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Challenges and Opportunities in Face Recognition

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Summary of Face Recognition Progress

Last IFPC, we discussed the continued exponential reductions in error rates

Are these still occurring?

Top 10 Algorithms older than 3 years:

hm	Gallery	VISA	MUGSHOT	MUGSHOT	VISA	VISA Yaw≥45	BORDER	BORDER
	Probe	VISA	MUGSHOT	MUGSHOT ΔT≥12 YRS	BORDER	BORDER°	BORDER	KIOSK
	Date	FMR = 0.000001	= 0.00001	= 0.00001	= 0.000001	= 0.000001	= 0.000001	= 0.00001
e-006	2021-12-28	0.0024(17)	0.0021(1)	0.002(1)	0.0021(1)	-	0.004(1)	0.0475(2)
e-005	2021-05-24	0.0029(31)	0.0022(2)	0.0021(3)	0.0023(2)	-	0.0044(2)	0.0503(6)
n-010	2022-02-02	0.0021(11)	0.0022(3)	0.0021(4)	0.0027(5)	-	0.0055(7)	0.0477(3)
e-004	2020-11-20	0.0038(49)	0.0022(4)	0.0023(5)	0.0042(43)	-	0.0082(46)	-
09	2021-12-08	0.0294(432)	0.0023(5)	0.0025(7)	0.0036(28)	-	0.0065(18)	0.0539(11)
008	2021-07-07	0.0032(35)	0.0023(6)	0.0028(21)	0.0034(22)	-	0.0067(20)	0.0682(35)
e-012	2022-01-20	0.0016(3)	0.0023(7)	0.003(33)	0.0026(4)	0.0123(2)	0.005(3)	0.0501(5)
007	2022-01-12	0.0028(29)	0.0024(8)	0.0026(13)	0.0033(17)	-	0.0061(12)	0.0497(4)
ai-000	2021-09-22	0.0019(10)	0.0024(9)	0.0028(22)	0.0029(11)	-	0.0057(8)	0.0532(9)
n-008	2021-07-01	0.0025(21)	0.0024(10)	0.0025(9)	0.0036(26)	-	0.007(25)	0.0677(33)

Top 10 Algorithms newer than 3 years:

	Gallery	VISA	MUGSHOT	MUGSHOT	VISA	VISA Yaw≥45	BORDER	BORDER
	Probe	VISA	MUGSHOT	MUGSHOT ΔT≥12 YRS	BORDER	BORDER°	BORDER	KIOSK
	Date	FMR = 0.000001	= 0.00001	= 0.00001	= 0.000001	= 0.000001	= 0.000001	= 0.00001
ai-002	2024-09-25	-	0.002(1)	0.002(7)	0.0014(1)	0.004(6)	0.0028(1)	0.0338(1)
ai-003	2025-01-30	-	0.002(2)	0.002(8)	0.0015(2)	0.0043(13)	0.0029(2)	0.0339(2)
ai-001	2024-05-21	0.0008(8)	0.002(3)	0.002(12)	0.0015(3)	0.0045(14)	0.003(3)	0.0353(3)
	2022-10-06	0.0026(52)	0.0021(4)	0.0021	0.0024	0.0067	0.0047	0.0464
ai-000	2024-01-11	0.0011(12)	0.0021(5)	0.0022(26)	0.0018(18)	0.0069(35)	0.0035(12)	0.038(6)
08	2023-01-04	0.0014(16)	0.0021(6)	0.002(5)	0.0018(21)	0.0041(8)	0.0036(13)	0.0477(45)
17	2025-01-13	-	0.0021(7)	0.0021(13)	0.0019(22)	0.0039(5)	0.0038(16)	0.0428(22)
01	2023-09-27	0.0007(4)	0.0021(8)	0.0022(28)	0.0016(4)	0.007(36)	0.0662(267)	0.1047(229)
1	2023-01-11	0.0014(17)	0.0021(9)	0.002(11)	0.0019(27)	0.0084(50)	0.0037(14)	0.0394(9)
13	2023-05-08	0.0018(31)	0.0021(10)	0.0019(3)	0.0019(28)	0.0027(1)	0.0041(24)	0.0403(13)

Mugshot accuracy largely unchanged the last 3 years

MUGSHOT
MUGSHOT
= 0.00001
0.0021(1)
0.0022(2)
0.0022(3)
0.0022(4)
0.0023(5)
0.0023(6)
0.0023(7)
0.0024(8)
0.0024(9)
0.0024(10)

MUGSHOT
MUGSHOT
= 0.00001
0.002(1)
0.002(2)
0.002(3)
0.0021(4)
0.0021(5)
0.0021(6)
0.0021(7)
0.0021(8)
0.0021(9)
0.0021(10)

Source:: https://pages.nist.gov/frvt/html/frvt11.html (Accessed on 4-1-2025)

Top 10 Algorithms older than 3 years:

	Gallery	VISA	MUGSHOT	MUGSHOT	VISA	VISA Yaw≥45	BORDER	BORDER
	Probe	VISA	MUGSHOT	MUGSHOT ΔT≥12 YRS	BORDER	BORDER°	BORDER	KIOSK
	Date	FMR = 0.000001	= 0.00001	= 0.00001	= 0.000001	= 0.000001	= 0.000001	= 0.00001
006	2021-12-28	0.0024(17)	0.0021(1)	0.002(1)	0.0021(1)	-	0.004(1)	0.0475(2)
005	2021-05-24	0.0029(31)	0.0022(2)	0.0021(3)	0.0023(2)	-	0.0044(2)	0.0503(6)
0	2021-12-20	0.0031(33)	0.0036(99)	0.0049(109)	0.0025(3)	-	0.0065(17)	0.0518(8)
12	2022-01-20	0.0016(3)	0.0023(7)	0.003(33)	0.0026(4)	0.0123(42)	0.005(42)	0.0501(42)
010	2022-02-02	0.0021(11)	0.0022(3)	0.0021(4)	0.0027(5)	-	0.0055(7)	0.0477(3)
001	2022-03-11	0.0019(7)	0.0024(16)	0.0025(10)	0.0027(6)	-	0.0115(103)	0.0763(57)
011	2021-10-13	0.0022(13)	0.0024(17)	0.0026(15)	0.0028(7)	-	0.0053(4)	0.057(16)
-004	2021-11-09	0.0013(1)	0.0024(11)	0.0021(2)	0.0028(8)	-	0.0054(5)	0.0508(7)
-001	2022-03-04	0.0047(81)	0.0025(23)	0.0031(39)	0.0029(9)	-	0.0338(286)	0.1011(89)
11	2021-09-13	0.0019(9)	0.0024(14)	0.0028(28)	0.0029(10)	-	0.0054(6)	0.0536(10)

Top 10 Algorithms newer than 3 years:

	Gallery	VISA	MUGSHOT	MUGSHOT	VISA	VISA Yaw≥45	BORDER	BORDER
	Probe	VISA	MUGSHOT	MUGSHOT ΔT≥12 YRS	BORDER	BORDER°	BORDER	KIOSK
	Date	FMR = 0.000001	= 0.00001	= 0.00001	= 0.000001	= 0.000001	= 0.000001	= 0.00001
ai-002	2024-09-25	-	0.002(1)	0.002(7)	0.0014(1)	0.004(6)	0.0028(1)	0.0338(1)
ai-003	2025-01-30	-	0.002(2)	0.002(8)	0.0015(2)	0.0043(13)	0.0029(2)	0.0339(2)
ai-001	2024-05-21	0.0008(8)	0.002(3)	0.002(12)	0.0015(3)	0.0045(14)	0.003(3)	0.0353(3)
01	2023-09-27	0.0007(4)	0.0021(8)	0.0022(28)	0.0016(4)	0.0037(34)	0.0032(17)	0.0347(88)
1	2024-12-30	-	0.0025(134)	0.0025(77)	0.0016(5)	0.0042(10)	0.0031(4)	0.0368(5)
-007	2023-02-21	0.0007(3)	0.0023(53)	0.0019(2)	0.0016(6)	0.0036(3)	0.0032(5)	0.0394(8)
-006	2022-10-20	0.0006(1)	0.0023(49)	0.0019(1)	0.0016(7)	0.0034(2)	0.0032(6)	0.0399(11)
00	2023-05-24	0.0006(2)	0.0021(15)	0.0022(34)	0.0016(8)	0.0063(28)	0.0553(262)	0.1085(238)
5	2024-11-13	-	0.0021(12)	0.0021(14)	0.0017(9)	0.0066(30)	0.0334(233)	0.094(214)
0	2023-06-09	0.0007(5)	0.0026(158)	0.0026(96)	0.0017(10)	0.0056(22)	0.0033(7)	0.0394(10)

Visa Border: ~ 1.5x reduction in error rate in 3 years

VISA	BORDER
= 0.000001	
0.0021(1)	
0.0023(2)	
0.0025(3)	
0.0026(4)	
0.0027(5)	
0.0027(6)	
0.0028(7)	
0.0028(8)	
0.0029(9)	
0.0029(10)	

VISA	BORDER
= 0.000001	
0.0014(1)	
0.0015(2)	
0.0015(3)	
0.0016(4)	
0.0016(5)	
0.0016(6)	
0.0016(7)	
0.0016(8)	
0.0017(9)	
0.0017(10)	

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Top 10 Algorithms older than 3 years:

m	Gallery	VISA	MUGSHOT	MUGSHOT	VISA	VISA Yaw≥45	BORDER	BORDER
	Probe	VISA	MUGSHOT	MUGSHOT ΔT≥12 YRS	BORDER	BORDER°	BORDER	KIOSK
	Date	FMR = 0.000001	= 0.00001	= 0.00001	= 0.000001	= 0.000001	= 0.000001	= 0.00001
02	2021-08-24	0.0041(60)	0.0025(19)	0.0025(11)	0.0033(18)	0.0105(1)	0.0064(15)	0.0461(1)
-006	2021-12-28	0.0024(17)	0.0021(1)	0.002(1)	0.0021(1)	-	0.004(1)	0.0475(2)
-010	2022-02-02	0.0021(11)	0.0022(3)	0.0021(4)	0.0027(5)	-	0.0055(7)	0.0477(3)
07	2022-01-12	0.0028(29)	0.0024(8)	0.0026(13)	0.0033(17)	-	0.0061(12)	0.0497(4)
012	2022-01-20	0.0016(3)	0.0023(7)	0.003(33)	0.0026(4)	0.0123(2)	0.005(3)	0.0501(5)
-005	2021-05-24	0.0029(31)	0.0022(2)	0.0021(3)	0.0023(2)	-	0.0044(2)	0.0503(6)
nt-004	2021-11-09	0.0013(1)	0.0024(11)	0.0021(2)	0.0028(8)	-	0.0054(5)	0.0508(7)
010	2021-12-20	0.0031(33)	0.0036(99)	0.0049(109)	0.0025(3)	-	0.0065(17)	0.0518(8)
i-000	2021-09-22	0.0019(10)	0.0024(9)	0.0028(22)	0.0029(11)	-	0.0057(8)	0.0532(9)
011	2021-09-13	0.0019(9)	0.0024(14)	0.0028(28)	0.0029(10)	-	0.0054(6)	0.0536(10)

Top 10 Algorithms newer than 3 years:

	Gallery	VISA	MUGSHOT	MUGSHOT	VISA	VISA Yaw≥45	BORDER	BORDER
	Probe	VISA	MUGSHOT	MUGSHOT ΔT≥12 YRS	BORDER	BORDER°	BORDER	KIOSK
	Date	FMR = 0.000001	= 0.00001	= 0.00001	= 0.000001	= 0.000001	= 0.000001	= 0.00001
ai-002	2024-09-25	-	0.002(1)	0.002(7)	0.0014(1)	0.004(6)	0.0028(1)	0.0338(1)
ai-003	2025-01-30	-	0.002(2)	0.002(8)	0.0015(2)	0.0043(13)	0.0029(2)	0.0339(2)
ai-001	2024-05-21	0.0008(8)	0.002(3)	0.002(12)	0.0015(3)	0.0045(14)	0.003(3)	0.0353(3)
014	2025-03-13	-	0.0021(11)	0.002(4)	0.0017(11)	0.0056(21)	0.0033(8)	0.0362(4)
1	2024-12-30	-	0.0025(134)	0.0025(77)	0.0016(5)	0.0042(10)	0.0031(4)	0.0368(5)
ai-000	2024-01-11	0.0011(12)	0.0021(5)	0.0022(26)	0.0018(18)	0.0069(35)	0.0035(12)	0.038(6)
10	2024-12-03	-	0.0022(20)	0.0021(15)	0.0018(15)	0.0081(47)	0.0034(10)	0.0383(7)
-007	2023-02-21	0.0007(3)	0.0023(53)	0.0019(2)	0.0016(6)	0.0036(3)	0.0032(5)	0.0394(8)
1	2023-01-11	0.0014(17)	0.0021(9)	0.002(11)	0.0019(27)	0.0084(50)	0.0037(14)	0.0394(9)
0	2023-06-09	0.0007(5)	0.0026(158)	0.0026(96)	0.0017(10)	0.0056(22)	0.0033(7)	0.0394(10)

Border Kiosk: ~ 1.3x reduction in error rate in 3 years

BORDER
KIOSK
= 0.00001
0.0461(1)
0.0475(2)
0.0477(3)
0.0497(4)
0.0501(5)
0.0503(6)
0.0508(7)
0.0518(8)
0.0532(9)
0.0536(10)

BORDER
KIOSK
= 0.00001
0.0338(1)
0.0339(2)
0.0353(3)
0.0362(4)
0.0368(5)
0.038(6)
0.0383(7)
0.0394(8)
0.0394(9)
0.0394(10)

Source:: https://pages.nist.gov/frvt/html/frvt11.html (Accessed on 4-1-2025)

Top 10 Algorithms older than 3 years:

	Gallery	VISA	MUGSHOT	MUGSHOT	VISA	VISA Yaw≥45	BORDER	BORDER
	Probe	VISA	MUGSHOT	MUGSHOT ΔT≥12 YRS	BORDER	BORDER°	BORDER	KIOSK
	Date	FMR = 0.000001	= 0.00001	= 0.00001	= 0.000001	= 0.000001	= 0.000001	= 0.00001
02	2021-08-24	0.0041[60]	0.0025[19]	0.0025[11]	0.0033[18]	0.0105[1]	0.0064[15]	0.0461[1]
012	2022-01-20	0.0016[3]	0.0023[7]	0.003[33]	0.0026[4]	0.0123[2]	0.005[3]	0.0501[5]
00	2022-02-14	0.0028[30]	0.0024[15]	0.0027[17]	0.0031[13]	0.0175[3]	0.7968[506]	0.8075[179]
-009	2023-01-19	0.0031[34]	0.0028[46]	0.0032[43]	0.0034[20]	0.0221[4]	0.1162[466]	0.1877[140]
-002	2022-01-19	0.0046[78]	0.0027[43]	0.0039[67]	0.0041[39]	0.0256[5]	0.0076[30]	0.0677[32]
a-006	2022-01-26	0.0067[141]	0.0041[136]	0.0056[130]	0.0056[93]	0.0545[6]	0.0085[53]	0.0729[48]
06	2021-07-16	0.0819[549]	0.0529[517]	0.109[518]	0.1011[503]	0.6819[7]	0.1058[396]	0.3066[158]
-006	2021-12-28	0.0024[17]	0.0021[1]	0.002[1]	0.0021[1]	-	0.004[1]	0.0475[2]
-010	2022-02-02	0.0021[11]	0.0022[3]	0.0021[4]	0.0027[5]	-	0.0055[7]	0.0477[3]
07	2022-01-12	0.0028[29]	0.0024[8]	0.0026[13]	0.0033[17]	-	0.0061[12]	0.0497[4]

Top 10 Algorithms newer than 3 years:

	Gallery	VISA	MUGSHOT	MUGSHOT	VISA	VISA Yaw≥45	BORDER	BORDER
	Probe	VISA	MUGSHOT	MUGSHOT ΔT≥12 YRS	BORDER	BORDER°	BORDER	KIOSK
	Date	FMR = 0.000001	= 0.00001	= 0.00001	= 0.000001	= 0.000001	= 0.000001	= 0.00001
13	2023-05-08	0.0018[31]	0.0021[10]	0.0019[3]	0.0019[28]	0.0027[1]	0.0041[24]	0.0403[13]
-006	2022-10-20	0.0006[1]	0.0023[49]	0.0019[1]	0.0016[7]	0.0034[2]	0.0032[6]	0.0399[11]
-007	2023-02-21	0.0007[3]	0.0023[53]	0.0019[2]	0.0016[6]	0.0036[3]	0.0032[5]	0.0394[8]
0	2025-02-03	-	0.0024[69]	0.0021[20]	0.0017[12]	0.0038[4]	0.0037[21]	0.0475[18]
17	2025-01-13	-	0.0021[7]	0.0021[13]	0.0019[22]	0.0039[5]	0.0038[16]	0.0428[22]
ai-002	2024-09-25	-	0.002[1]	0.002[7]	0.0014[1]	0.004[6]	0.0028[1]	0.0338[1]
11	2022-12-12	0.002[34]	0.0021[16]	0.002[10]	0.0026[114]	0.004[7]	0.0053[63]	0.0457[34]
08	2023-01-04	0.0014[16]	0.0021[6]	0.002[5]	0.0018[21]	0.0041[8]	0.0036[13]	0.0477[45]
15	2024-09-09	-	0.0021[14]	0.0021[22]	0.0021[34]	0.0041[9]	0.0043[28]	0.0502[67]
1	2024-12-30	-	0.0025[134]	0.0025[77]	0.0016[5]	0.0042[10]	0.0031[4]	0.0368[5]

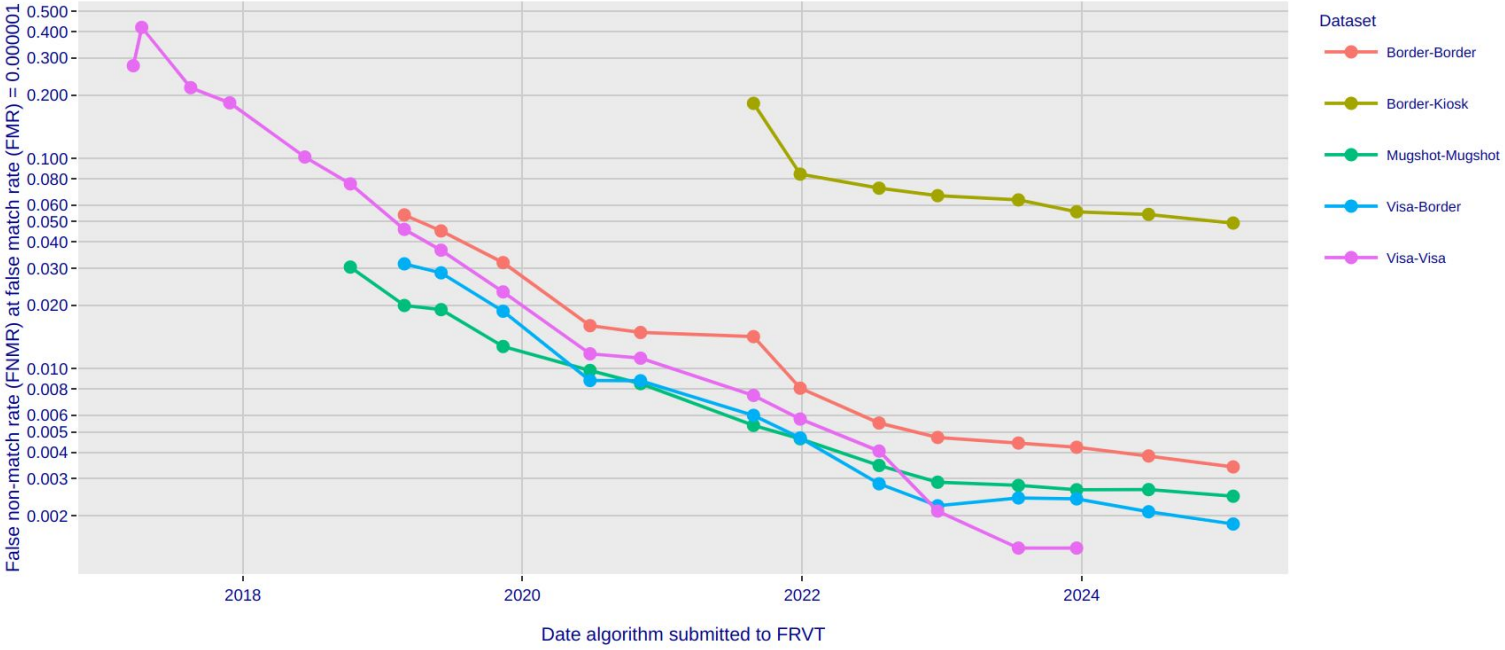
Yaw > 45 degrees:
Over 3x error rate reduction

VISA Yaw≥45
BORDER°
= 0.000001
0.0105[1]
0.0123[2]
0.0175[3]
0.0221[4]
0.0256[5]
0.0545[6]
0.6819[7]
-
-
-

VISA Yaw≥45
BORDER°
= 0.000001
0.0027[1]
0.0034[2]
0.0036[3]
0.0038[4]
0.0039[5]
0.004[6]
0.004[7]
0.0041[8]
0.0041[9]
0.0042[10]

Source:: https://pages.nist.gov/frvt/html/frvt11.html (Accessed on 4-1-2025)

Vendor Error Rate Reduction Over Time



2017-2022: Exponential error rate reduction

2023 to now: linear reduction in error rate

Challenges

Is progress is slowing down, or are certain datasets getting “solved” in constrained use-cases?

What are these remaining errors in the mugshot dataset?

Identical twins? Quality issues? Ground truth errors? Confounding dopplegangers?

How consistently are these top 10 algorithms all getting the wrong answer on the same comparisons?

If all these extremely accurate algorithms are wrong on the same comparisons, are they wrong, or are us humans wrong? 🤔

Challenges

Perhaps issue is 1:1 FR benchmarks need to measure FNMR at lower FMRs?

- FRVT 1:N shows continued error rate reductions for watchlist identification across large mugshot datasets
- This suggests that 1e-6, and especially 1e-5, may no longer be ideal summary statistic thresholds for FMR in 1:1 benchmark
- Instead, Face Recognition 1:1 needs to start looking FMR=1e-7 and 1e-8 thresholds (though, large data burden to do so)
- 1:N analysis is always important, but IMO nothing is more important than 1:1 FMR vs. FNMR tradeoff analysis; **1:1 performance can generalizes to nearly every use-case**

Error rates from FRVT 1:N Top 10 Mugshot algorithms: *Significantly more variance than 1:1!*

	Gallery	Mugshot	Mugshot	Mugshot	Mugshot
	Probe	Mugshot	Mugshot	Webcam	Profile 90°
	Date	N = 12000000	N = 1600000	N = 1600000	N = 1600000
0	2025-01-24	0.0007(1)	0.0006(2)	0.0057(2)	0.0462(2)
nai_002	2024-12-03	0.0007(2)	0.0005(1)	0.0057(1)	0.0460(1)
010	2023-01-11	0.0009(3)	0.0007(4)	0.0075(4)	0.0826(7)
_010	2024-12-03	0.0009(4)	0.0006(3)	0.0073(3)	0.0714(5)
004	2023-10-18	0.0011(5)	0.0009(9)	0.0081(7)	0.0599(4)
_000	2024-07-23	0.0014(6)	0.0007(5)	0.0076(5)	0.1069(12)
_002	2023-11-09	0.0014(7)	0.0007(7)	0.0076(6)	0.1069(13)
_016	2024-12-04	0.0016(8)	0.0008(8)	0.0090(9)	0.0877(8)
2	2024-07-26	0.0017(9)	0.0007(6)	0.0090(8)	0.0720(6)
nt_002	2023-02-24	0.0017(10)	0.0015(18)	0.0113(15)	0.0484(3)
006	2024-07-15	0.0019(11)	0.0010(11)	0.0096(12)	0.1206(19)
02	2025-01-31	0.0020(12)	0.0009(10)	0.0092(10)	0.0917(9)
_012	2024-09-20	0.0022(13)	0.0013(12)	0.0096(13)	0.1330(22)
02	2023-11-07	0.0025(14)	0.0014(16)	0.0128(20)	0.1040(11)

Error rates are False Negative Identification Rate (FNIR) at False Positive Identification Rate (FPIR) to 0.003

Source:: https://pages.nist.gov/frvt/html/frvt1N.html (Accessed on 4-1-2025)

Challenges

Cases where quality issues cause errors

If all top performing algorithms fail on the same sample due to quality issues, can we expect these cases to ever be “solved”?

Operationally, best you can hope for is to flag as low quality and reject in many cases. Should we remove these samples from benchmarks, or give vendors credit for flagging them instead?

It is unclear what errors currently remain in NIST benchmarks that are getting saturated.

Maybe there could be a “qualitative analysis” FRTE document that analyzes remaining error cases in constrained test sets and shares the findings with vendor community?

Challenges

Massive progress is still being made on highly unconstrained use-cases

Frontal to profile matching is now quite accurate! ~95% Rank-1 accuracy on 1.6M database for several algorithms. (Of course, mugshot frontal to profile is constrained use-case.)

Incorporating NIST FIVE as a new FRTE test set in the ongoing benchmarks would be critically impactful

We are almost certainly still in the midst of exponential error rate reduction on highly unconstrained data and now more than ever need ongoing benchmarks that capture this use-case

Images from:
B. Klare, B. Klein, E. Taborsky, A. Blanton, J. Cheney, K. Allen, P. Grother, A. Mah, and A.K. Jain, "Pushing the Frontiers of Unconstrained Face Detection and Recognition: IARPA Janus Benchmark A." Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2015.

Challenges

Who is the most accurate vendor overall?

	FALSE NON-MATCH RATE (FNMR)							
	Constrained, Cooperative							Unconstrained, Non-Coop
	Gallery	VISA	MUGSHOT	MUGSHOT	VISA	VISA Yaw≥45	BORDER	BORDER
	Probe	VISA	MUGSHOT	MUGSHOT ΔT≥12 YRS	BORDER	BORDER°	BORDER	KIOSK
	Date	FMR = 0.000001	= 0.00001	= 0.00001	= 0.000001	= 0.000001	= 0.000001	= 0.00001
hai-002	2024-09-25	-	0.002(1)	0.002(3)	0.0014(1)	0.004(4)	0.0028(1)	0.0338(1)
001	2023-09-27	0.0007(2)	0.0021(3)	0.0022(12)	0.0016(2)	0.007(14)	0.0662(201)	0.1047(120)
01	2024-12-30	-	0.0025(59)	0.0025(32)	0.0016(3)	0.0042(5)	0.0031(2)	0.0368(3)
t-007	2023-02-21	0.0007(1)	0.0023(21)	0.0019(1)	0.0016(4)	0.0036(1)	0.0032(3)	0.0394(5)
5	2024-11-13	-	0.0021(6)	0.0021(6)	0.0017(5)	0.0066(11)	0.0334(172)	0.094(108)
-014	2025-03-13	-	0.0021(5)	0.002(2)	0.0017(6)	0.0056(8)	0.0033(4)	0.0362(2)
10	2025-02-03	-	0.0024(31)	0.0021(9)	0.0017(7)	0.0038(2)	0.0307(168)	0.0495(28)
09	2024-02-12	0.0008(3)	0.0023(26)	0.0021(10)	0.0018(8)	0.0043(7)	0.0149(113)	0.0433(13)
010	2024-12-03	-	0.0022(9)	0.0021(7)	0.0018(9)	0.0081(20)	0.0034(5)	0.0383(4)
006	2025-03-07	-	0.0022(12)	0.0022(15)	0.0018(10)	0.0062(9)	0.0331(170)	0.0818(90)
8	2025-01-31	-	0.0022(11)	0.0022(13)	0.0018(11)	0.0069(13)	0.0034(6)	0.0415(8)
11	2024-08-06	-	0.0021(7)	0.0021(8)	0.0018(12)	0.0062(10)	0.0077(49)	0.0489(25)
017	2025-01-13	-	0.0021(2)	0.0021(5)	0.0019(13)	0.0039(3)	0.0038(9)	0.0428(12)
01	2023-01-11	0.0014(7)	0.0021(4)	0.002(4)	0.0019(14)	0.0084(23)	0.0037(7)	0.0394(6)
006	2025-02-19	-	0.0022(15)	0.0023(21)	0.0019(15)	0.0082(21)	0.0037(8)	0.0423(10)

Only two vendors in the top 10 for every benchmark

One of these two is listed 5th overall on the 1:1 online leaderboard, even they are #2 overall in mean error rate

This is because the table default sorts by Visa-Border error rate

Challenges

What test sets are the most important?

Seven Total Datasets are Currently Listed in FRTE 1:1 Online Leaderboard:

Gallery	MUGSHOT	MUGSHOT	VISA	VISA Yaw≥45	BORDER	BORDER
Probe	MUGSHOT	MUGSHOT ΔT≥12 YRS	BORDER	BORDER°	BORDER	KIOSK

FRTE online leaderboard defaults to sort by “Visa Border” error rate; is this the most important dataset?

Or, are all seven listed datasets equally important?

What about sorting based on mean error rate across all test sets?

Most people seem to take the default ordering on the site as the defacto ranking, even though it is sorted based on error rate for one of the seven test sets listed

Challenges

Who is the most accurate vendor for Identity Proofing / Mobile Identity Verification?

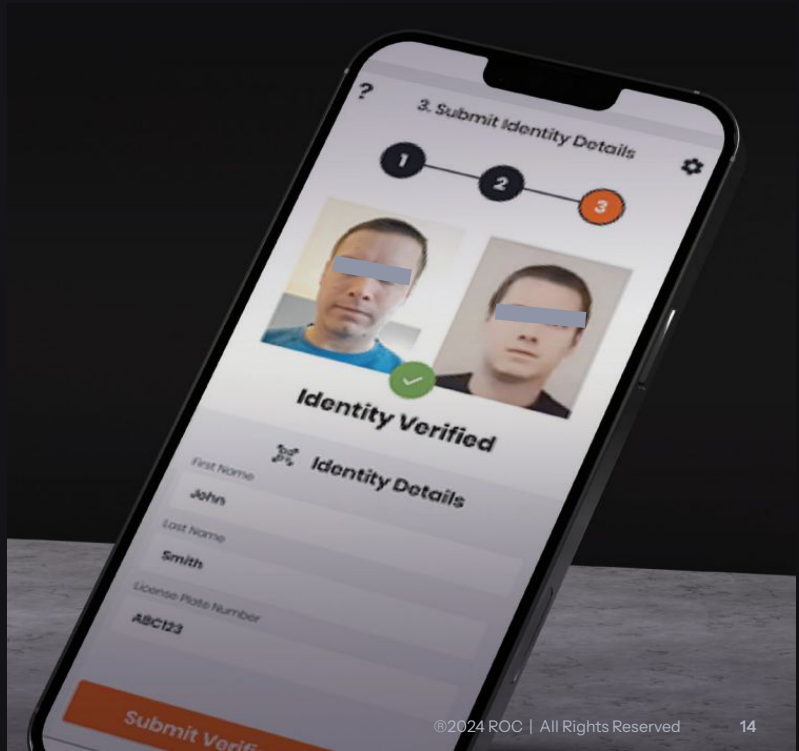
No one knows! 😀

Use-case involves comparing selfie face photo to drivers license, passport or other ID card through a mobile app.

Despite being a massive use-case across banking and enterprise ID verification, there is no ongoing benchmark measuring what vendor is most accurate.

Perhaps Visa Border approximates to this use case?

The IRS and other USG agencies are deploying this use-case, perhaps they can feed FRTE team some data?



Mobile Identity Verification

Are DeepFakes the biggest threat to facial verification use cases?

No

Mobile Identity Verification

Injection Attacks are the biggest threat.

Both DeepFakes and **- much worse - authentic face images acquired from the public domain**, can be presented to an Identity Verification system via sensor bypass (e.g., virtual camera)

Opportunities

What have we discussed so far?

- Certain FRTE benchmarks have saturated
- Need to measure FNMR at lower FMR rates
- Lack of ongoing benchmarks for rapidly progressing use-cases (Mobile IDV, Unconstrained) is a challenge
- **Face recognition algorithms have gotten extremely accurate!!!**
- Qualitative analysis of errors more important than ever

Opportunity

What are the implications of these factors?

Opportunities

Amazing time for agencies managing identity systems!

Dozens of face recognition algorithm providers are offering elite, top-tier performance solutions

Critical procurement factors other than accuracy can now be emphasized:

- Cost
- Customer support
- Hardware requirements
- Scalability
- Trustworthiness

Opportunities

Face recognition solution providers have a lot more work to

- Keep delivering exponential improvements to unconstrained face recognition
- Focus on accuracy improvements for constrained use case at very low FMR's (1e-7 and lower)
- Solve edge-case problems and broader facial analytics problems (injection attack, age estimation, etc).
- Are FR algos solving identical twins, or is this going to be handled via metadata (hint: metadata works, algos may never)