A: Datasheet

Algorithm: qnap_000

Developer: Qnap Security

Submission Date: 2021_07_28

Template size: 2048 bytes

Template time (2.5 percentile): 455 msec

Template time (median): 457 msec

Template time (97.5 percentile): 464 msec

Investigation:

Frontal mugshot ranking 165 (out of 329) −− FNIR(1600000, 0, 1) = 0.0078 vs. lowest 0.0009 from sensetime_006

Mugshot webcam ranking 166 (out of 291) −− FNIR(1600000, 0, 1) = 0.0274 vs. lowest 0.0057 from sensetime_006

Mugshot profile ranking 97 (out of 260) −− FNIR(1600000, 0, 1) = 0.5217 vs. lowest 0.0550 from sensetime_006

Immigration visa−border ranking 125 (out of 218) −− FNIR(1600000, 0, 1) = 0.0132 vs. lowest 0.0009 from sensetime_006

Immigration visa−kiosk ranking 124 (out of 215) −− FNIR(1600000, 0, 1) = 0.1582 vs. lowest 0.0487 from cubox_000

Identification:

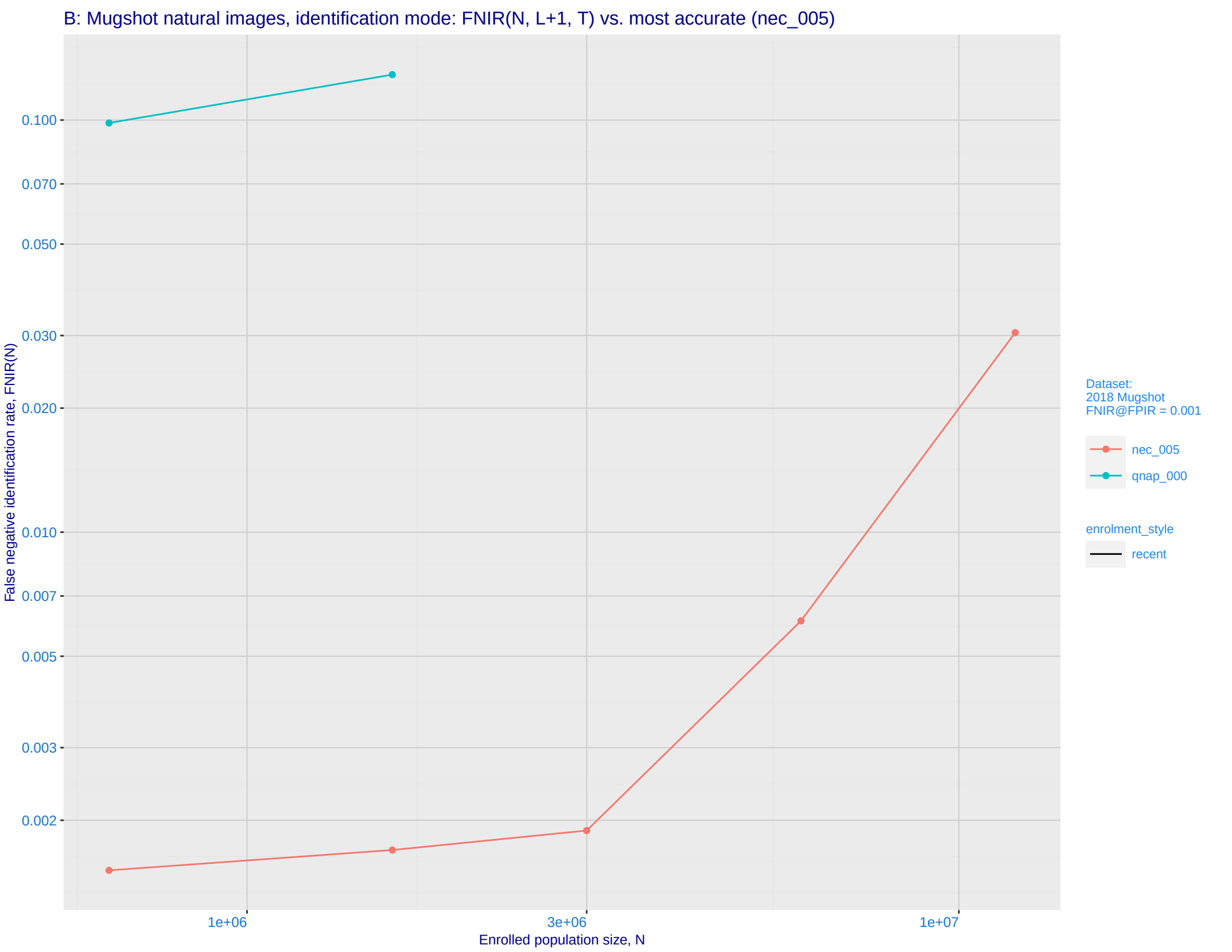
Frontal mugshot ranking 210 (out of 329) −− FNIR(1600000, T, L+1) = 0.1289, FPIR=0.001000 vs. lowest 0.0017 from nec_005

Mugshot webcam ranking 196 (out of 289) −− FNIR(1600000, T, L+1) = 0.2379, FPIR=0.001000 vs. lowest 0.0120 from nec_005

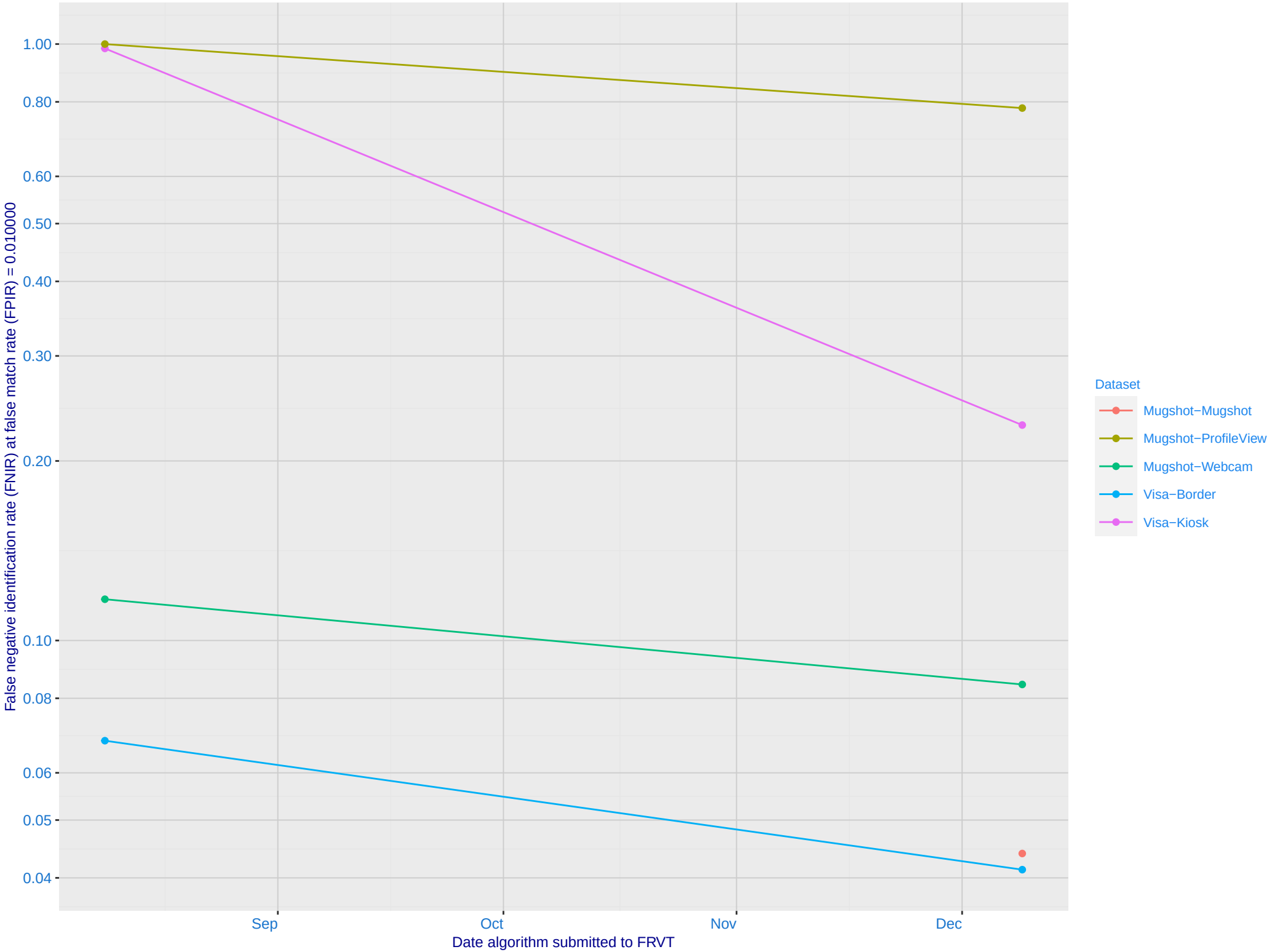
Mugshot profile ranking 248 (out of 259) −− FNIR(1600000, T, L+1) = 1.0000, FPIR=0.001000 vs. lowest 0.1331 from cloudwalk_hr_000

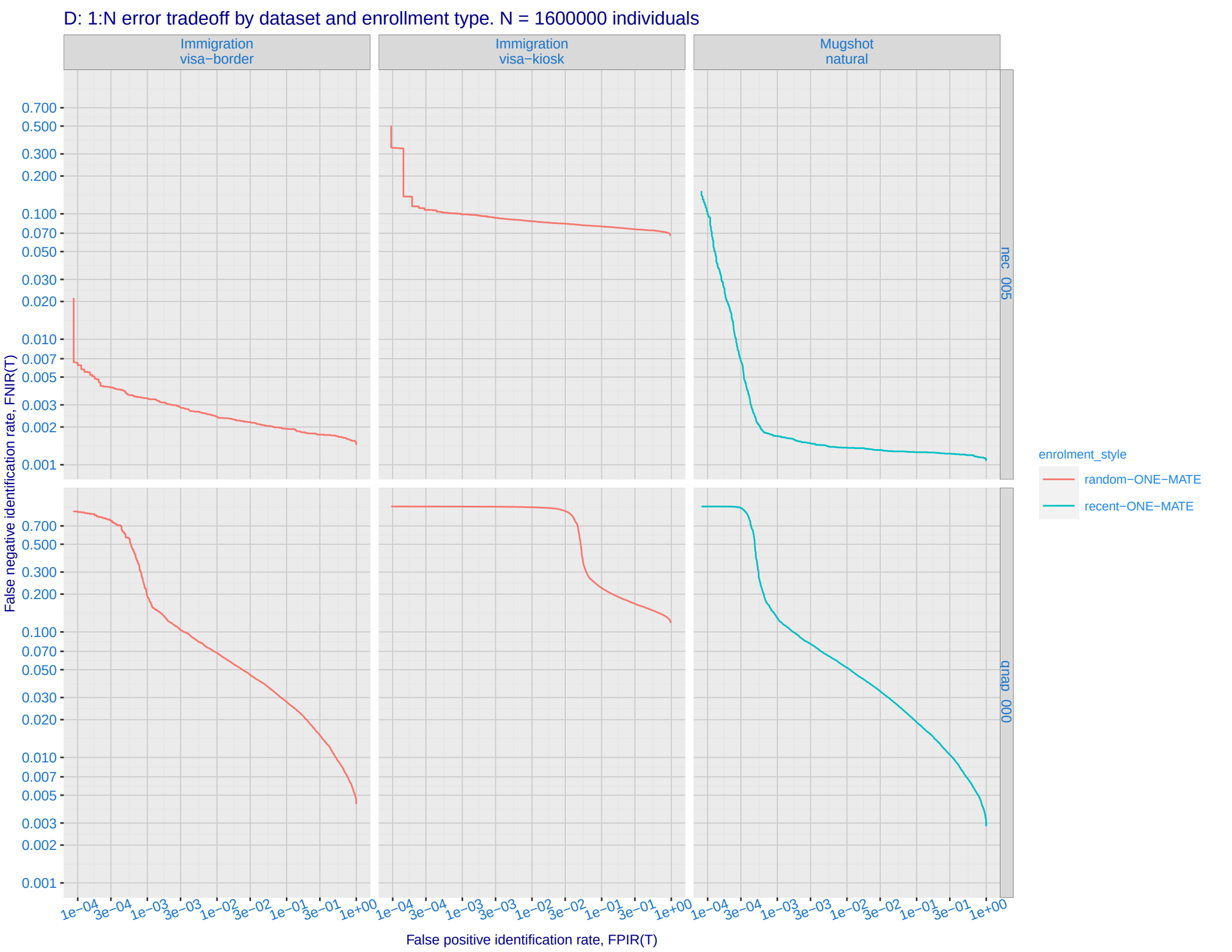
Immigration visa−border ranking 146 (out of 217) −− FNIR(1600000, T, L+1) = 0.1908, FPIR=0.001000 vs. lowest 0.0032 from paravision_009

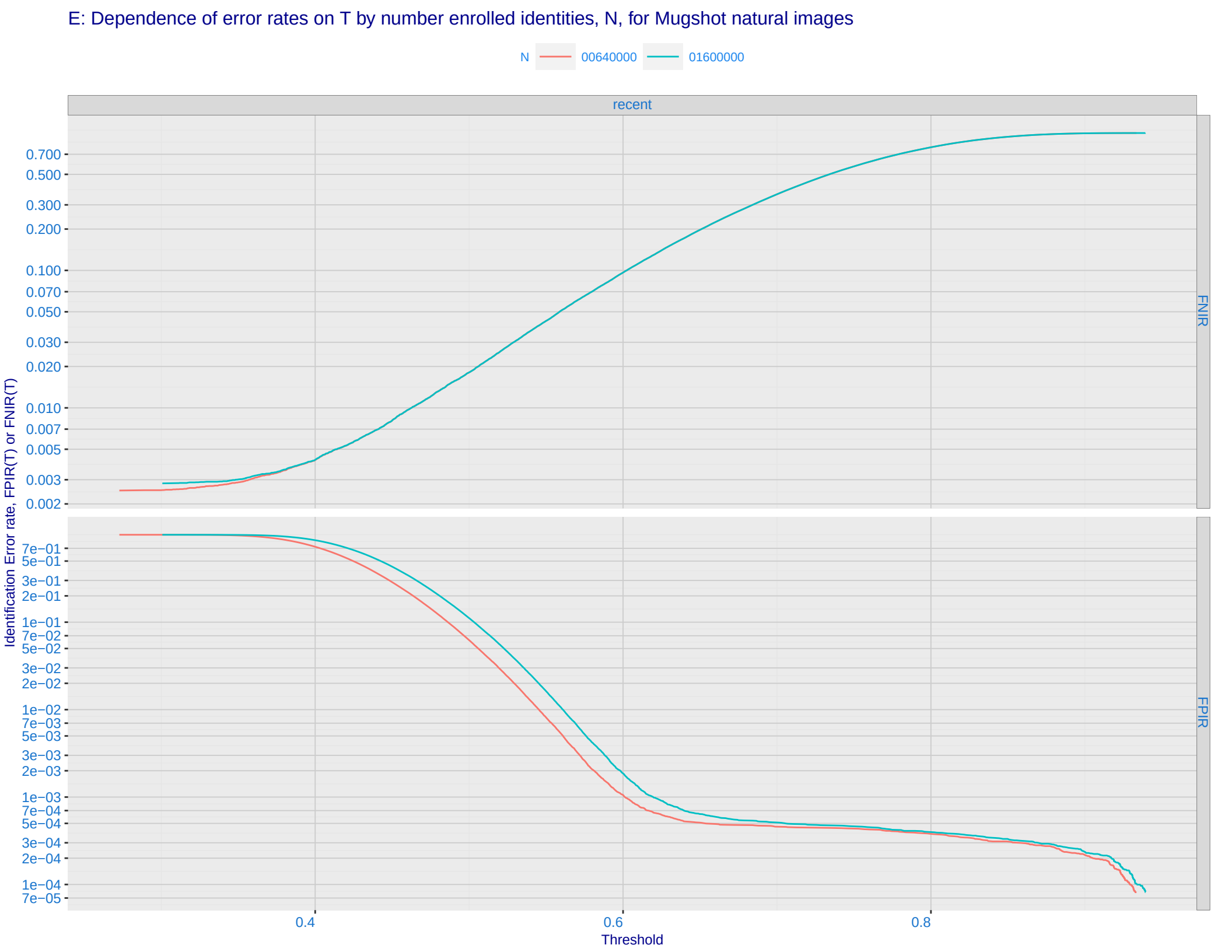
Immigration visa−kiosk ranking 188 (out of 212) −− FNIR(1600000, T, L+1) = 0.9980, FPIR=0.001000 vs. lowest 0.0728 from paravision_009

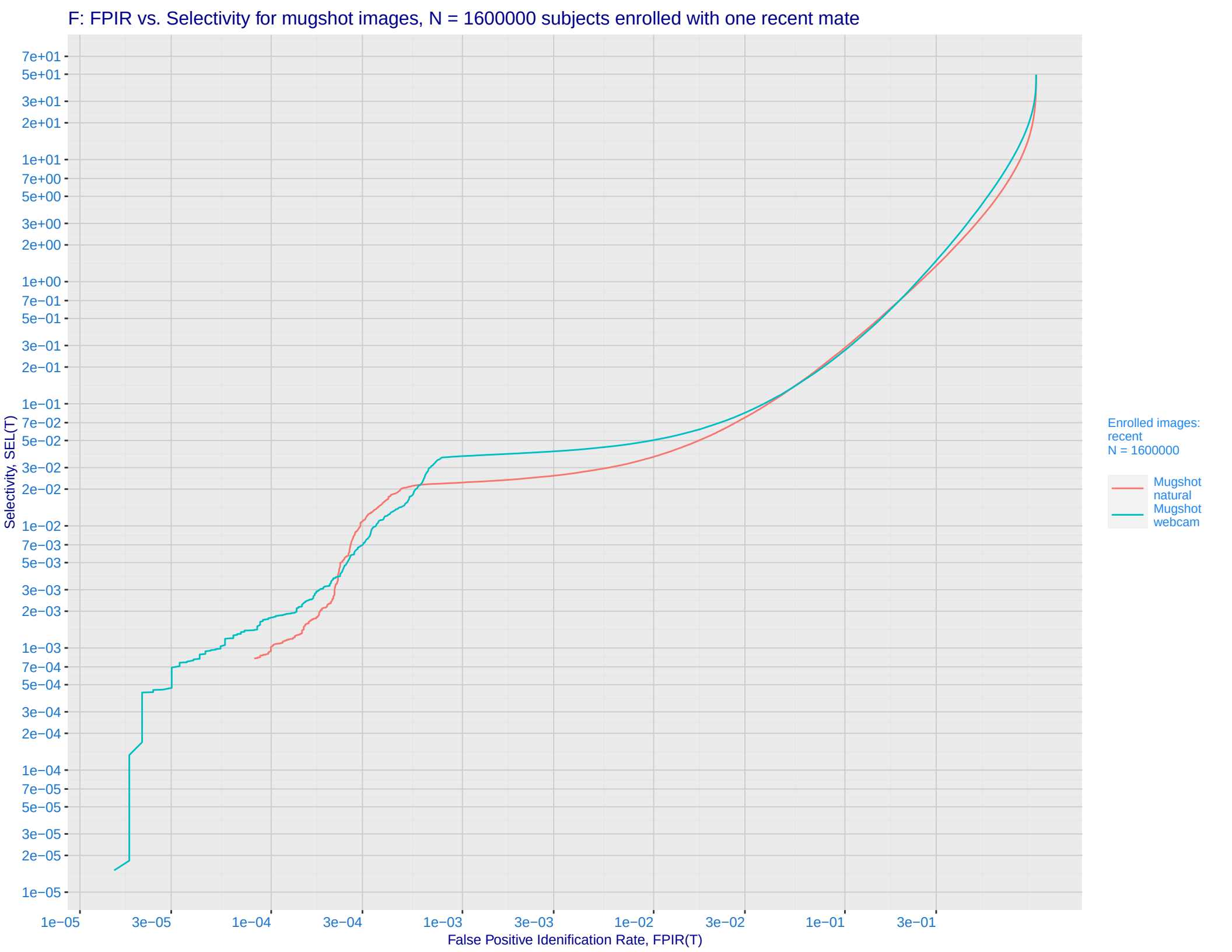

B: Mugshot natural images, identification mode: FNIR(N, L+1, T) vs. most accurate (nec_005)
False negative identification rate, FNIR(N)
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
1e+06
3e+06
1e+07
Enrolled population size, N
Dataset:
2018 Mugshot
FNIR@FPIR = 0.001
nec_005
qnap_000
enrolment_style
recent

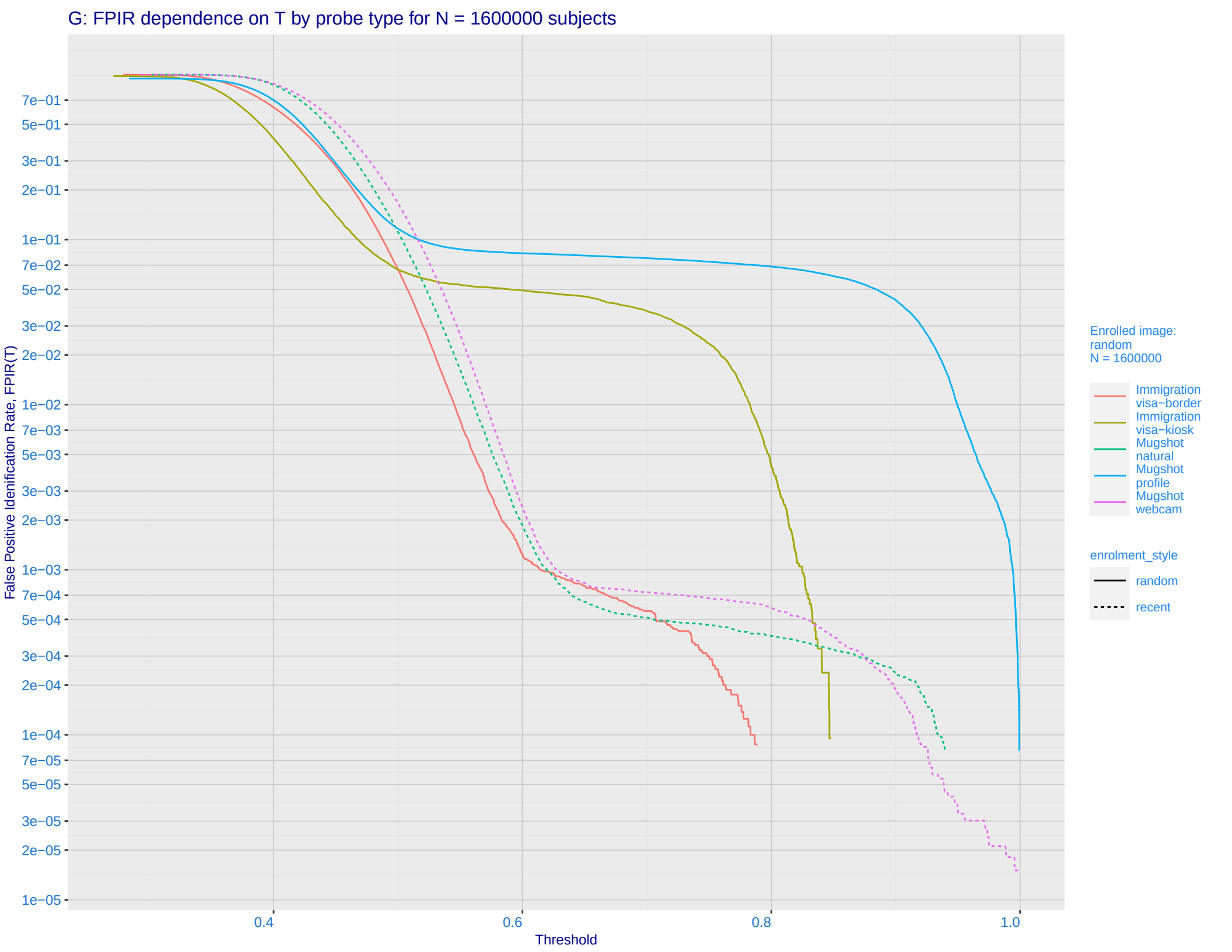
C: Evolution of accuracy for QNAP algorithms on three datasets 2018 − present

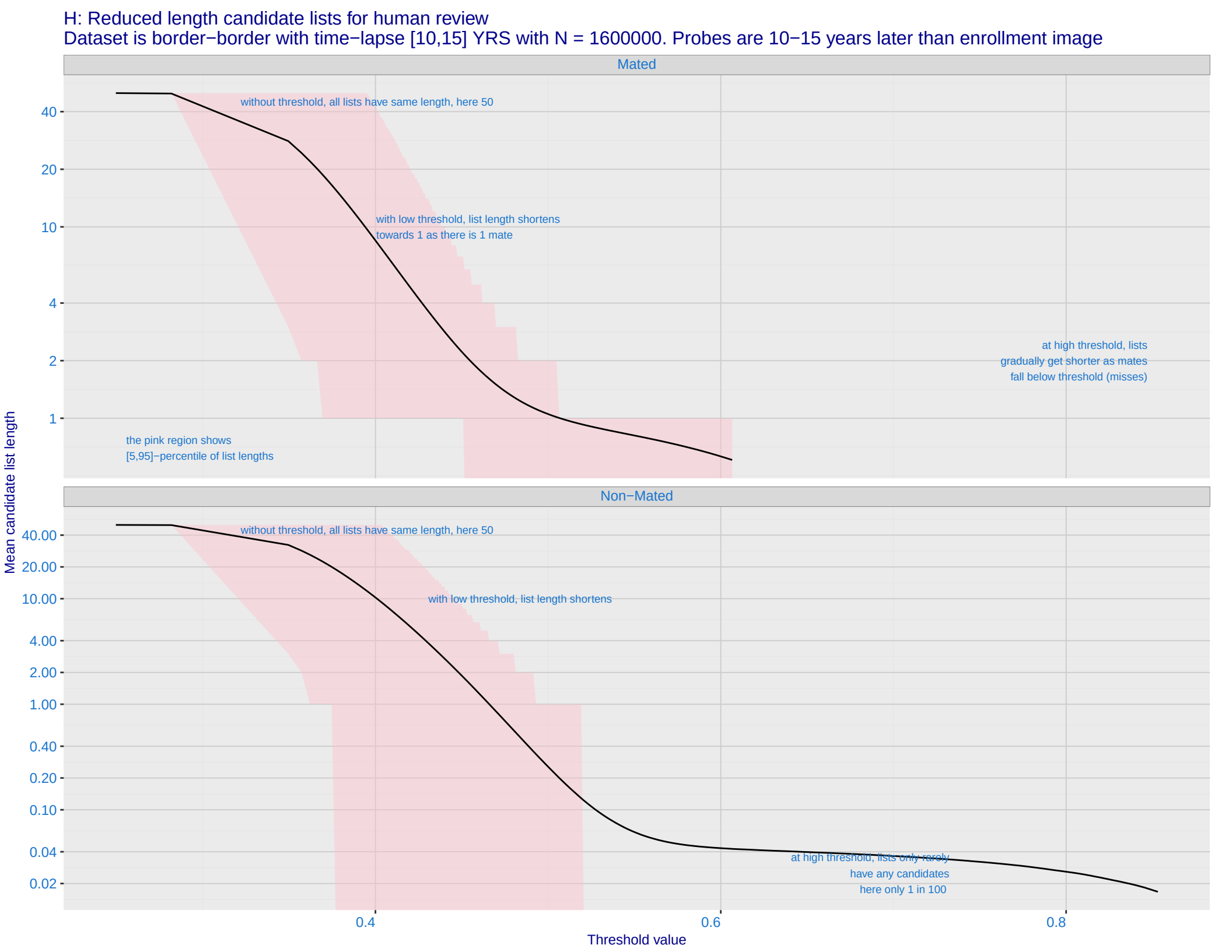


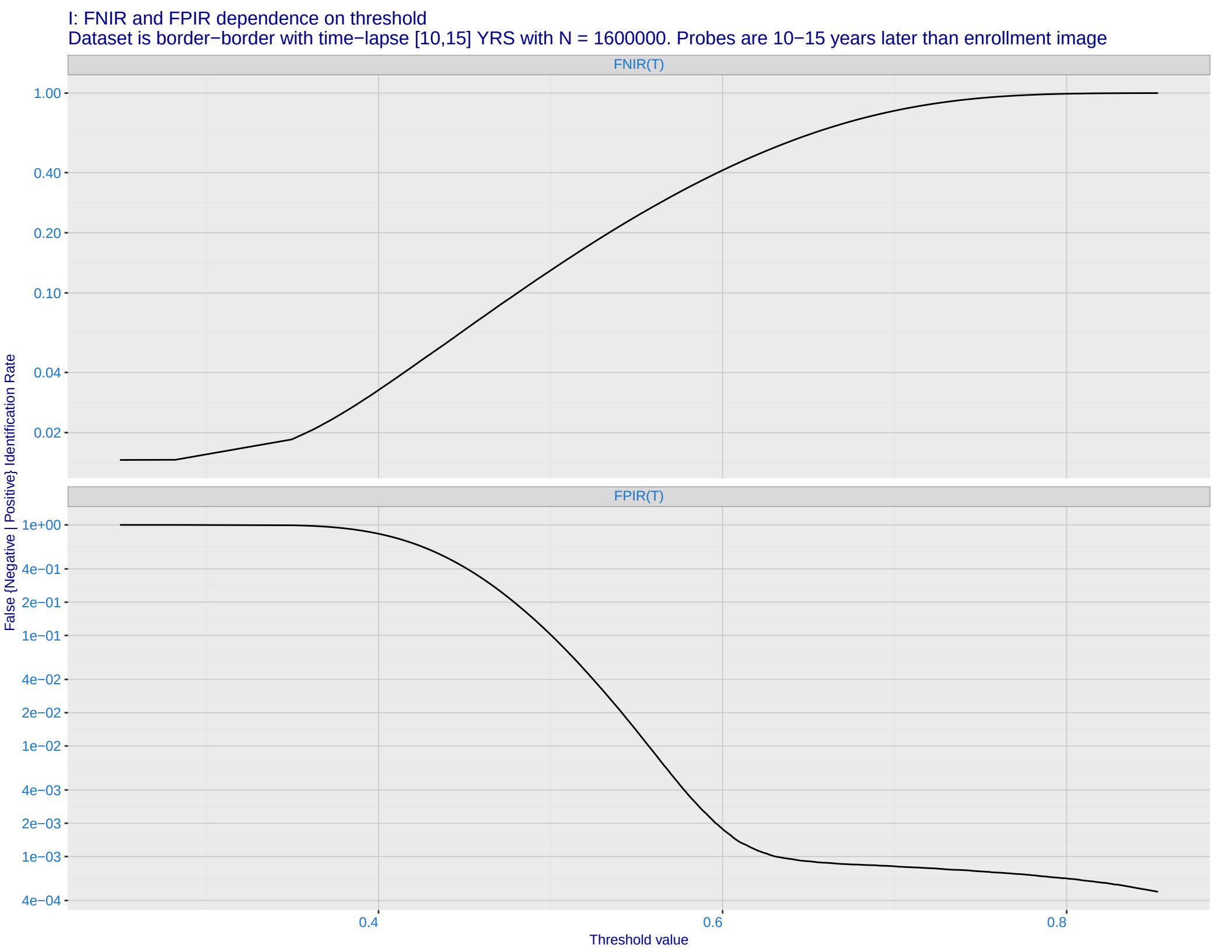

D: 1:N error tradeoff by dataset and enrollment type. N = 1600000 individuals
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
nec_005
qnap_000
False negative identification rate, FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e−04
3e−04
1e−03
3e−03
1e−02
3e−02
1e−01
3e−01
1e+00
False positive identification rate, FPIR(T)
enrolment_style
random−ONE−MATE
recent−ONE−MATE

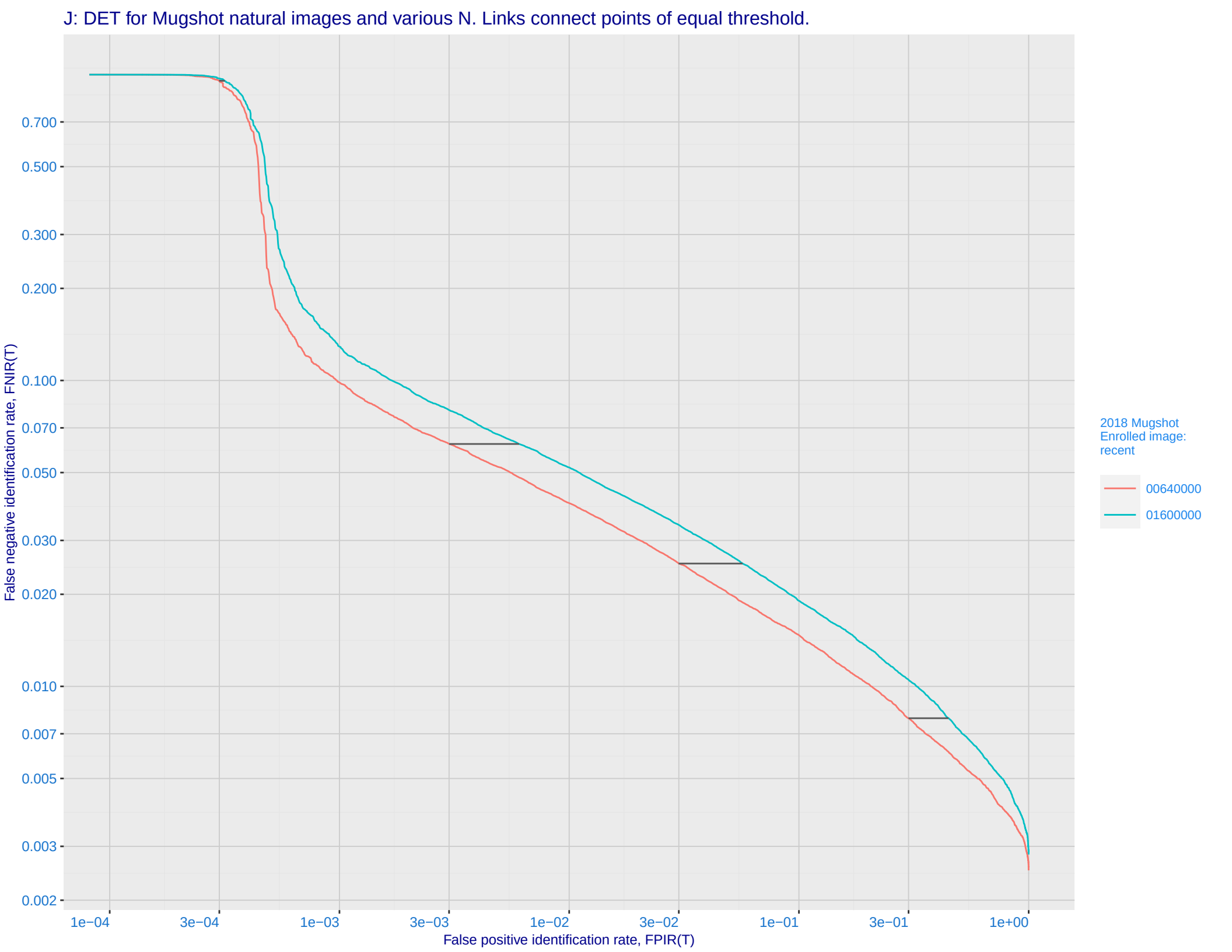

E: Dependence of error rates on T by number enrolled identities, N, for Mugshot natural images
N
00640000
01600000
recent
FNIR
FPIR
Identification Error rate, FPIR(T) or FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
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
0.4
0.6
0.8
Threshold

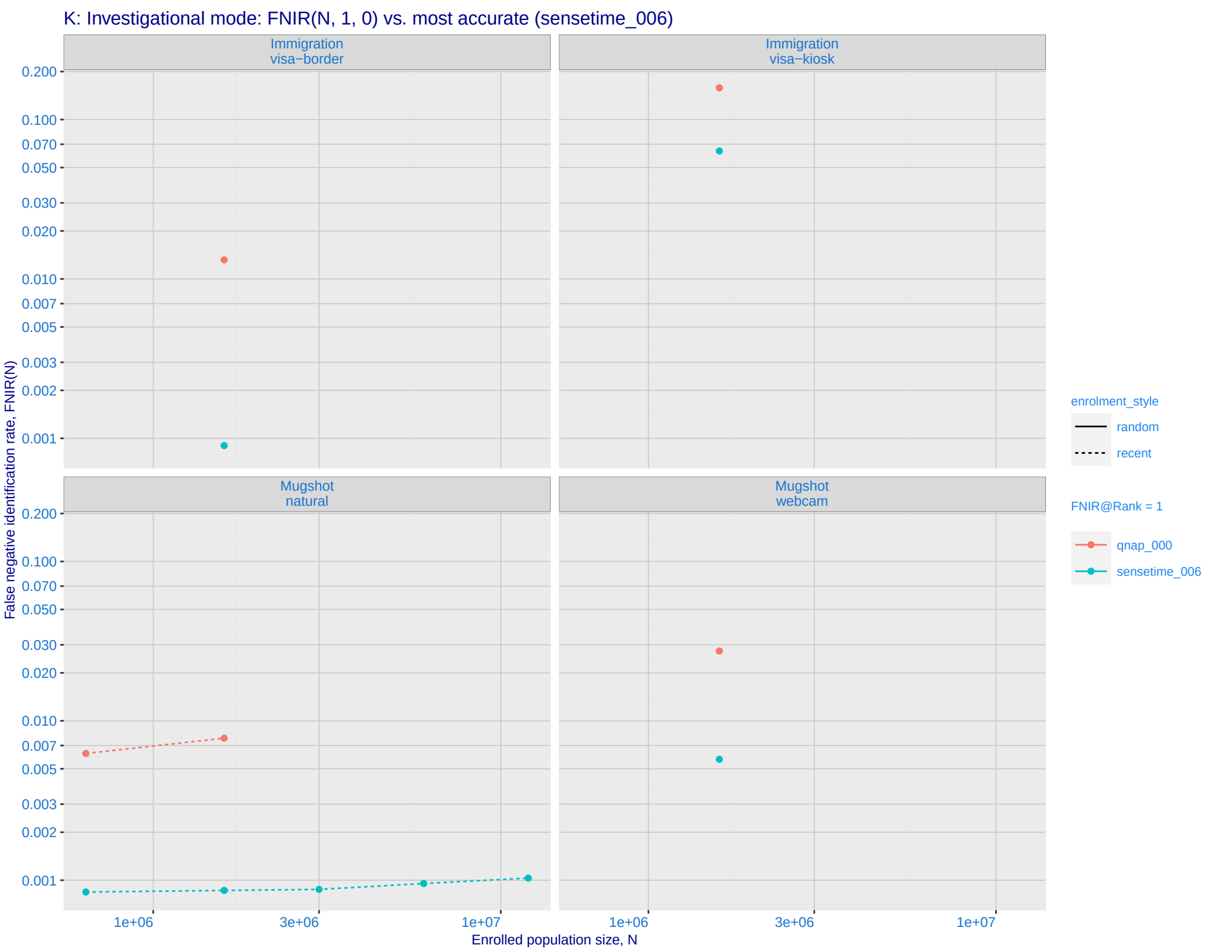

F: FPIR vs. Selectivity for mugshot images, N = 1600000 subjects enrolled with one recent mate
Selectivity, SEL(T)
7e+01
5e+01
3e+01
2e+01
1e+01
7e+00
5e+00
3e+00
2e+00
1e+00
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05
5e−05
3e−05
2e−05
1e−05
1e−05
3e−05
1e−04
3e−04
1e−03
3e−03
1e−02
3e−02
1e−01
3e−01
False Positive Idenification Rate, FPIR(T)
Enrolled images:
recent
N = 1600000
Mugshot
natural
Mugshot
webcam

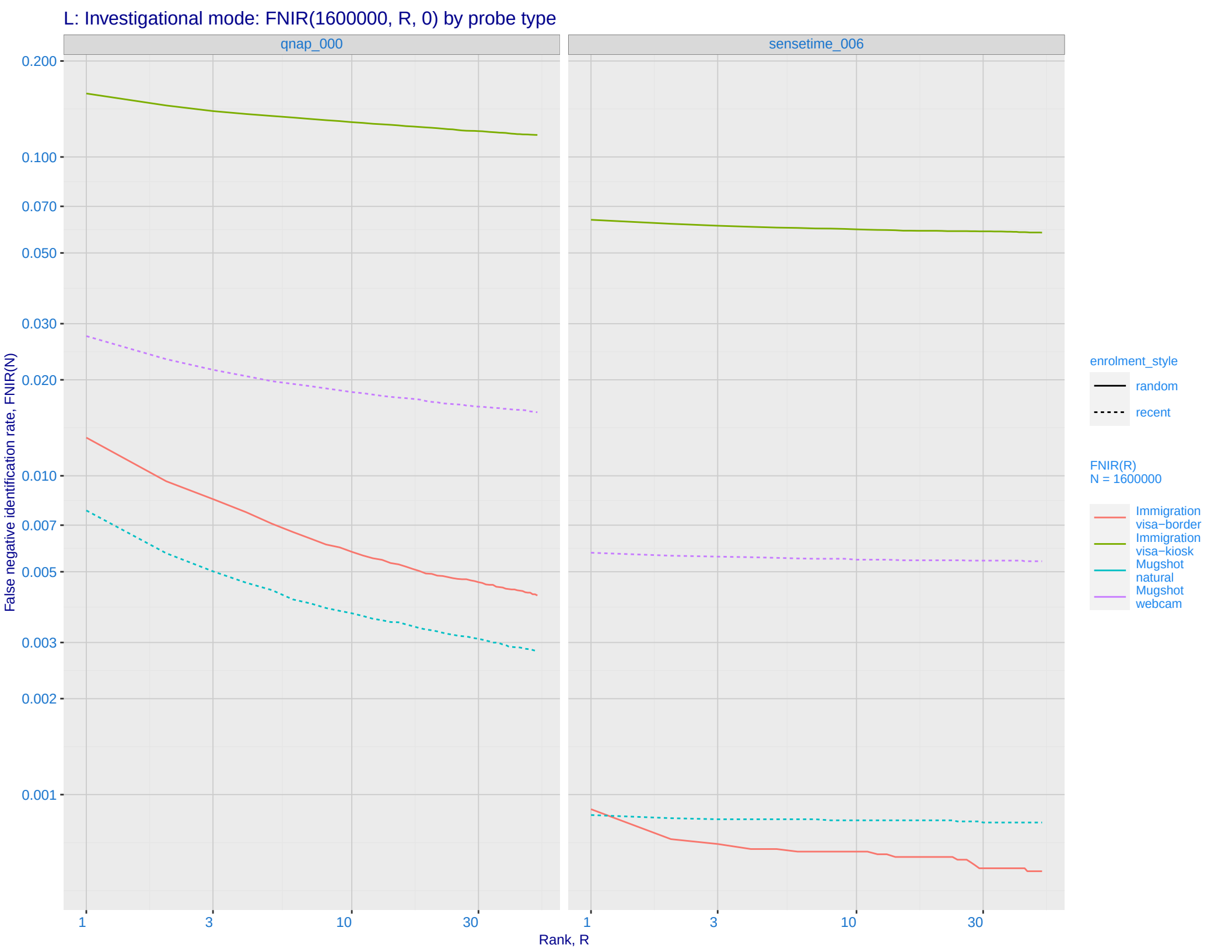

G: FPIR dependence on T by probe type for N = 1600000 subjects
False Positive Idenification Rate, FPIR(T)
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05
5e−05
3e−05
2e−05
1e−05
0.4
0.6
0.8
1.0
Threshold
Enrolled image:
random
N = 1600000
Immigration
visa−border
Immigration
visa−kiosk
Mugshot
natural
Mugshot
profile
Mugshot
webcam
enrolment_style
random
recent

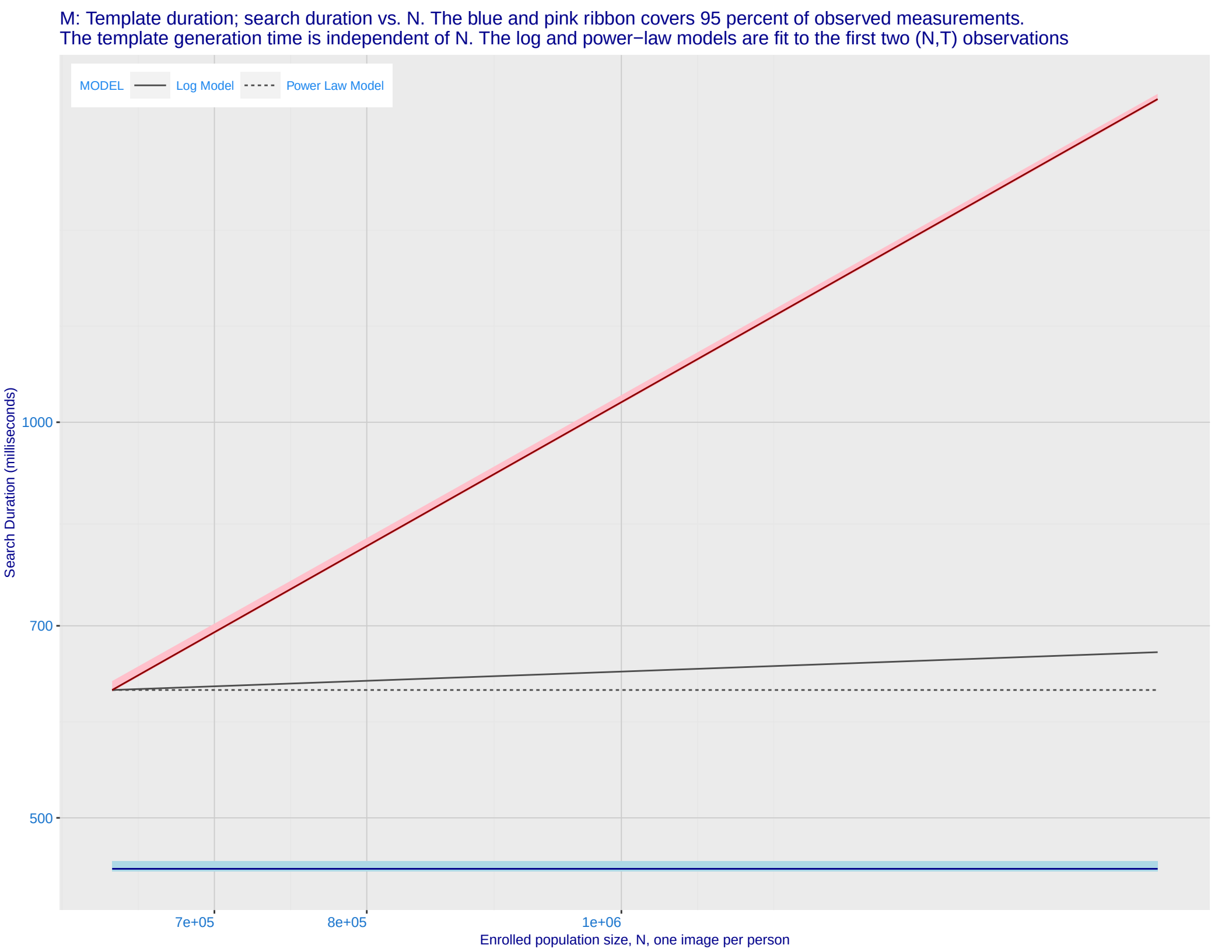

H: Reduced length candidate lists for human review
Dataset is border−border with time−lapse [10,15] YRS with N = 1600000. Probes are 10−15 years later than enrollment image
Mated
without threshold, all lists have same length, here 50
with low threshold, list length shortens
towards 1 as there is 1 mate
at high threshold, lists
gradually get shorter as mates
fall below threshold (misses)
the pink region shows
[5,95]−percentile of list lengths
Non−Mated
without threshold, all lists have same length, here 50
with low threshold, list length shortens
at high threshold, lists only rarely
have any candidates
here only 1 in 100
Mean candidate list length
Threshold value

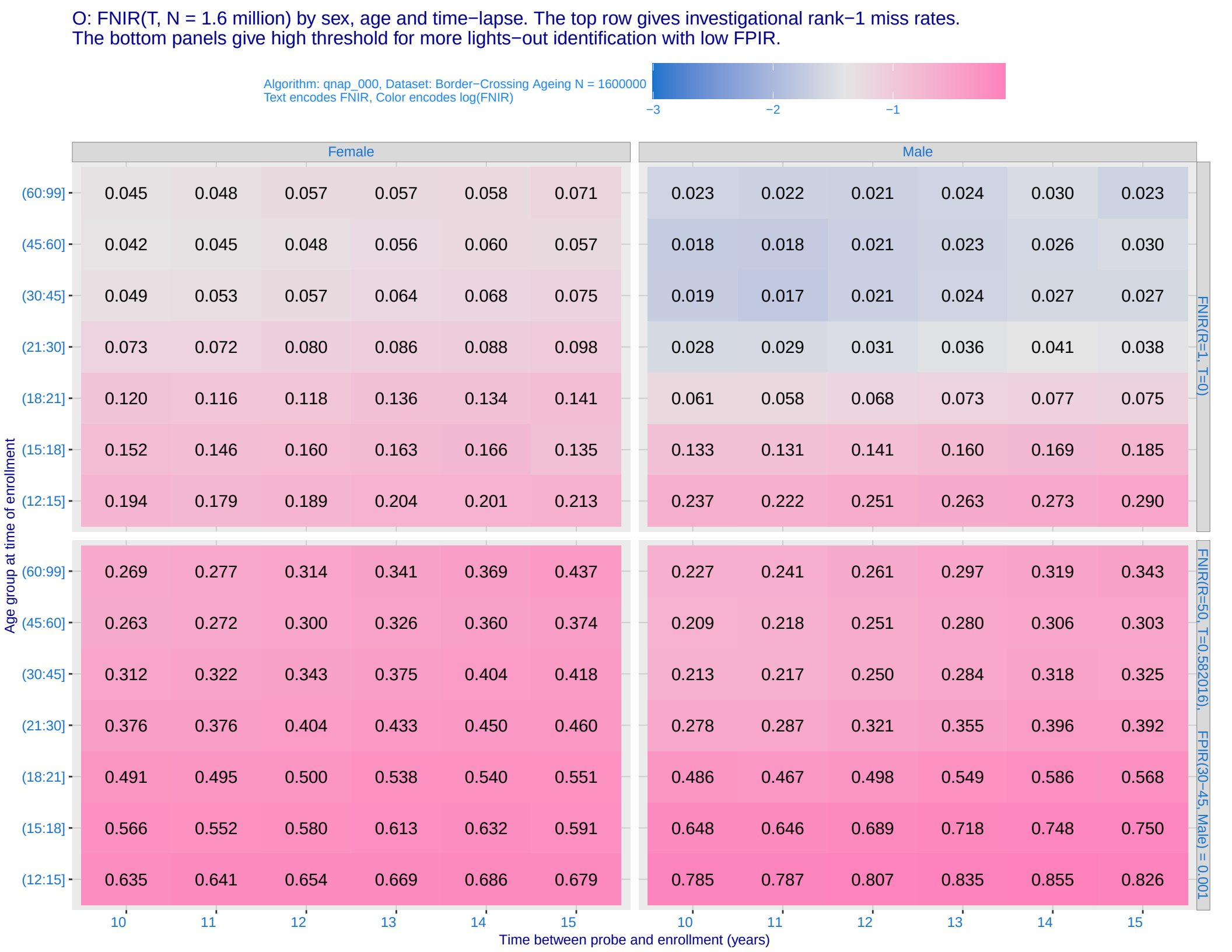

I: FNIR and FPIR dependence on threshold
Dataset is border−border with time−lapse [10,15] YRS with N = 1600000. Probes are 10−15 years later than enrollment image
FNIR(T)
1.00
0.40
0.20
0.10
0.04
0.02
FPIR(T)
1e+00
4e−01
2e−01
1e−01
4e−02
2e−02
1e−02
4e−03
2e−03
1e−03
4e−04
False {Negative | Positive} Identification Rate
0.4
0.6
0.8
Threshold value


J: DET for Mugshot natural images and various N. Links connect points of equal threshold.
False negative identification rate, FNIR(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
1e−04
3e−04
1e−03
3e−03
1e−02
3e−02
1e−01
3e−01
1e+00
False positive identification rate, FPIR(T)
2018 Mugshot
Enrolled image:
recent
00640000
01600000

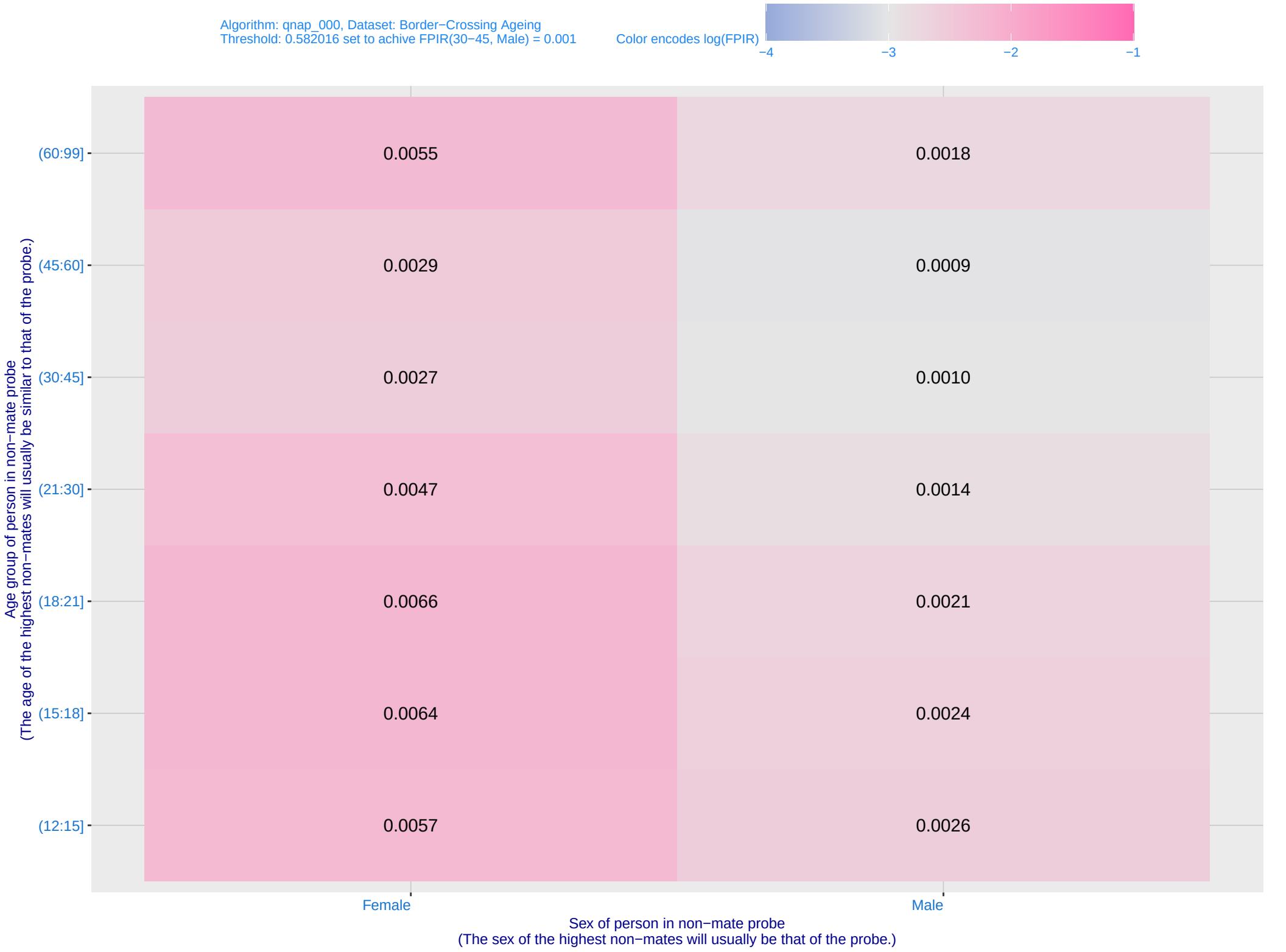

K: Investigational mode: FNIR(N, 1, 0) vs. most accurate (sensetime_006)
Immigration
visa−border
Immigration
visa−kiosk
Mugshot
natural
Mugshot
webcam
False negative identification rate, FNIR(N)
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e+06
3e+06
1e+07
Enrolled population size, N
enrolment_style
random
recent
FNIR@Rank = 1
qnap_000
sensetime_006

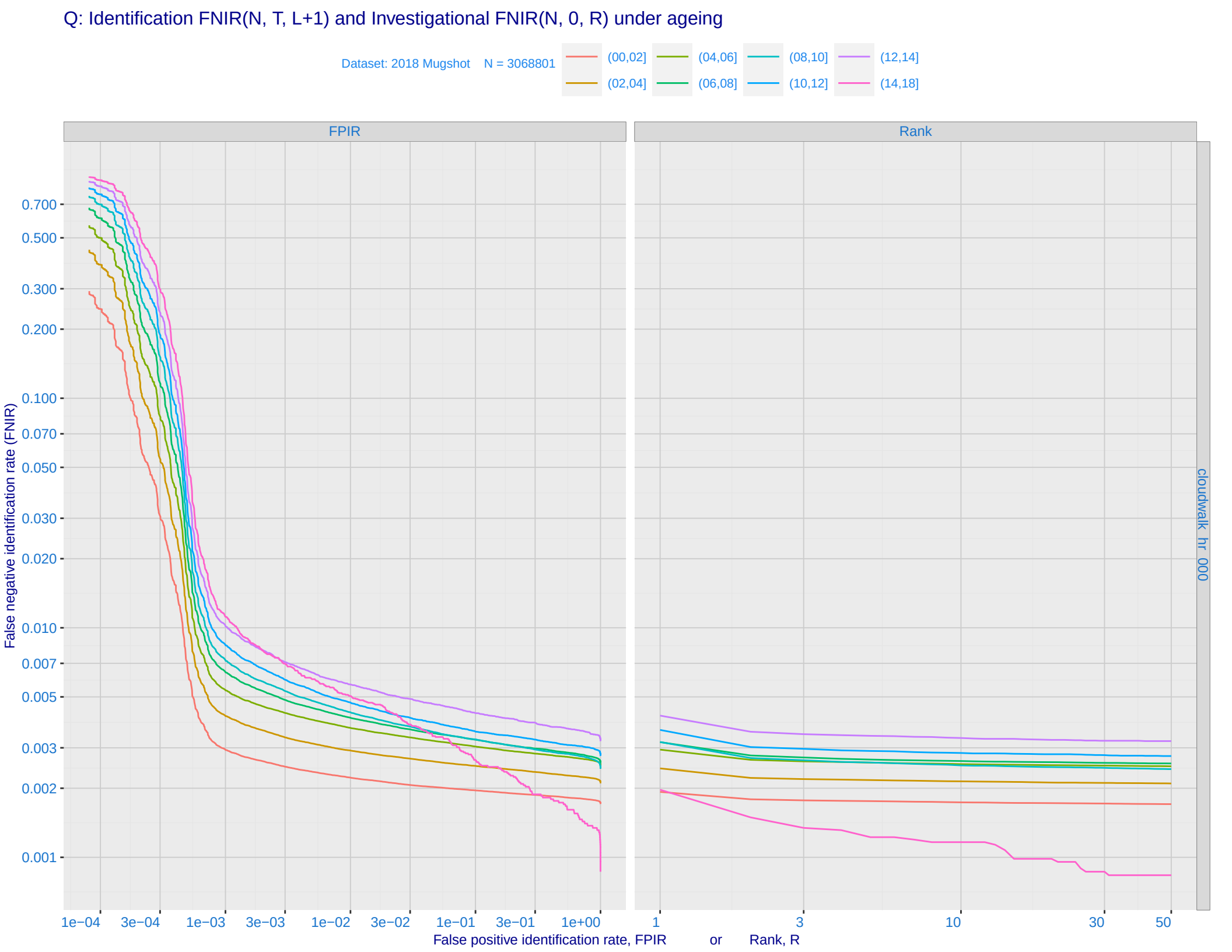

L: Investigational mode: FNIR(1600000, R, 0) by probe type
qnap_000
sensetime_006
False negative identification rate, FNIR(N)
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1
3
10
30
Rank, R
enrolment_style
random
recent
FNIR(R)
N = 1600000
Immigration visa−border
Immigration 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
MODEL
Log Model
Power Law Model
Search Duration (milliseconds)
1000
700
500
7e+05
8e+05
1e+06
Enrolled population size, N, one image per person


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: qnap_000, Dataset: Border−Crossing Ageing N = 1600000
Text encodes FNIR, Color encodes log(FNIR)
−3
−2
−1
Female
Male
(60:99]
(45:60]
(30:45]
(21:30]
(18:21]
(15:18]
(12:15]
0.045 0.048 0.057 0.057 0.058 0.071
0.042 0.045 0.048 0.056 0.060 0.057
0.049 0.053 0.057 0.064 0.068 0.075
0.073 0.072 0.080 0.086 0.088 0.098
0.120 0.116 0.118 0.136 0.134 0.141
0.152 0.146 0.160 0.163 0.166 0.135
0.194 0.179 0.189 0.204 0.201 0.213
0.023 0.022 0.021 0.024 0.030 0.023
0.018 0.018 0.021 0.023 0.026 0.030
0.019 0.017 0.021 0.024 0.027 0.027
0.028 0.029 0.031 0.036 0.041 0.038
0.061 0.058 0.068 0.073 0.077 0.075
0.133 0.131 0.141 0.160 0.169 0.185
0.237 0.222 0.251 0.263 0.273 0.290
FNIR(R=1, T=0)
0.269 0.277 0.314 0.341 0.369 0.437
0.263 0.272 0.300 0.326 0.360 0.374
0.312 0.322 0.343 0.375 0.404 0.418
0.376 0.376 0.404 0.433 0.450 0.460
0.491 0.495 0.500 0.538 0.540 0.551
0.566 0.552 0.580 0.613 0.632 0.591
0.635 0.641 0.654 0.669 0.686 0.679
0.227 0.241 0.261 0.297 0.319 0.343
0.209 0.218 0.251 0.280 0.306 0.303
0.213 0.217 0.250 0.284 0.318 0.325
0.278 0.287 0.321 0.355 0.396 0.392
0.486 0.467 0.498 0.549 0.586 0.568
0.648 0.646 0.689 0.718 0.748 0.750
0.785 0.787 0.807 0.835 0.855 0.826
FNIR(R=50, T=0.582016), FPIR(30−45, Male) = 0.001
Age group at time of enrollment
10 11 12 13 14 15
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
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
cloudwalk hr 000