
B	0.002	0.000	0.002	0.001	0.005	0.002	0.001	0.014	0.009	0.007	0.008	0.005	0.004	0.004	0.005	2
C	0.004	0.002	0.000	0.001	0.006	0.000	0.004	0.027	0.013	0.023	0.010	0.009	0.003	0.004	0.008	7
D	0.002	0.001	0.001	0.000	0.005	0.001	0.001	0.011	0.006	0.008	0.006	0.003	0.003	0.003	0.004	1
E	0.006	0.005	0.006	0.005	0.001	0.006	0.004	0.022	0.015	0.013	0.014	0.007	0.005	0.001	0.008	8
F	0.004	0.002	0.000	0.001	0.006	0.000	0.004	0.027	0.013	0.023	0.011	0.009	0.003	0.004	0.007	6
G	0.005	0.001	0.004	0.001	0.004	0.004	0.000	0.018	0.014	0.009	0.012	0.009	0.004	0.004	0.006	4
H	0.008	0.014	0.027	0.011	0.022	0.027	0.018	0.000	0.021	0.013	0.019	0.011	0.035	0.021	0.018	14
I	0.006	0.009	0.013	0.006	0.015	0.013	0.014	0.021	0.000	0.023	0.014	0.012	0.026	0.010	0.013	12
J	0.006	0.007	0.023	0.008	0.013	0.023	0.009	0.013	0.023	0.000	0.015	0.011	0.028	0.013	0.014	13
K	0.005	0.008	0.010	0.006	0.014	0.011	0.012	0.019	0.014	0.015	0.004	0.018	0.019	0.012	0.012	11
L	0.006	0.005	0.009	0.003	0.007	0.009	0.009	0.011	0.012	0.011	0.018	0.000	0.016	0.004	0.009	9
M	0.007	0.004	0.003	0.003	0.005	0.003	0.004	0.035	0.026	0.028	0.019	0.016	0.000	0.006	0.011	10
N	0.005	0.004	0.004	0.003	0.001	0.004	0.004	0.021	0.010	0.013	0.012	0.004	0.006	0.000	0.006	5
Mean	0.005	0.005	0.008	0.004	0.008	0.007	0.006	0.018	0.013	0.014	0.012	0.009	0.011	0.006		
Rank	3	2	7	1	8	6	4	14	12	13	11	9	10	5		

Table 4: Scenario 4 Interoperability, Matcher D

POEBVA and MIN:A . The fraction of same-image templates produced by the vendors identified in the rows and columns that fail to exceed the threshold that produced a FMR of 0.01 and 0.001 using matcher D. Cells are colored green when the value is less than 0.002.

(a) FMR = 0.01

E	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.002	0.003	0.002	0.003	0.003	0.004	0.009	0.004	0.007	0.005	0.008	0.006	0.005	0.004	1
B	0.002	0.000	0.003	0.001	0.003	0.003	0.001	0.022	0.011	0.011	0.007	0.007	0.006	0.005	0.006	3
C	0.003	0.003	0.000	0.001	0.004	0.000	0.004	0.044	0.016	0.033	0.009	0.013	0.004	0.004	0.010	7
D	0.002	0.001	0.001	0.000	0.003	0.001	0.002	0.019	0.008	0.014	0.006	0.006	0.004	0.004	0.005	2
E	0.003	0.003	0.004	0.003	0.000	0.004	0.000	0.024	0.011	0.011	0.008	0.006	0.003	0.001	0.006	4
F	0.004	0.003	0.000	0.001	0.004	0.000	0.004	0.044	0.016	0.033	0.008	0.013	0.004	0.004	0.010	9
G	0.003	0.001	0.004	0.002	0.002	0.004	0.000	0.027	0.014	0.012	0.009	0.011	0.004	0.004	0.007	5
H	0.009	0.022	0.044	0.019	0.024	0.044	0.027	0.000	0.027	0.023	0.019	0.020	0.061	0.030	0.026	14
I	0.004	0.011	0.016	0.008	0.011	0.016	0.014	0.027	0.000	0.029	0.010	0.013	0.033	0.010	0.014	11
J	0.007	0.011	0.033	0.014	0.011	0.033	0.012	0.023	0.029	0.000	0.014	0.017	0.043	0.017	0.019	13
K	0.005	0.007	0.009	0.006	0.008	0.008	0.009	0.019	0.010	0.014	0.004	0.015	0.015	0.010	0.010	8
L	0.008	0.007	0.013	0.006	0.006	0.013	0.011	0.020	0.013	0.017	0.015	0.000	0.021	0.004	0.011	10
M	0.006	0.006	0.004	0.004	0.003	0.004	0.004	0.061	0.033	0.043	0.015	0.021	0.000	0.006	0.015	12
N	0.005	0.005	0.004	0.004	0.001	0.004	0.004	0.030	0.010	0.017	0.010	0.004	0.006	0.000	0.008	6
Mean	0.004	0.006	0.010	0.005	0.006	0.010	0.007	0.026	0.014	0.019	0.010	0.011	0.015	0.008		
Rank	1	3	7	2	4	9	5	14	11	13	8	10	12	6		

(b) FMR = 0.001

E	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.005	0.010	0.004	0.008	0.010	0.011	0.022	0.011	0.017	0.006	0.017	0.018	0.012	0.011	1
B	0.005	0.000	0.007	0.003	0.007	0.007	0.002	0.057	0.029	0.028	0.012	0.016	0.015	0.011	0.014	3
C	0.010	0.007	0.000	0.003	0.009	0.000	0.012	0.111	0.048	0.090	0.018	0.031	0.011	0.010	0.026	9
D	0.004	0.003	0.003	0.000	0.007	0.004	0.005	0.048	0.024	0.037	0.009	0.017	0.011	0.008	0.013	2
E	0.008	0.007	0.009	0.007	0.000	0.009	0.005	0.062	0.028	0.029	0.014	0.014	0.007	0.001	0.014	4
F	0.010	0.007	0.000	0.004	0.009	0.000	0.012	0.113	0.048	0.090	0.018	0.031	0.011	0.010	0.026	10
G	0.011	0.002	0.012	0.005	0.005	0.012	0.000	0.072	0.042	0.030	0.019	0.025	0.011	0.011	0.018	6
H	0.022	0.057	0.111	0.048	0.062	0.113	0.072	0.000	0.064	0.057	0.040	0.047	0.149	0.073	0.065	14
I	0.011	0.029	0.048	0.024	0.028	0.048	0.042	0.064	0.000	0.072	0.019	0.032	0.088	0.027	0.038	12
J	0.017	0.028	0.090	0.037	0.029	0.090	0.030	0.057	0.072	0.000	0.030	0.042	0.104	0.044	0.048	13
K	0.006	0.012	0.018	0.009	0.014	0.018	0.019	0.040	0.019	0.030	0.004	0.031	0.035	0.018	0.020	7
L	0.017	0.016	0.031	0.017	0.014	0.031	0.025	0.047	0.032	0.042	0.031	0.000	0.047	0.012	0.026	8
M	0.018	0.015	0.011	0.011	0.007	0.011	0.011	0.149	0.088	0.104	0.035	0.047	0.000	0.013	0.037	11
N	0.012	0.011	0.010	0.008	0.001	0.010	0.011	0.073	0.027	0.044	0.018	0.012	0.013	0.000	0.018	5
Mean	0.011	0.014	0.026	0.013	0.014	0.026	0.018	0.065	0.038	0.048	0.020	0.026	0.037	0.018		
Rank	1	3	9	2	4	10	6	14	12	13	7	8	11	5		

Table 5: Scenario 4 Interoperability, Matcher E

POEBVA and MIN:A . The fraction of same-image templates produced by the vendors identified in the rows and columns that fail to exceed the threshold that produced a FMR of 0.01 and 0.001 using matcher E. Cells are colored green when the value is less than 0.002.

(a) FMR = 0.01

F	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.002	0.004	0.004	0.003	0.002	0.002	0.002	1
B	0.001	0.000	0.001	0.000	0.002	0.001	0.000	0.007	0.003	0.005	0.005	0.002	0.002	0.002	0.002	3
C	0.001	0.001	0.000	0.001	0.002	0.000	0.001	0.013	0.005	0.018	0.006	0.003	0.001	0.001	0.004	9
D	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.005	0.002	0.007	0.005	0.002	0.002	0.001	0.002	2
E	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.006	0.004	0.006	0.005	0.002	0.002	0.000	0.003	6
F	0.001	0.001	0.000	0.000	0.002	0.000	0.001	0.013	0.005	0.017	0.006	0.003	0.001	0.001	0.004	8
G	0.001	0.000	0.001	0.001	0.002	0.001	0.000	0.008	0.003	0.005	0.005	0.004	0.001	0.002	0.002	4
H	0.003	0.008	0.013	0.005	0.006	0.014	0.008	0.000	0.009	0.009	0.009	0.006	0.019	0.008	0.008	14
I	0.002	0.004	0.005	0.003	0.003	0.005	0.003	0.009	0.000	0.013	0.006	0.004	0.010	0.002	0.005	10
J	0.003	0.004	0.016	0.006	0.005	0.016	0.004	0.008	0.012	0.000	0.009	0.005	0.017	0.006	0.008	13
K	0.004	0.005	0.006	0.005	0.005	0.006	0.005	0.009	0.007	0.010	0.004	0.009	0.008	0.006	0.006	12
L	0.003	0.002	0.003	0.002	0.002	0.003	0.003	0.006	0.004	0.006	0.009	0.000	0.007	0.001	0.005	7
M	0.002	0.002	0.001	0.002	0.002	0.001	0.001	0.017	0.009	0.019	0.008	0.007	0.000	0.002	0.004	11
N	0.002	0.002	0.001	0.001	0.000	0.001	0.001	0.008	0.003	0.007	0.007	0.001	0.002	0.000	0.003	5
Mean	0.002	0.002	0.004	0.002	0.002	0.004	0.002	0.008	0.005	0.009	0.006	0.004	0.005	0.002		
Rank	1	3	8	2	6	9	4	13	10	14	12	7	11	5		

(b) FMR = 0.001

F	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.001	0.002	0.001	0.002	0.002	0.002	0.005	0.003	0.006	0.005	0.004	0.003	0.003	0.003	1
B	0.001	0.000	0.001	0.000	0.003	0.001	0.000	0.012	0.005	0.007	0.006	0.003	0.004	0.003	0.003	3
C	0.002	0.001	0.000	0.001	0.003	0.000	0.002	0.021	0.008	0.029	0.007	0.005	0.002	0.002	0.006	9
D	0.001	0.001	0.001	0.000	0.002	0.001	0.001	0.009	0.004	0.011	0.005	0.003	0.003	0.002	0.003	2
E	0.002	0.003	0.003	0.003	0.000	0.003	0.002	0.011	0.006	0.010	0.006	0.003	0.003	0.001	0.004	6
F	0.002	0.001	0.000	0.001	0.003	0.000	0.002	0.021	0.008	0.029	0.007	0.005	0.002	0.002	0.006	8
G	0.002	0.000	0.002	0.001	0.002	0.002	0.000	0.013	0.006	0.008	0.006	0.006	0.002	0.002	0.004	4
H	0.005	0.012	0.022	0.010	0.010	0.022	0.013	0.000	0.015	0.014	0.012	0.010	0.029	0.014	0.013	14
I	0.003	0.006	0.008	0.004	0.006	0.008	0.006	0.015	0.000	0.020	0.008	0.006	0.015	0.004	0.008	10
J	0.006	0.007	0.026	0.010	0.009	0.026	0.007	0.013	0.019	0.000	0.012	0.008	0.027	0.010	0.013	13
K	0.005	0.006	0.007	0.005	0.006	0.007	0.007	0.012	0.008	0.014	0.004	0.012	0.010	0.008	0.008	11
L	0.004	0.003	0.005	0.003	0.003	0.005	0.005	0.010	0.006	0.009	0.012	0.000	0.011	0.001	0.006	7
M	0.003	0.003	0.002	0.003	0.003	0.002	0.002	0.027	0.013	0.029	0.010	0.011	0.000	0.003	0.008	12
N	0.003	0.003	0.002	0.002	0.001	0.002	0.002	0.013	0.004	0.011	0.008	0.001	0.003	0.000	0.004	5
Mean	0.003	0.003	0.006	0.003	0.004	0.006	0.004	0.013	0.008	0.014	0.008	0.006	0.008	0.004		
Rank	1	3	9	2	5	8	4	13	10	14	11	7	12	6		

Table 6: Scenario 4 Interoperability, Matcher F

POEBVA and MIN:A. The fraction of same-image templates produced by the vendors identified in the rows and columns that fail to exceed the threshold that produced a FMR of 0.01 and 0.001 using matcher F. Cells are colored green when the value is less than 0.002.

(a) FMR = 0.01

G	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.001	0.002	0.002	0.003	0.002	0.002	0.008	0.003	0.005	0.005	0.003	0.002	0.003	0.003	4
B	0.001	0.000	0.001	0.001	0.003	0.001	0.000	0.010	0.003	0.004	0.006	0.002	0.002	0.003	0.003	2
C	0.002	0.001	0.000	0.001	0.004	0.000	0.001	0.016	0.003	0.010	0.006	0.002	0.001	0.002	0.003	7
D	0.001	0.001	0.001	0.000	0.003	0.001	0.001	0.010	0.003	0.006	0.005	0.002	0.002	0.002	0.003	3
E	0.003	0.003	0.004	0.003	0.000	0.004	0.002	0.013	0.005	0.007	0.007	0.003	0.003	0.001	0.004	9
F	0.002	0.001	0.000	0.001	0.004	0.000	0.001	0.016	0.003	0.010	0.006	0.002	0.001	0.002	0.004	8
G	0.002	0.000	0.001	0.001	0.002	0.001	0.000	0.009	0.002	0.004	0.006	0.002	0.001	0.002	0.002	1
H	0.008	0.010	0.016	0.010	0.014	0.016	0.009	0.000	0.013	0.013	0.015	0.007	0.018	0.013	0.012	14
I	0.003	0.003	0.003	0.003	0.005	0.003	0.003	0.013	0.000	0.009	0.007	0.002	0.005	0.003	0.004	11
J	0.005	0.004	0.010	0.006	0.007	0.010	0.004	0.013	0.008	0.000	0.010	0.004	0.010	0.006	0.007	12
K	0.005	0.006	0.006	0.005	0.007	0.006	0.006	0.015	0.007	0.010	0.004	0.009	0.008	0.008	0.007	13
L	0.003	0.002	0.002	0.002	0.003	0.003	0.003	0.007	0.002	0.004	0.009	0.000	0.004	0.001	0.003	5
M	0.002	0.002	0.001	0.002	0.003	0.001	0.001	0.018	0.005	0.010	0.008	0.004	0.000	0.002	0.004	10
N	0.003	0.003	0.002	0.002	0.001	0.002	0.002	0.013	0.003	0.007	0.008	0.001	0.002	0.000	0.003	6
Mean	0.003	0.003	0.003	0.003	0.004	0.004	0.002	0.011	0.004	0.007	0.007	0.003	0.004	0.003		
Rank	4	2	7	3	9	8	1	14	11	12	13	5	10	6		

(b) FMR = 0.001

G	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.002	0.003	0.002	0.004	0.003	0.002	0.011	0.004	0.007	0.005	0.005	0.004	0.004	0.004	4
B	0.002	0.000	0.001	0.001	0.004	0.001	0.001	0.017	0.005	0.007	0.006	0.003	0.003	0.004	0.004	2
C	0.003	0.001	0.000	0.001	0.005	0.000	0.002	0.025	0.006	0.017	0.007	0.004	0.002	0.003	0.006	7
D	0.002	0.001	0.001	0.000	0.004	0.001	0.001	0.014	0.004	0.010	0.006	0.003	0.003	0.003	0.004	1
E	0.004	0.004	0.005	0.004	0.000	0.005	0.003	0.019	0.008	0.010	0.008	0.005	0.004	0.001	0.006	9
F	0.003	0.001	0.000	0.001	0.005	0.000	0.002	0.026	0.006	0.017	0.007	0.004	0.002	0.003	0.006	8
G	0.002	0.001	0.002	0.001	0.003	0.002	0.000	0.015	0.005	0.006	0.007	0.004	0.002	0.003	0.004	3
H	0.011	0.017	0.025	0.014	0.020	0.026	0.016	0.000	0.021	0.022	0.019	0.012	0.029	0.020	0.018	14
I	0.004	0.005	0.006	0.004	0.008	0.006	0.005	0.021	0.000	0.015	0.009	0.005	0.010	0.005	0.007	11
J	0.007	0.007	0.017	0.010	0.010	0.017	0.006	0.022	0.015	0.000	0.013	0.006	0.018	0.010	0.011	13
K	0.005	0.006	0.007	0.006	0.008	0.007	0.007	0.019	0.009	0.012	0.004	0.012	0.009	0.009	0.009	12
L	0.005	0.003	0.004	0.003	0.005	0.004	0.004	0.013	0.004	0.007	0.012	0.000	0.007	0.002	0.005	6
M	0.004	0.003	0.002	0.003	0.004	0.002	0.002	0.030	0.010	0.017	0.009	0.008	0.000	0.004	0.007	10
N	0.004	0.004	0.003	0.003	0.001	0.003	0.003	0.020	0.005	0.010	0.009	0.002	0.004	0.000	0.005	5
Mean	0.004	0.004	0.006	0.004	0.006	0.006	0.004	0.018	0.007	0.011	0.009	0.005	0.007	0.005		
Rank	4	2	8	1	9	7	3	14	11	13	12	6	10	5		

Table 7: Scenario 4 Interoperability, Matcher G

POEBVA and MIN:A . The fraction of same-image templates produced by the vendors identified in the rows and columns that fail to exceed the threshold that produced a FMR of 0.01 and 0.001 using matcher G. Cells are colored green when the value is less than 0.002.

(a) FMR = 0.01

I	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.002	0.003	0.002	0.006	0.003	0.003	0.007	0.004	0.006	0.006	0.005	0.004	0.004	0.004	4
B	0.002	0.000	0.001	0.001	0.005	0.001	0.001	0.007	0.003	0.004	0.007	0.002	0.002	0.003	0.003	1
C	0.003	0.001	0.000	0.001	0.007	0.000	0.002	0.016	0.004	0.011	0.008	0.004	0.002	0.003	0.004	6
D	0.002	0.000	0.001	0.000	0.005	0.001	0.001	0.008	0.003	0.006	0.006	0.002	0.002	0.003	0.003	2
E	0.006	0.005	0.007	0.005	0.001	0.007	0.005	0.017	0.010	0.011	0.011	0.007	0.006	0.002	0.007	11
F	0.003	0.001	0.000	0.001	0.007	0.000	0.002	0.016	0.004	0.011	0.008	0.004	0.002	0.003	0.004	7
G	0.003	0.001	0.002	0.001	0.005	0.002	0.000	0.010	0.004	0.005	0.009	0.004	0.002	0.003	0.004	3
H	0.007	0.007	0.016	0.007	0.017	0.016	0.010	0.000	0.011	0.009	0.016	0.009	0.017	0.014	0.011	14
I	0.004	0.003	0.004	0.003	0.010	0.004	0.004	0.011	0.000	0.009	0.009	0.004	0.006	0.004	0.005	10
J	0.005	0.003	0.010	0.005	0.011	0.010	0.004	0.009	0.009	0.000	0.012	0.005	0.009	0.008	0.007	12
K	0.006	0.007	0.008	0.006	0.010	0.008	0.009	0.016	0.009	0.012	0.004	0.013	0.011	0.010	0.009	13
L	0.005	0.003	0.004	0.002	0.007	0.004	0.004	0.009	0.004	0.005	0.013	0.000	0.006	0.002	0.005	8
M	0.004	0.002	0.002	0.002	0.005	0.002	0.001	0.017	0.007	0.010	0.011	0.006	0.000	0.003	0.005	9
N	0.004	0.003	0.003	0.003	0.002	0.003	0.003	0.013	0.005	0.008	0.010	0.002	0.003	0.000	0.004	5
Mean	0.004	0.003	0.004	0.003	0.007	0.004	0.004	0.011	0.006	0.008	0.009	0.005	0.005	0.004		
Rank	4	1	6	2	11	5	3	14	10	12	13	8	9	7		

(b) FMR = 0.001

I	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.002	0.004	0.002	0.006	0.004	0.004	0.009	0.005	0.009	0.006	0.007	0.006	0.005	0.005	3
B	0.002	0.000	0.001	0.001	0.007	0.001	0.001	0.012	0.005	0.006	0.008	0.003	0.003	0.004	0.004	1
C	0.004	0.002	0.000	0.001	0.008	0.000	0.003	0.026	0.007	0.019	0.010	0.006	0.003	0.003	0.007	7
D	0.002	0.001	0.001	0.000	0.007	0.001	0.001	0.012	0.004	0.009	0.007	0.004	0.003	0.004	0.004	2
E	0.006	0.007	0.008	0.006	0.001	0.008	0.006	0.023	0.014	0.016	0.012	0.009	0.007	0.002	0.009	11
F	0.004	0.002	0.000	0.001	0.008	0.000	0.003	0.026	0.007	0.019	0.010	0.006	0.003	0.003	0.007	6
G	0.004	0.001	0.003	0.001	0.005	0.003	0.000	0.015	0.008	0.007	0.010	0.006	0.003	0.004	0.005	4
H	0.009	0.012	0.025	0.012	0.024	0.025	0.016	0.000	0.019	0.015	0.020	0.013	0.029	0.020	0.017	14
I	0.005	0.005	0.006	0.004	0.013	0.006	0.007	0.017	0.000	0.015	0.012	0.006	0.011	0.007	0.008	10
J	0.008	0.005	0.017	0.008	0.016	0.017	0.007	0.014	0.015	0.000	0.017	0.008	0.016	0.012	0.011	12
K	0.006	0.008	0.010	0.007	0.012	0.010	0.011	0.020	0.012	0.017	0.004	0.017	0.015	0.011	0.011	13
L	0.007	0.004	0.005	0.003	0.009	0.005	0.006	0.013	0.006	0.009	0.017	0.000	0.009	0.003	0.007	8
M	0.005	0.003	0.003	0.003	0.007	0.003	0.002	0.028	0.012	0.017	0.015	0.009	0.000	0.005	0.008	9
N	0.005	0.004	0.004	0.004	0.002	0.004	0.004	0.020	0.007	0.012	0.011	0.003	0.005	0.000	0.006	5
Mean	0.005	0.004	0.006	0.004	0.009	0.006	0.005	0.017	0.009	0.012	0.011	0.007	0.008	0.006		
Rank	3	2	6	1	11	7	4	14	10	13	12	8	9	5		

Table 8: Scenario 4 Interoperability, Matcher I

POEBVA and MIN:A . The fraction of same-image templates produced by the vendors identified in the rows and columns that fail to exceed the threshold that produced a FMR of 0.01 and 0.001 using matcher I. Cells are colored green when the value is less than 0.002.

(a) FMR = 0.01

J	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.018	0.049	0.008	0.029	0.049	0.036	1.000	0.017	0.014	0.012	0.019	0.042	0.016	0.094	5
B	0.018	0.000	0.010	0.003	0.019	0.010	0.003	1.000	0.067	0.011	0.038	0.012	0.012	0.010	0.087	3
C	0.049	0.010	0.000	0.007	0.033	0.000	0.028	1.000	0.133	0.090	0.095	0.045	0.008	0.017	0.108	11
D	0.008	0.003	0.007	0.000	0.016	0.007	0.004	1.000	0.026	0.017	0.020	0.012	0.009	0.007	0.081	1
E	0.029	0.019	0.033	0.016	0.001	0.033	0.013	1.000	0.066	0.033	0.057	0.017	0.012	0.002	0.095	7
F	0.049	0.010	0.000	0.007	0.033	0.000	0.027	1.000	0.133	0.089	0.094	0.045	0.008	0.017	0.108	10
G	0.036	0.003	0.028	0.004	0.013	0.027	0.000	1.000	0.069	0.021	0.062	0.021	0.009	0.007	0.093	4
H	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	14
I	0.017	0.067	0.133	0.026	0.066	0.133	0.069	1.000	0.000	0.041	0.050	0.023	0.131	0.038	0.128	13
J	0.014	0.011	0.090	0.017	0.033	0.089	0.021	1.000	0.041	0.000	0.033	0.013	0.058	0.019	0.103	9
K	0.012	0.038	0.095	0.020	0.057	0.094	0.062	1.000	0.050	0.033	0.004	0.064	0.089	0.038	0.118	12
L	0.019	0.012	0.045	0.012	0.017	0.045	0.021	1.000	0.023	0.013	0.064	0.000	0.041	0.006	0.094	6
M	0.042	0.012	0.008	0.009	0.012	0.008	0.009	1.000	0.131	0.058	0.089	0.041	0.000	0.008	0.102	8
N	0.016	0.010	0.017	0.007	0.002	0.017	0.007	1.000	0.038	0.019	0.038	0.006	0.008	0.000	0.085	2
Mean	0.094	0.087	0.108	0.081	0.095	0.108	0.093	1.000	0.128	0.103	0.118	0.094	0.102	0.085		
Rank	5	3	11	1	7	10	4	14	13	9	12	6	8	2		

(b) FMR = 0.001

J	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.042	0.102	0.019	0.059	0.103	0.082	1.000	0.039	0.027	0.022	0.040	0.085	0.035	0.118	6
B	0.042	0.000	0.027	0.007	0.036	0.026	0.008	1.000	0.143	0.022	0.076	0.029	0.027	0.021	0.105	3
C	0.102	0.027	0.000	0.019	0.069	0.000	0.067	1.000	0.250	0.168	0.174	0.093	0.019	0.039	0.145	11
D	0.019	0.007	0.019	0.000	0.029	0.018	0.012	1.000	0.061	0.036	0.041	0.025	0.021	0.013	0.093	1
E	0.059	0.036	0.069	0.029	0.002	0.069	0.026	1.000	0.127	0.065	0.104	0.033	0.023	0.004	0.118	4
F	0.103	0.026	0.000	0.018	0.069	0.000	0.065	1.000	0.250	0.167	0.174	0.094	0.019	0.038	0.144	10
G	0.082	0.008	0.067	0.012	0.026	0.065	0.000	1.000	0.151	0.048	0.120	0.046	0.022	0.017	0.119	7
H	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	14
I	0.039	0.143	0.250	0.061	0.127	0.250	0.151	1.000	0.000	0.090	0.098	0.053	0.247	0.081	0.185	13
J	0.027	0.022	0.168	0.036	0.065	0.167	0.048	1.000	0.090	0.000	0.060	0.026	0.110	0.040	0.133	9
K	0.022	0.076	0.174	0.041	0.104	0.174	0.120	1.000	0.098	0.060	0.004	0.115	0.156	0.072	0.158	12
L	0.040	0.029	0.093	0.025	0.033	0.094	0.046	1.000	0.053	0.026	0.115	0.000	0.082	0.013	0.118	5
M	0.085	0.027	0.019	0.021	0.023	0.019	0.022	1.000	0.247	0.110	0.156	0.082	0.000	0.016	0.130	8
N	0.035	0.021	0.039	0.013	0.004	0.038	0.017	1.000	0.081	0.040	0.072	0.013	0.016	0.000	0.099	2
Mean	0.118	0.105	0.145	0.093	0.118	0.144	0.119	1.000	0.185	0.133	0.158	0.118	0.130	0.099		
Rank	6	3	11	1	4	10	7	14	13	9	12	5	8	2		

Table 9: Scenario 4 Interoperability, Matcher J

POEBVA and MIN:A . The fraction of same-image templates produced by the vendors identified in the rows and columns that fail to exceed the threshold that produced a FMR of 0.01 and 0.001 using matcher J. Cells are colored green when the value is less than 0.002.

(a) FMR = 0.01

K	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.517	0.553	0.631	0.360	0.038	0.631	0.151	0.668	0.573	0.961	0.012	0.636	0.692	0.026	0.461	7
B	0.553	0.478	0.600	0.390	0.019	0.600	0.077	0.771	0.632	0.926	0.039	0.628	0.670	0.024	0.458	6
C	0.631	0.600	0.594	0.385	0.030	0.613	0.140	0.787	0.688	0.975	0.072	0.695	0.689	0.027	0.495	9
D	0.360	0.390	0.385	0.246	0.020	0.383	0.088	0.549	0.511	0.769	0.021	0.436	0.448	0.017	0.330	5
E	0.038	0.019	0.030	0.020	0.000	0.030	0.023	0.115	0.187	0.610	0.030	0.061	0.045	0.001	0.086	2
F	0.631	0.600	0.613	0.383	0.030	0.592	0.139	0.787	0.688	0.975	0.072	0.695	0.689	0.028	0.494	8
G	0.151	0.077	0.140	0.088	0.023	0.139	0.002	0.270	0.279	0.985	0.057	0.164	0.158	0.026	0.154	4
H	0.668	0.771	0.787	0.549	0.115	0.787	0.270	0.644	0.728	0.966	0.057	0.763	0.871	0.096	0.577	13
I	0.573	0.632	0.688	0.511	0.187	0.688	0.279	0.728	0.225	0.939	0.121	0.630	0.781	0.145	0.509	11
J	0.961	0.926	0.975	0.769	0.610	0.975	0.585	0.966	0.939	0.787	0.473	0.958	0.972	0.499	0.814	14
K	0.012	0.039	0.072	0.021	0.030	0.072	0.057	0.057	0.121	0.473	0.005	0.089	0.174	0.021	0.089	3
L	0.636	0.628	0.695	0.436	0.061	0.695	0.164	0.763	0.630	0.958	0.089	0.519	0.752	0.048	0.505	10
M	0.692	0.670	0.689	0.448	0.045	0.689	0.158	0.871	0.781	0.972	0.174	0.752	0.564	0.046	0.539	12
N	0.026	0.024	0.027	0.017	0.001	0.028	0.026	0.096	0.145	0.499	0.021	0.048	0.046	0.000	0.072	1
Mean	0.461	0.458	0.495	0.330	0.086	0.494	0.154	0.577	0.509	0.814	0.089	0.505	0.539	0.072		
Rank	7	6	9	5	2	8	4	13	11	14	3	10	12	1		

(b) FMR = 0.001

K	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.520	0.635	0.689	0.451	0.090	0.689	0.259	0.733	0.680	0.981	0.032	0.702	0.763	0.063	0.521	6
B	0.635	0.481	0.674	0.490	0.049	0.674	0.139	0.839	0.741	0.956	0.122	0.708	0.747	0.057	0.522	7
C	0.689	0.674	0.596	0.470	0.066	0.619	0.234	0.837	0.777	0.989	0.182	0.748	0.740	0.056	0.548	9
D	0.451	0.490	0.470	0.247	0.047	0.469	0.154	0.661	0.628	0.822	0.061	0.533	0.543	0.039	0.401	5
E	0.090	0.049	0.066	0.047	0.000	0.066	0.047	0.251	0.307	0.672	0.058	0.121	0.091	0.003	0.133	2
F	0.689	0.674	0.619	0.469	0.066	0.595	0.234	0.837	0.777	0.989	0.181	0.748	0.740	0.055	0.548	8
G	0.259	0.139	0.234	0.154	0.047	0.234	0.002	0.438	0.422	0.666	0.121	0.262	0.246	0.048	0.234	4
H	0.733	0.839	0.837	0.661	0.251	0.837	0.438	0.647	0.817	0.985	0.142	0.816	0.907	0.212	0.652	13
I	0.680	0.741	0.777	0.628	0.307	0.777	0.422	0.817	0.228	0.971	0.234	0.720	0.850	0.238	0.599	11
J	0.981	0.956	0.989	0.822	0.672	0.989	0.666	0.985	0.971	0.789	0.574	0.980	0.987	0.577	0.853	14
K	0.032	0.122	0.182	0.061	0.058	0.181	0.121	0.142	0.234	0.574	0.005	0.198	0.339	0.043	0.164	3
L	0.702	0.708	0.748	0.533	0.121	0.748	0.262	0.816	0.720	0.980	0.198	0.524	0.796	0.091	0.568	10
M	0.763	0.747	0.740	0.543	0.091	0.740	0.246	0.907	0.850	0.987	0.339	0.796	0.567	0.083	0.600	12
N	0.063	0.057	0.056	0.039	0.003	0.055	0.048	0.212	0.238	0.577	0.043	0.091	0.083	0.000	0.112	1
Mean	0.521	0.522	0.548	0.401	0.133	0.548	0.234	0.652	0.599	0.853	0.164	0.568	0.600	0.112		
Rank	6	7	9	5	2	8	4	13	11	14	3	10	12	1		

Table 10: Scenario 4 Interoperability, Matcher K

POEBVA and MIN:A . The fraction of same-image templates produced by the vendors identified in the rows and columns that fail to exceed the threshold that produced a FMR of 0.01 and 0.001 using matcher K. Cells are colored green when the value is less than 0.002.

(a) FMR = 0.01

L	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.003	0.004	0.002	0.007	0.004	0.005	0.012	0.008	0.011	0.007	0.008	0.006	0.005	0.006	3
B	0.005	0.000	0.003	0.001	0.012	0.003	0.001	0.017	0.006	0.006	0.013	0.004	0.004	0.006	0.006	2
C	0.006	0.002	0.000	0.002	0.014	0.000	0.004	0.033	0.008	0.022	0.015	0.006	0.004	0.005	0.009	6
D	0.003	0.001	0.002	0.000	0.011	0.002	0.003	0.015	0.007	0.012	0.010	0.005	0.004	0.005	0.006	1
E	0.006	0.007	0.009	0.007	0.001	0.009	0.006	0.025	0.014	0.015	0.013	0.009	0.007	0.002	0.009	9
F	0.006	0.002	0.000	0.002	0.014	0.000	0.004	0.033	0.009	0.022	0.015	0.006	0.004	0.005	0.009	7
G	0.007	0.001	0.004	0.003	0.009	0.005	0.000	0.020	0.008	0.007	0.014	0.006	0.003	0.005	0.007	4
H	0.015	0.016	0.031	0.015	0.033	0.032	0.020	0.000	0.025	0.019	0.026	0.016	0.034	0.024	0.022	14
I	0.010	0.006	0.010	0.007	0.020	0.010	0.009	0.027	0.000	0.017	0.019	0.007	0.014	0.009	0.012	11
J	0.017	0.008	0.029	0.016	0.026	0.029	0.010	0.024	0.020	0.000	0.028	0.009	0.020	0.016	0.018	13
K	0.006	0.010	0.011	0.008	0.013	0.011	0.011	0.022	0.014	0.019	0.004	0.018	0.015	0.012	0.012	12
L	0.011	0.004	0.007	0.006	0.014	0.007	0.007	0.018	0.006	0.008	0.024	0.000	0.010	0.003	0.009	8
M	0.009	0.004	0.004	0.005	0.011	0.004	0.004	0.039	0.014	0.018	0.021	0.010	0.000	0.006	0.011	10
N	0.006	0.005	0.004	0.004	0.002	0.004	0.005	0.024	0.007	0.012	0.014	0.002	0.005	0.000	0.007	5
Mean	0.008	0.005	0.009	0.006	0.013	0.009	0.006	0.022	0.010	0.013	0.016	0.008	0.009	0.007		
Rank	5	1	7	2	11	8	3	14	10	12	13	6	9	4		

(b) FMR = 0.001

L	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.005	0.007	0.004	0.011	0.007	0.008	0.020	0.011	0.017	0.008	0.012	0.010	0.009	0.009	1
B	0.008	0.000	0.005	0.003	0.018	0.005	0.002	0.031	0.011	0.011	0.020	0.007	0.007	0.010	0.010	3
C	0.010	0.004	0.000	0.003	0.021	0.000	0.008	0.054	0.015	0.036	0.023	0.011	0.006	0.008	0.014	7
D	0.006	0.002	0.003	0.000	0.017	0.003	0.005	0.025	0.011	0.020	0.014	0.009	0.007	0.008	0.009	2
E	0.009	0.010	0.014	0.010	0.001	0.014	0.008	0.038	0.020	0.023	0.018	0.012	0.010	0.002	0.013	6
F	0.010	0.004	0.000	0.003	0.021	0.000	0.008	0.055	0.015	0.036	0.023	0.011	0.006	0.008	0.014	8
G	0.011	0.002	0.008	0.005	0.013	0.008	0.000	0.034	0.014	0.012	0.021	0.011	0.005	0.009	0.011	5
H	0.024	0.028	0.053	0.025	0.051	0.053	0.033	0.000	0.042	0.031	0.040	0.027	0.055	0.040	0.036	14
I	0.016	0.011	0.018	0.013	0.031	0.018	0.016	0.046	0.000	0.029	0.028	0.011	0.024	0.014	0.020	12
J	0.027	0.013	0.053	0.029	0.045	0.053	0.018	0.042	0.037	0.000	0.045	0.016	0.036	0.030	0.032	13
K	0.007	0.012	0.015	0.010	0.018	0.015	0.015	0.032	0.019	0.027	0.004	0.024	0.021	0.016	0.017	10
L	0.017	0.007	0.013	0.010	0.021	0.013	0.012	0.031	0.011	0.013	0.034	0.000	0.017	0.006	0.015	9
M	0.015	0.007	0.008	0.008	0.017	0.008	0.007	0.064	0.025	0.030	0.032	0.018	0.000	0.010	0.018	11
N	0.010	0.007	0.007	0.007	0.003	0.007	0.007	0.039	0.011	0.019	0.020	0.004	0.007	0.000	0.011	4
Mean	0.012	0.008	0.014	0.009	0.021	0.014	0.011	0.036	0.017	0.022	0.024	0.012	0.015	0.012		
Rank	5	1	7	2	11	8	3	14	10	12	13	6	9	4		

Table 11: Scenario 4 Interoperability, Matcher L

POEBVA and MIN:A . The fraction of same-image templates produced by the vendors identified in the rows and columns that fail to exceed the threshold that produced a FMR of 0.01 and 0.001 using matcher L. Cells are colored green when the value is less than 0.002.

(a) FMR = 0.01

M	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.005	0.005	0.003	0.006	0.006	0.006	0.014	0.009	0.016	0.006	0.010	0.008	0.006	0.007	5
B	0.003	0.000	0.002	0.001	0.007	0.002	0.001	0.014	0.006	0.007	0.009	0.004	0.003	0.004	0.005	1
C	0.004	0.002	0.000	0.001	0.009	0.000	0.004	0.029	0.009	0.028	0.010	0.007	0.004	0.004	0.008	7
D	0.002	0.001	0.001	0.000	0.007	0.001	0.002	0.014	0.007	0.014	0.007	0.005	0.004	0.004	0.005	2
E	0.007	0.012	0.013	0.011	0.001	0.001	0.009	0.031	0.019	0.026	0.013	0.013	0.011	0.002	0.013	12
F	0.004	0.002	0.000	0.001	0.009	0.000	0.004	0.029	0.009	0.028	0.010	0.006	0.004	0.004	0.008	8
G	0.005	0.001	0.004	0.002	0.006	0.004	0.000	0.019	0.008	0.009	0.010	0.007	0.003	0.004	0.006	3
H	0.012	0.016	0.030	0.014	0.023	0.030	0.018	0.000	0.025	0.022	0.020	0.017	0.035	0.023	0.020	14
I	0.007	0.006	0.008	0.006	0.012	0.008	0.006	0.023	0.000	0.019	0.013	0.006	0.012	0.006	0.009	10
J	0.010	0.006	0.019	0.011	0.014	0.019	0.007	0.017	0.016	0.000	0.017	0.007	0.015	0.011	0.012	11
K	0.006	0.013	0.014	0.009	0.012	0.014	0.013	0.026	0.018	0.027	0.004	0.023	0.020	0.014	0.015	13
L	0.008	0.004	0.006	0.005	0.008	0.006	0.006	0.015	0.006	0.008	0.017	0.000	0.010	0.002	0.007	6
M	0.005	0.003	0.003	0.004	0.007	0.003	0.003	0.031	0.012	0.018	0.013	0.009	0.000	0.004	0.008	9
N	0.005	0.006	0.005	0.005	0.002	0.005	0.005	0.023	0.008	0.016	0.011	0.003	0.005	0.000	0.007	4
Mean	0.006	0.005	0.008	0.005	0.009	0.008	0.006	0.020	0.011	0.017	0.012	0.008	0.010	0.006		
Rank	3	2	7	1	9	6	4	14	11	13	12	8	10	5		

(b) FMR = 0.001

M	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.007	0.009	0.005	0.008	0.009	0.010	0.023	0.014	0.026	0.007	0.016	0.013	0.009	0.011	4
B	0.004	0.000	0.003	0.002	0.010	0.003	0.001	0.025	0.010	0.012	0.012	0.006	0.006	0.006	0.007	1
C	0.006	0.004	0.000	0.002	0.012	0.000	0.007	0.047	0.015	0.050	0.014	0.012	0.007	0.006	0.013	8
D	0.004	0.002	0.002	0.000	0.009	0.002	0.004	0.022	0.011	0.026	0.009	0.009	0.007	0.007	0.008	2
E	0.011	0.018	0.020	0.017	0.001	0.020	0.013	0.049	0.029	0.043	0.018	0.020	0.016	0.003	0.020	12
F	0.006	0.004	0.000	0.002	0.012	0.000	0.007	0.047	0.016	0.050	0.014	0.012	0.007	0.006	0.013	9
G	0.007	0.002	0.007	0.004	0.008	0.007	0.000	0.031	0.014	0.017	0.014	0.011	0.006	0.007	0.010	3
H	0.018	0.028	0.048	0.022	0.035	0.048	0.031	0.000	0.042	0.038	0.029	0.028	0.056	0.036	0.033	14
I	0.010	0.010	0.014	0.010	0.018	0.014	0.011	0.038	0.000	0.035	0.017	0.010	0.021	0.010	0.015	10
J	0.016	0.010	0.033	0.017	0.021	0.033	0.011	0.027	0.026	0.000	0.025	0.012	0.026	0.018	0.020	11
K	0.008	0.019	0.021	0.014	0.017	0.021	0.020	0.039	0.026	0.044	0.004	0.032	0.030	0.020	0.022	13
L	0.011	0.007	0.010	0.008	0.011	0.010	0.010	0.025	0.010	0.015	0.022	0.000	0.016	0.003	0.011	6
M	0.008	0.006	0.005	0.006	0.009	0.005	0.005	0.048	0.019	0.032	0.019	0.014	0.000	0.007	0.013	7
N	0.008	0.009	0.008	0.008	0.002	0.008	0.008	0.038	0.013	0.028	0.015	0.005	0.009	0.000	0.011	5
Mean	0.008	0.009	0.013	0.008	0.012	0.013	0.010	0.033	0.018	0.030	0.016	0.013	0.016	0.010		
Rank	2	3	8	1	6	7	4	14	12	13	10	9	11	5		

Table 12: Scenario 4 Interoperability, Matcher M

POEBVA and MIN:A. The fraction of same-image templates produced by the vendors identified in the rows and columns that fail to exceed the threshold that produced a FMR of 0.01 and 0.001 using matcher M. Cells are colored green when the value is less than 0.002.

(a) FMR = 0.01

N	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.002	0.010	0.002	0.004	0.009	0.005	0.004	0.003	0.003	0.005	0.005	0.019	0.004	0.005	3
B	0.002	0.000	0.002	0.000	0.002	0.002	0.000	0.021	0.009	0.005	0.007	0.004	0.006	0.002	0.004	2
C	0.010	0.002	0.000	0.001	0.003	0.000	0.003	0.061	0.025	0.032	0.023	0.010	0.003	0.002	0.013	9
D	0.002	0.000	0.001	0.000	0.003	0.001	0.001	0.019	0.008	0.007	0.006	0.004	0.004	0.002	0.004	1
E	0.004	0.003	0.003	0.003	0.000	0.003	0.000	0.025	0.010	0.007	0.011	0.004	0.003	0.001	0.006	5
F	0.010	0.002	0.000	0.001	0.003	0.000	0.003	0.061	0.025	0.031	0.023	0.010	0.003	0.002	0.007	8
G	0.005	0.000	0.003	0.001	0.002	0.003	0.000	0.035	0.014	0.007	0.013	0.008	0.004	0.002	0.002	6
H	0.004	0.021	0.061	0.019	0.025	0.061	0.035	0.000	0.016	0.011	0.016	0.008	0.088	0.029	0.028	14
I	0.003	0.009	0.026	0.008	0.010	0.026	0.014	0.016	0.000	0.012	0.011	0.007	0.057	0.008	0.015	12
J	0.003	0.005	0.032	0.006	0.007	0.031	0.007	0.011	0.012	0.000	0.010	0.006	0.047	0.007	0.013	10
K	0.005	0.008	0.023	0.006	0.011	0.023	0.013	0.016	0.011	0.010	0.004	0.000	0.041	0.011	0.014	11
L	0.005	0.004	0.010	0.004	0.004	0.010	0.008	0.009	0.007	0.006	0.017	0.000	0.026	0.002	0.008	7
M	0.019	0.006	0.003	0.004	0.003	0.003	0.004	0.089	0.057	0.048	0.040	0.026	0.000	0.005	0.022	13
N	0.004	0.002	0.002	0.002	0.001	0.002	0.002	0.029	0.008	0.007	0.011	0.002	0.005	0.000	0.005	4
Mean	0.005	0.004	0.013	0.004	0.006	0.012	0.007	0.028	0.015	0.013	0.014	0.008	0.022	0.005		
Rank	4	2	9	1	5	8	6	14	12	10	11	7	13	3		

(b) FMR = 0.001

N	A	B	C	D	E	F	G	H	I	J	K	L	M	N	Mean	Rank
A	0.000	0.003	0.020	0.003	0.007	0.019	0.011	0.008	0.005	0.005	0.005	0.008	0.033	0.006	0.010	5
B	0.003	0.000	0.004	0.001	0.004	0.004	0.001	0.040	0.016	0.009	0.011	0.006	0.010	0.004	0.008	2
C	0.020	0.004	0.000	0.002	0.005	0.000	0.007	0.106	0.049	0.062	0.039	0.018	0.005	0.005	0.023	10
D	0.003	0.001	0.002	0.000	0.004	0.002	0.002	0.035	0.016	0.012	0.008	0.006	0.007	0.003	0.007	1
E	0.007	0.004	0.005	0.004	0.000	0.005	0.003	0.046	0.018	0.010	0.016	0.006	0.004	0.001	0.009	3
F	0.020	0.004	0.000	0.001	0.005	0.000	0.006	0.108	0.050	0.060	0.040	0.018	0.005	0.004	0.023	9
G	0.010	0.001	0.007	0.002	0.003	0.006	0.000	0.063	0.026	0.011	0.022	0.013	0.006	0.004	0.012	6
H	0.008	0.040	0.106	0.034	0.045	0.109	0.062	0.000	0.028	0.021	0.025	0.015	0.146	0.054	0.050	14
I	0.005	0.016	0.050	0.016	0.018	0.049	0.025	0.029	0.000	0.022	0.016	0.012	0.097	0.015	0.026	12
J	0.004	0.009	0.063	0.012	0.010	0.061	0.012	0.022	0.023	0.000	0.013	0.010	0.079	0.012	0.023	11
K	0.005	0.011	0.039	0.008	0.016	0.040	0.023	0.026	0.016	0.013	0.004	0.025	0.067	0.015	0.022	8
L	0.008	0.007	0.019	0.006	0.006	0.018	0.013	0.016	0.012	0.010	0.025	0.000	0.041	0.003	0.013	7
M	0.034	0.010	0.005	0.007	0.004	0.005	0.006	0.146	0.097	0.079	0.067	0.041	0.000	0.007	0.036	13
N	0.006	0.004	0.004	0.003	0.001	0.004	0.004	0.055	0.015	0.012	0.015	0.003	0.007	0.000	0.009	4
Mean	0.010	0.008	0.023	0.007	0.009	0.023	0.012	0.050	0.027	0.023	0.022	0.013	0.036	0.009		
Rank	5	2	10	1	3	9	6	14	12	11	8	7	13	4		

Table 13: Scenario 4 Interoperability, Matcher N

POEBVA and MIN:A . The fraction of same-image templates produced by the vendors identified in the rows and columns that fail to exceed the threshold that produced a FMR of 0.01 and 0.001 using matcher N. Cells are colored green when the value is less than 0.002.