A: Datasheet

Algorithm: vigilantsolutions_007

Developer: Vigilant Solutions

Submission Date: 2021_01_08

Template size: 1544 bytes

Template time (2.5 percentile): 615 msec

Template time (median): 616 msec

Template time (97.5 percentile): 659 msec

Investigation:

Frontal mugshot ranking 107 (out of 329) −− FNIR(1600000, 0, 1) = 0.0034 vs. lowest 0.0009 from sensetime_006

Mugshot webcam ranking 108 (out of 291) −− FNIR(1600000, 0, 1) = 0.0171 vs. lowest 0.0057 from sensetime_006

Mugshot profile ranking 183 (out of 260) −− FNIR(1600000, 0, 1) = 0.9253 vs. lowest 0.0550 from sensetime_006

Immigration visa−border ranking 122 (out of 218) −− FNIR(1600000, 0, 1) = 0.0126 vs. lowest 0.0009 from sensetime_006

Immigration visa−kiosk ranking 130 (out of 215) −− FNIR(1600000, 0, 1) = 0.1752 vs. lowest 0.0487 from cubox_000

Identification:

Frontal mugshot ranking 98 (out of 329) −− FNIR(1600000, T, L+1) = 0.0282, FPIR=0.001000 vs. lowest 0.0017 from nec_005

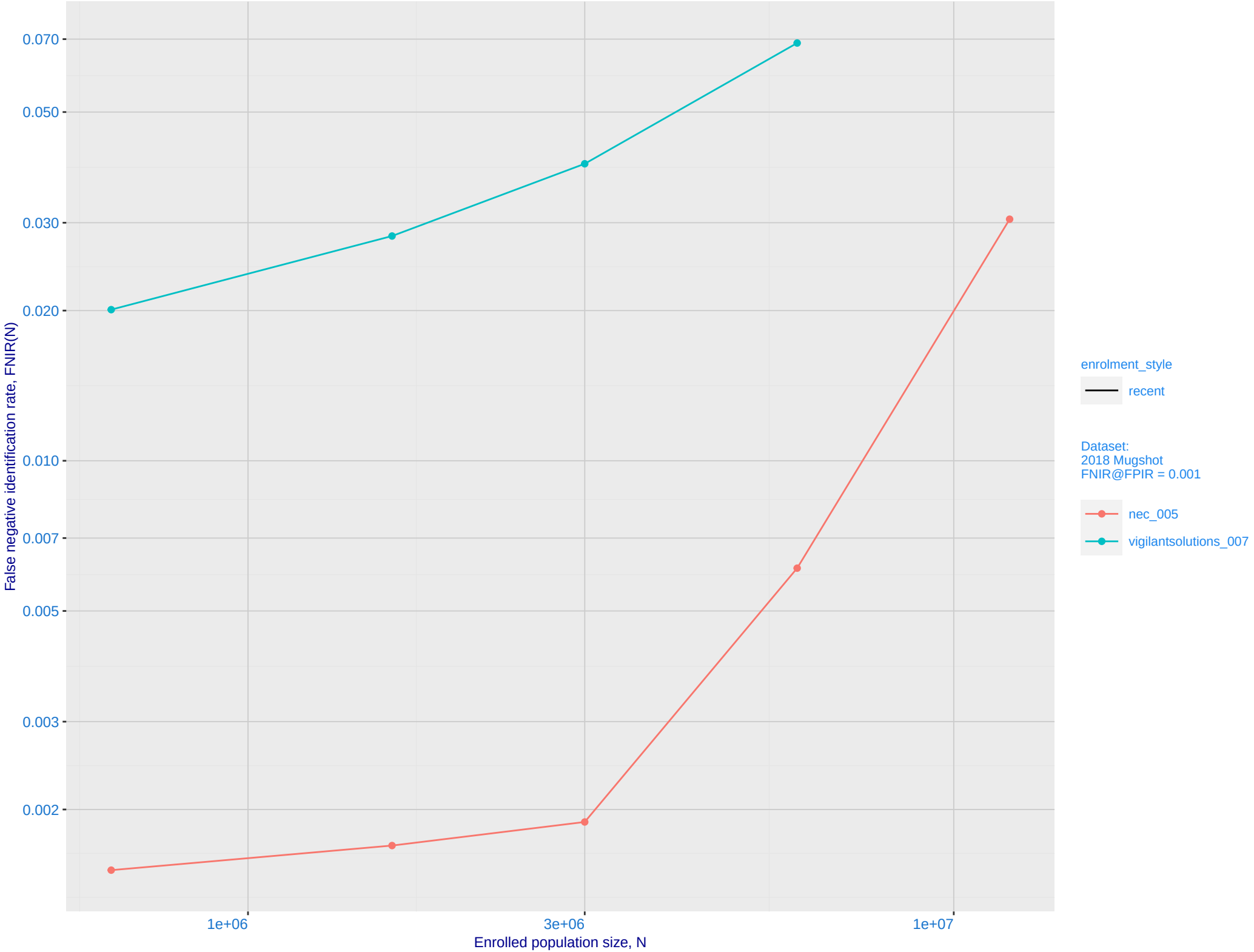
Mugshot webcam ranking 99 (out of 289) −− FNIR(1600000, T, L+1) = 0.0880, FPIR=0.001000 vs. lowest 0.0120 from nec_005

Mugshot profile ranking 143 (out of 259) −− FNIR(1600000, T, L+1) = 0.9956, FPIR=0.001000 vs. lowest 0.1331 from cloudwalk_hr_000

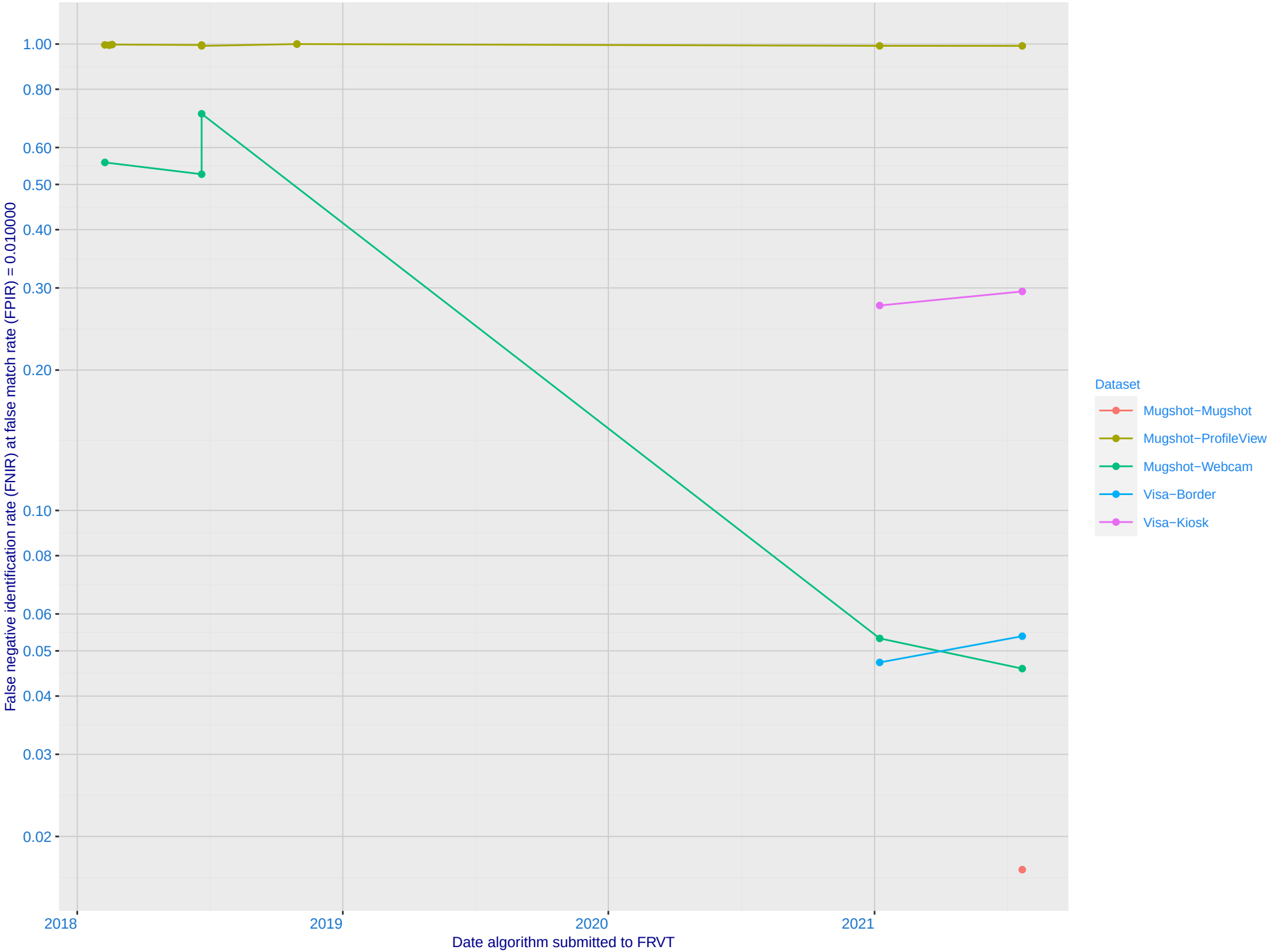
Immigration visa−border ranking 119 (out of 217) −− FNIR(1600000, T, L+1) = 0.0815, FPIR=0.001000 vs. lowest 0.0032 from paravision_009

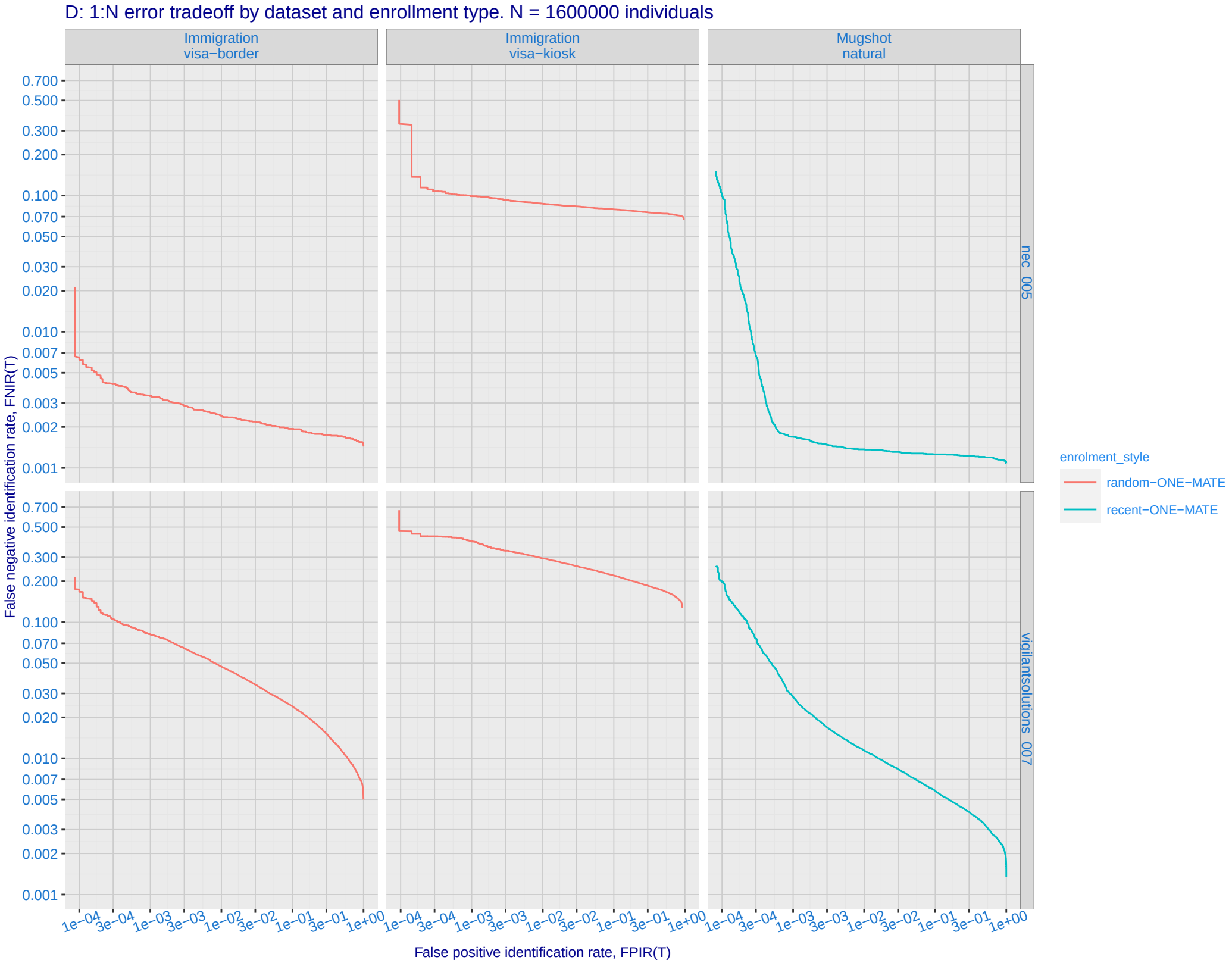
Immigration visa−kiosk ranking 92 (out of 212) −− FNIR(1600000, T, L+1) = 0.3945, FPIR=0.001000 vs. lowest 0.0728 from paravision_009

B: Mugshot natural images, identification mode: FNIR(N, L+1, T) vs. most accurate (nec_005)

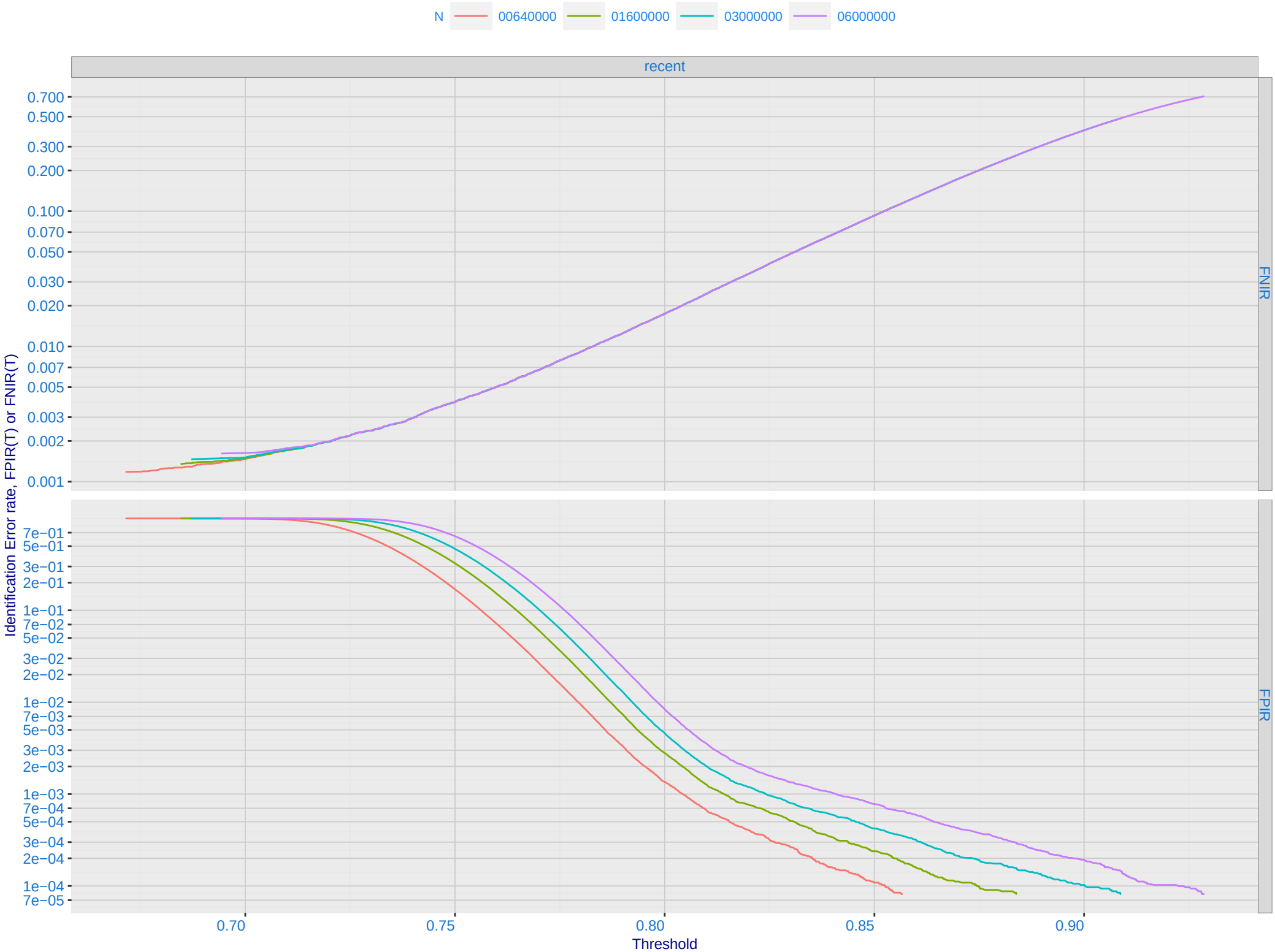


C: Evolution of accuracy for VIGILANTSOLUTIONS algorithms on three datasets 2018 − present

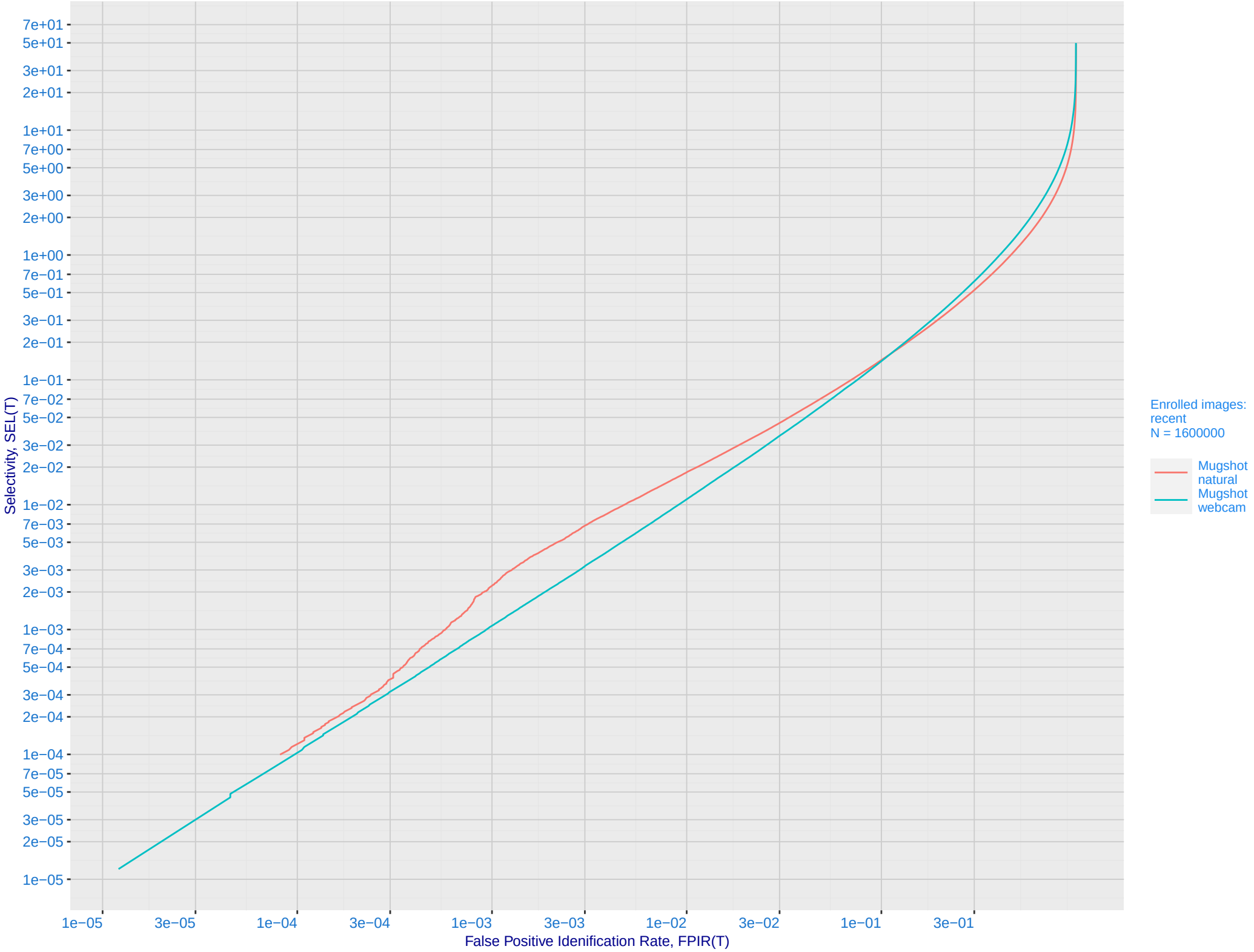


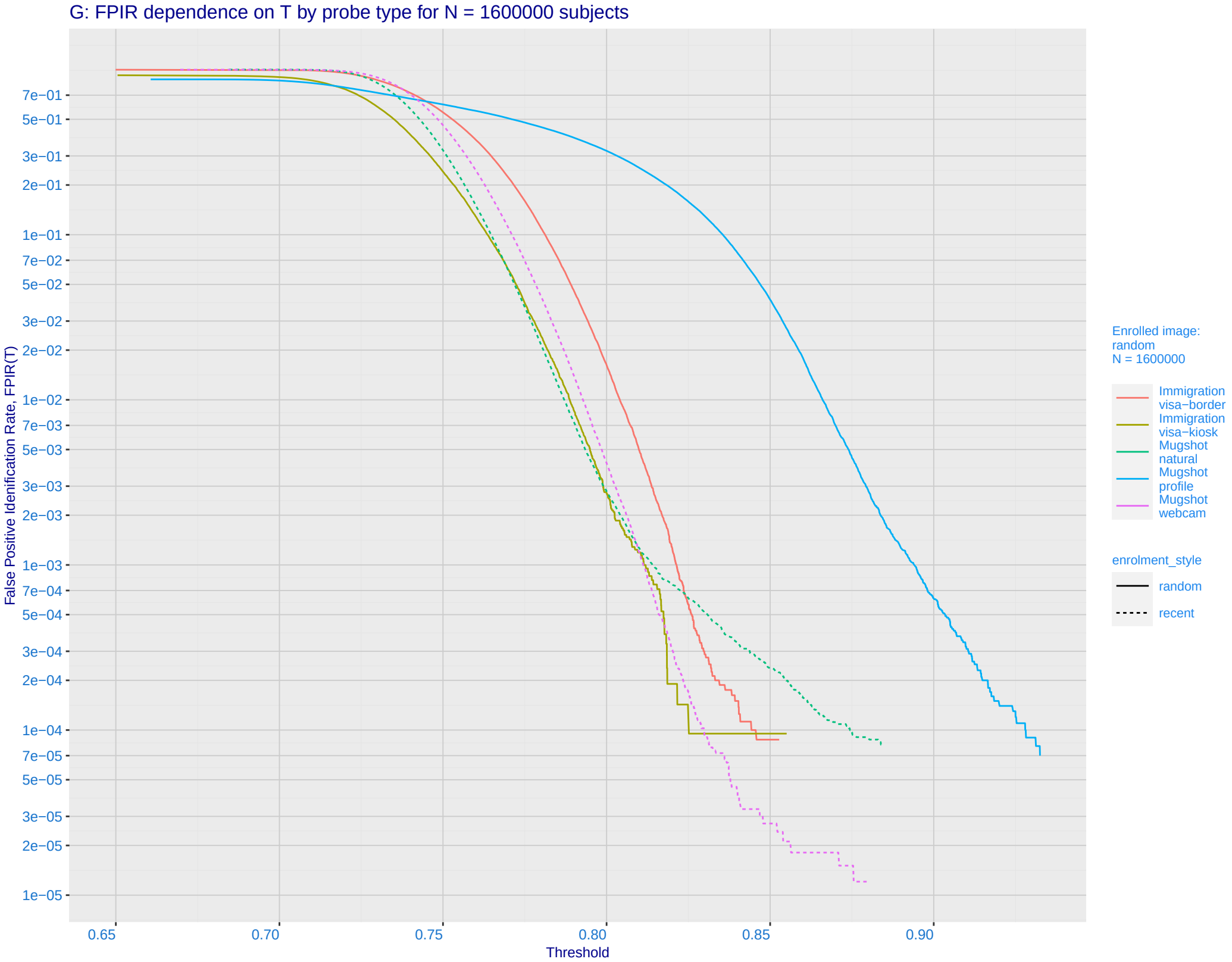

D: 1:N error tradeoff by dataset and enrollment type. N = 1600000 individuals
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
nec_005
vigilantsolutions_007
False negative identification rate, FNIR(T)
False positive identification rate, FPIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e−04
3e−04
1e−03
3e−03
1e−02
3e−02
1e−01
3e−01
1e+00
enrolment_style
random−ONE−MATE
recent−ONE−MATE

E: Dependence of error rates on T by number enrolled identities, N, for Mugshot natural images

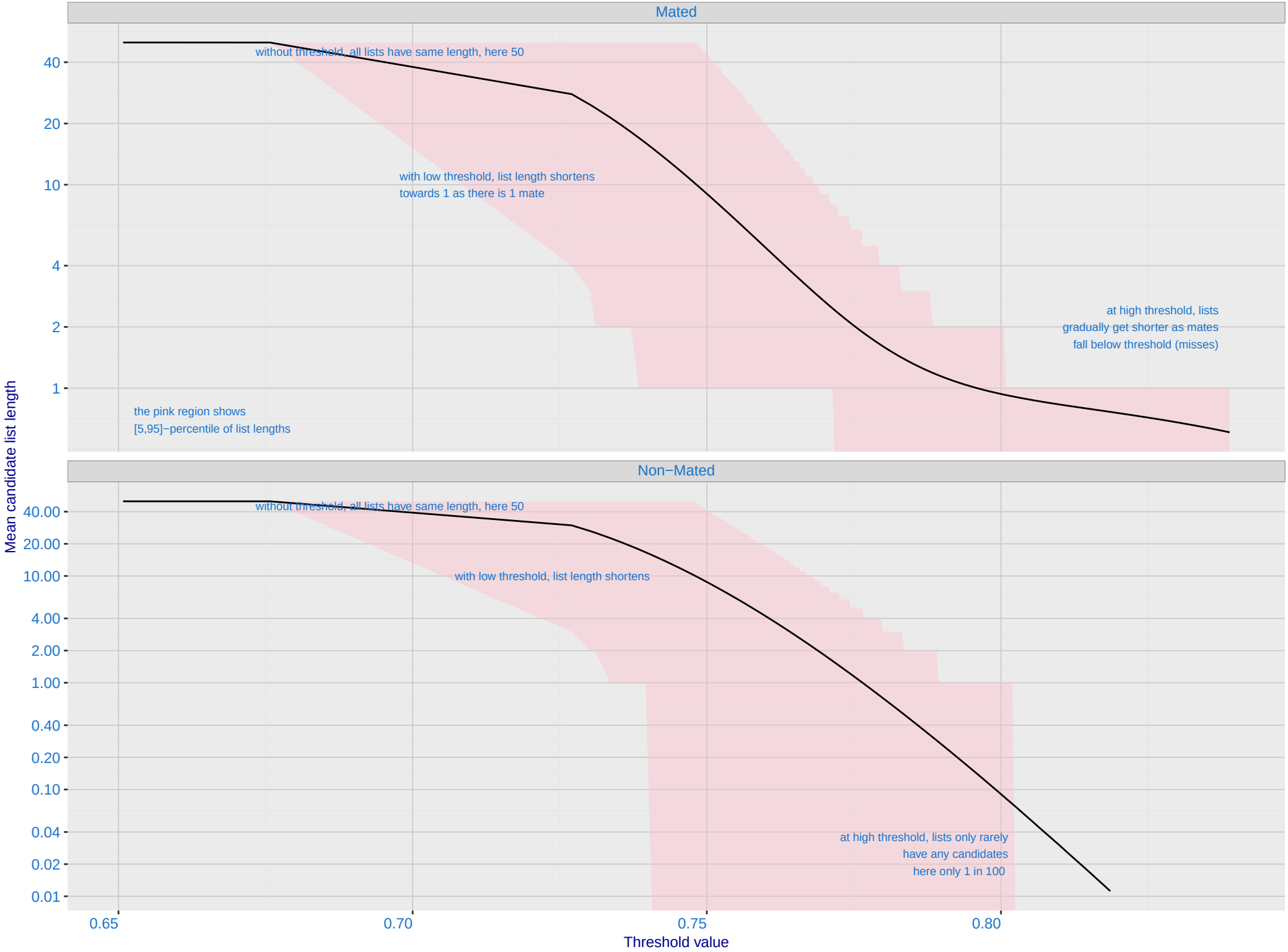


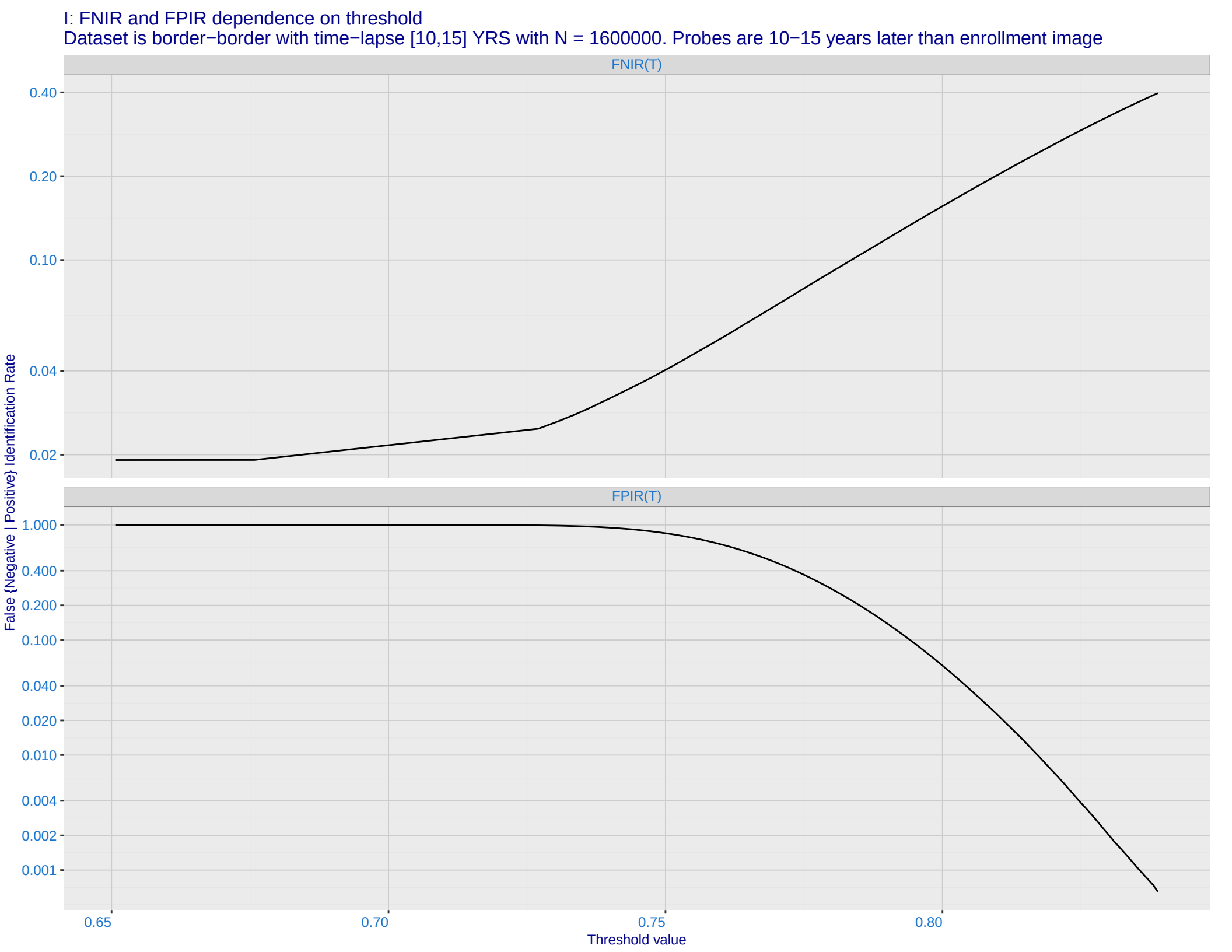
F: FPIR vs. Selectivity for mugshot images, N = 1600000 subjects enrolled with one recent mate



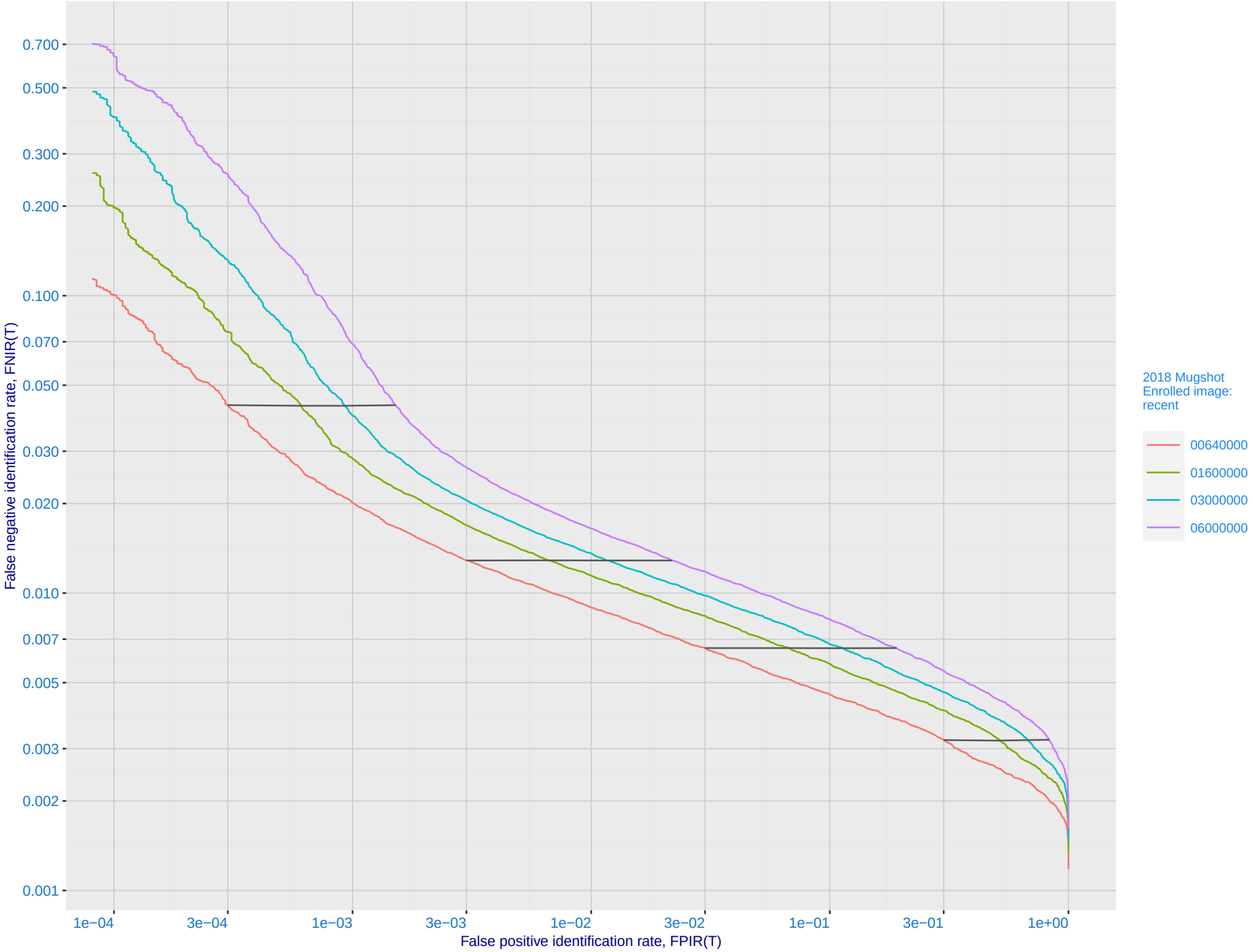

G: FPIR dependence on T by probe type for N = 1600000 subjects
False Positive Idenification Rate, FPIR(T)
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05
5e−05
3e−05
2e−05
1e−05
0.65
0.70
0.75
0.80
0.85
0.90
Threshold
Enrolled image:
random
N = 1600000
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
Mugshot profile
Mugshot webcam
enrolment_style
random
recent

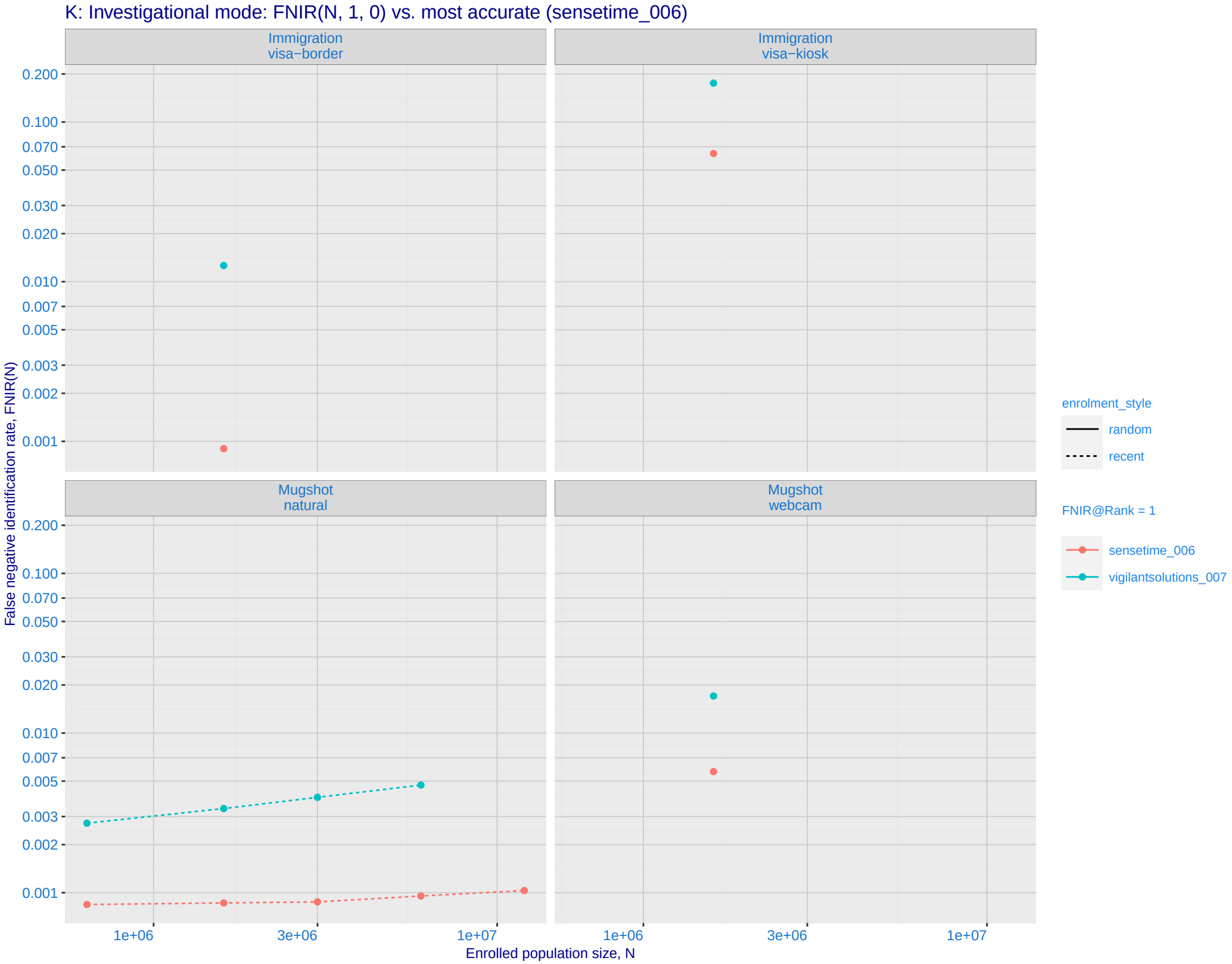
H: Reduced length candidate lists for human review
Dataset is border−border with time−lapse [10,15] YRS with N = 1600000. Probes are 10−15 years later than enrollment image

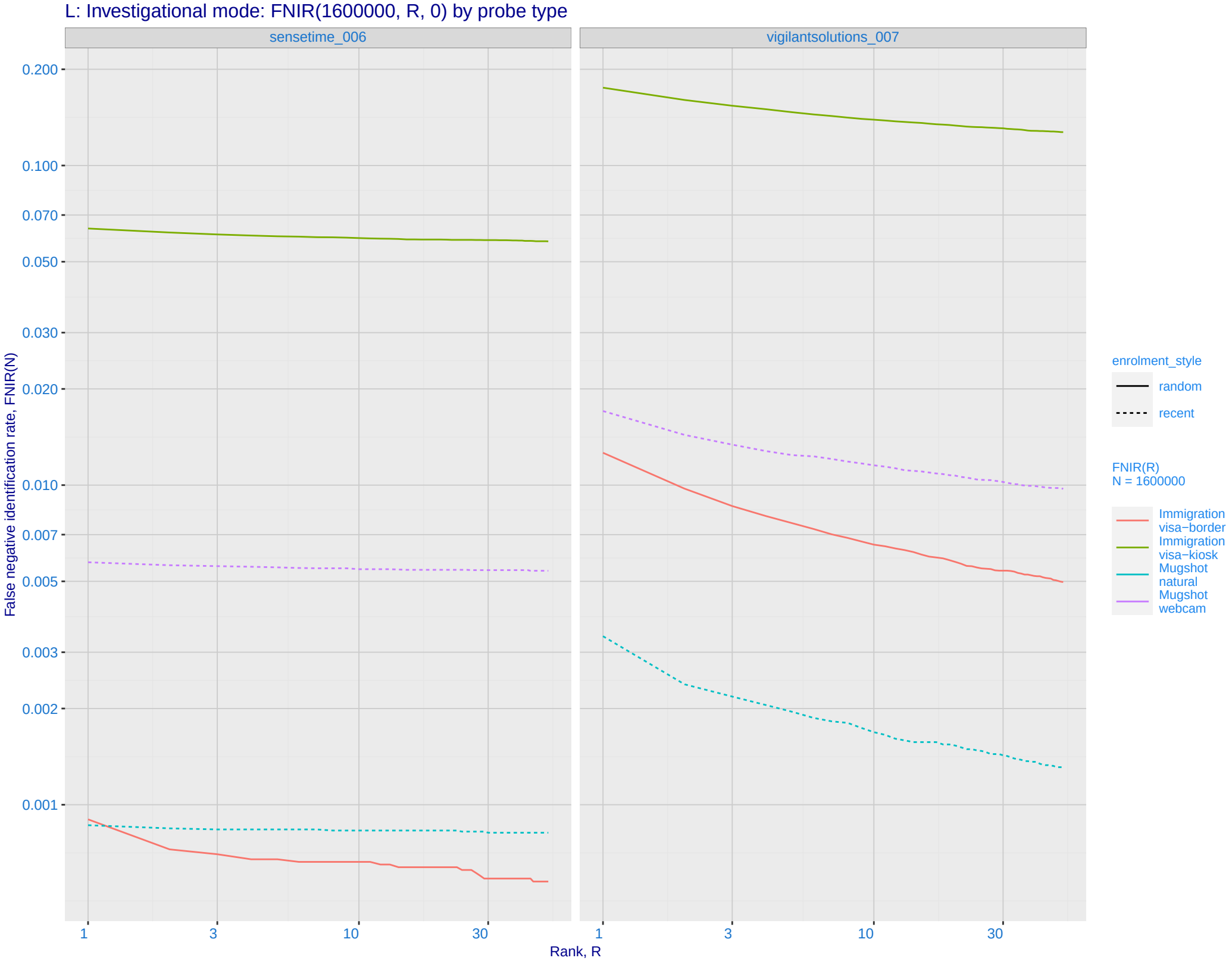



I: FNIR and FPIR dependence on threshold
Dataset is border−border with time−lapse [10,15] YRS with N = 1600000. Probes are 10−15 years later than enrollment image
FNIR(T)
0.40
0.20
0.10
0.04
0.02
FPIR(T)
1.000
0.400
0.200
0.100
0.040
0.020
0.010
0.004
0.002
0.001
False {Negative | Positive} Identification Rate
0.65
0.70
0.75
0.80
Threshold value

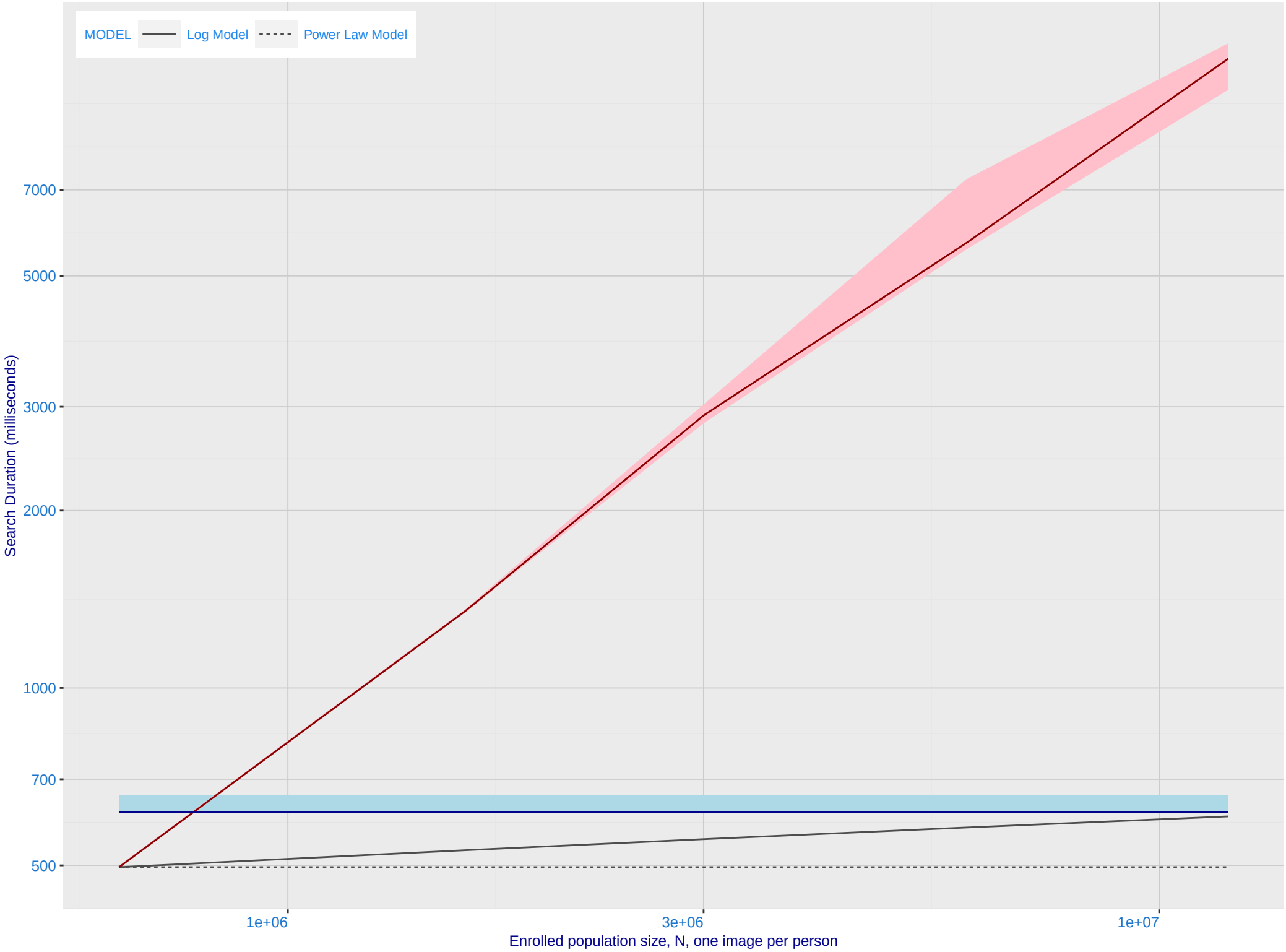
J: DET for Mugshot natural images and various N. Links connect points of equal threshold.




K: Investigational mode: FNIR(N, 1, 0) vs. most accurate (sensetime_006)
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
Mugshot webcam
False negative identification rate, FNIR(N)
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e+06
3e+06
1e+07
Enrolled population size, N
enrolment_style
random
recent
FNIR@Rank = 1
sensetime_006
vigilantsolutions_007


L: Investigational mode: FNIR(1600000, R, 0) by probe type
sensetime_006
vigilantsolutions_007
False negative identification rate, FNIR(N)
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1
3
10
30
Rank, R
enrolment_style
random
recent
FNIR(R)
N = 1600000
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
Mugshot webcam

M: Template duration; search duration vs. N. The blue and pink ribbon covers 95 percent of observed measurements.
The template generation time is independent of N. The log and power−law models are fit to the first two (N,T) observations



O: FNIR(T, N = 1.6 million) by sex, age and time−lapse. The top row gives investigational rank−1 miss rates.
The bottom panels give high threshold for more lights−out identification with low FPIR.

Algorithm: vigilantsolutions_007, Dataset: Border−Crossing Ageing N = 1600000
Text encodes FNIR, Color encodes log(FNIR)

−3 −2 −1

FNIR(R=1, T=0)

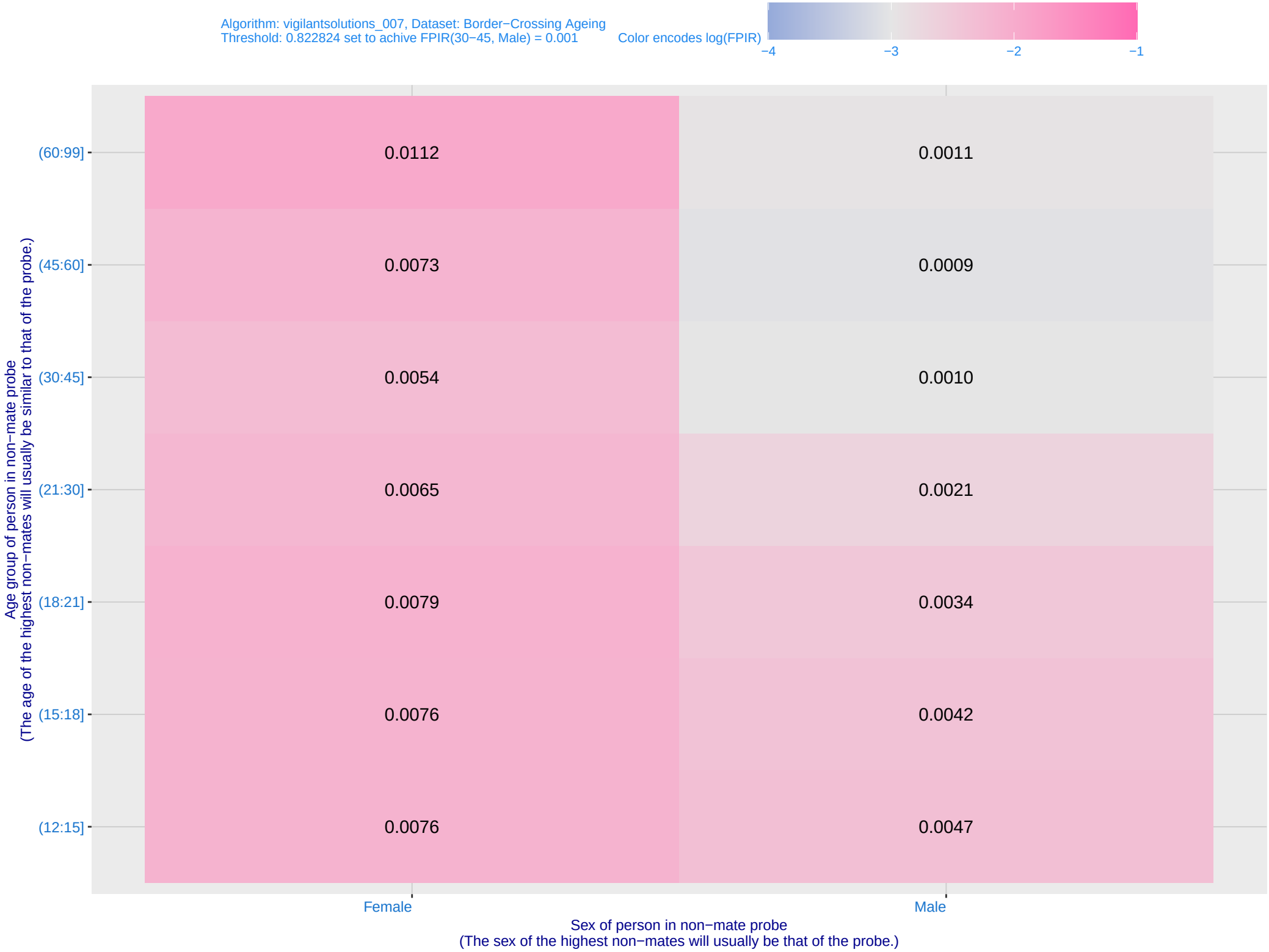
Age group at time of enrollment	Female 10	Female 11	Female 12	Female 13	Female 14	Female 15	Male 10	Male 11	Male 12	Male 13	Male 14	Male 15
(60:99]	0.067	0.071	0.085	0.087	0.101	0.096	0.043	0.044	0.045	0.049	0.047	0.056
(45:60]	0.061	0.063	0.072	0.082	0.092	0.101	0.032	0.033	0.036	0.042	0.044	0.046
(30:45]	0.062	0.064	0.071	0.081	0.089	0.088	0.029	0.027	0.032	0.037	0.040	0.038
(21:30]	0.085	0.081	0.088	0.101	0.104	0.107	0.036	0.035	0.038	0.043	0.049	0.045
(18:21]	0.135	0.131	0.134	0.151	0.149	0.172	0.070	0.064	0.074	0.082	0.089	0.098
(15:18]	0.169	0.157	0.168	0.184	0.188	0.147	0.138	0.135	0.142	0.170	0.177	0.176
(12:15]	0.201	0.180	0.186	0.221	0.219	0.181	0.252	0.237	0.284	0.295	0.297	0.333

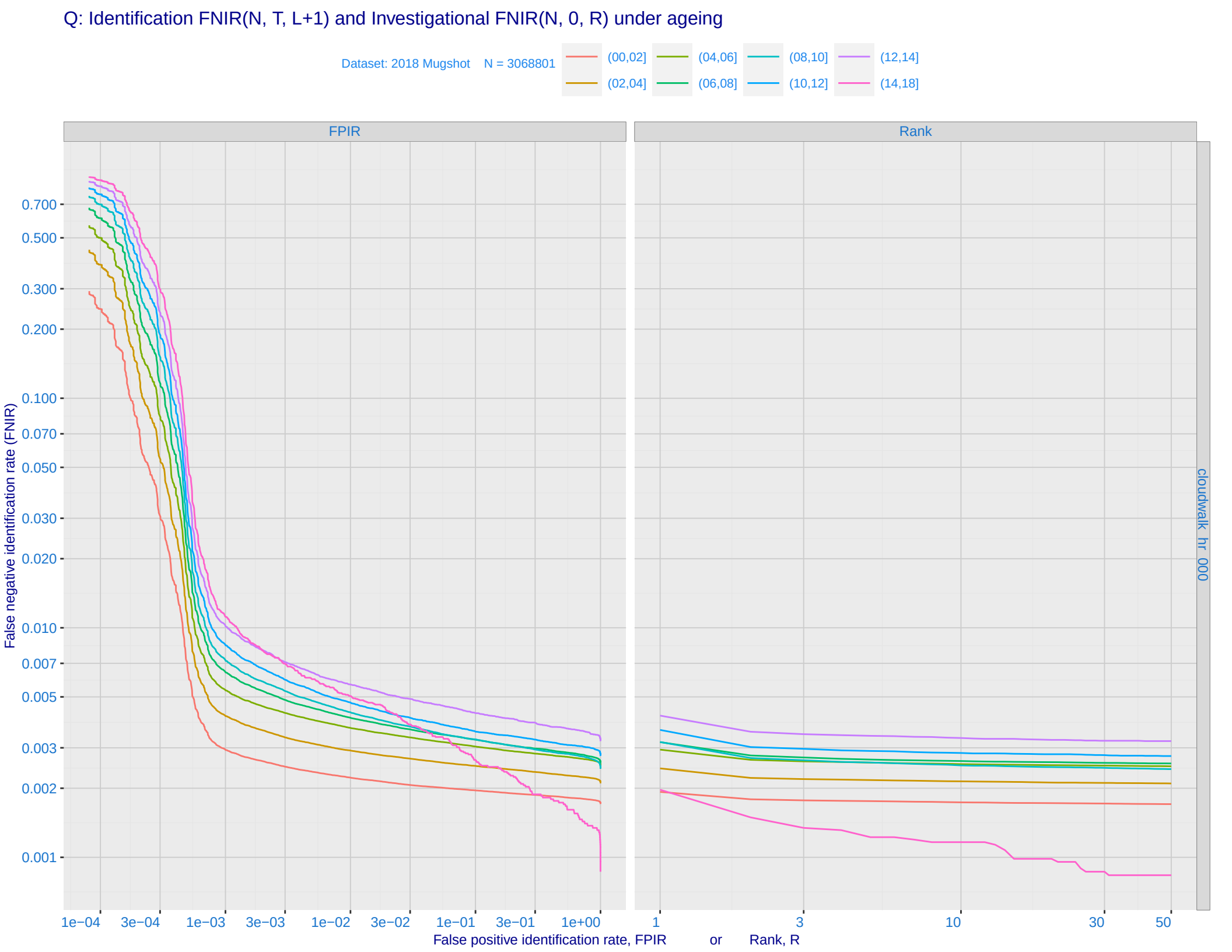
FNIR(R=50, T=0.822824), FPIR(30−45, Male) = 0.001

Age group at time of enrollment	Female 10	Female 11	Female 12	Female 13	Female 14	Female 15	Male 10	Male 11	Male 12	Male 13	Male 14	Male 15
(60:99]	0.230	0.237	0.271	0.286	0.327	0.353	0.192	0.200	0.220	0.250	0.263	0.308
(45:60]	0.219	0.224	0.249	0.279	0.309	0.323	0.164	0.175	0.200	0.225	0.245	0.250
(30:45]	0.248	0.254	0.278	0.308	0.338	0.339	0.160	0.163	0.190	0.219	0.248	0.244
(21:30]	0.303	0.302	0.325	0.353	0.370	0.373	0.199	0.201	0.233	0.264	0.297	0.289
(18:21]	0.422	0.410	0.424	0.465	0.475	0.462	0.361	0.356	0.385	0.435	0.466	0.507
(15:18]	0.495	0.471	0.500	0.525	0.548	0.482	0.530	0.534	0.573	0.611	0.650	0.688
(12:15]	0.554	0.537	0.556	0.584	0.601	0.534	0.705	0.690	0.736	0.770	0.790	0.775

Time between probe and enrollment (years)

P: FPIR(N = 1.6 million) by sex and age. It is typical for false positive identification rates to be higher in women except in their teens.




Q: Identification FNIR(N, T, L+1) and Investigational FNIR(N, 0, R) under ageing
Dataset: 2018 Mugshot N = 3068801
(00,02]
(02,04]
(04,06]
(06,08]
(08,10]
(10,12]
(12,14]
(14,18]
FPIR
Rank
cloudwalk_hr_000
False negative identification rate (FNIR)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e−04
3e−04
1e−03
3e−03
1e−02
3e−02
1e−01
3e−01
1e+00
1
3
10
30
50
False positive identification rate, FPIR or Rank, R