A: Datasheet

Algorithm: vnpt_002

Developer: Vietnam Posts and Telecommunications Group

Submission Date: 2022_09_08

Template size: 2048 bytes

Template time (2.5 percentile): 808 msec

Template time (median): 809 msec

Template time (97.5 percentile): 824 msec

Investigation:

Mugshot webcam ranking 93 (out of 331) −− FNIR(1600000, 0, 1) = 0.0122 vs. lowest 0.0055 from sensetime_008

Mugshot profile ranking 25 (out of 300) −− FNIR(1600000, 0, 1) = 0.0682 vs. lowest 0.0521 from sensetime_007

Immigration visa−border ranking 12 (out of 258) −− FNIR(1600000, 0, 1) = 0.0012 vs. lowest 0.0006 from cloudwalk_mt_001

Immigration visa−kiosk ranking 10 (out of 203) −− FNIR(1600000, 0, 1) = 0.0501 vs. lowest 0.0395 from cloudwalk_mt_001

Identification:

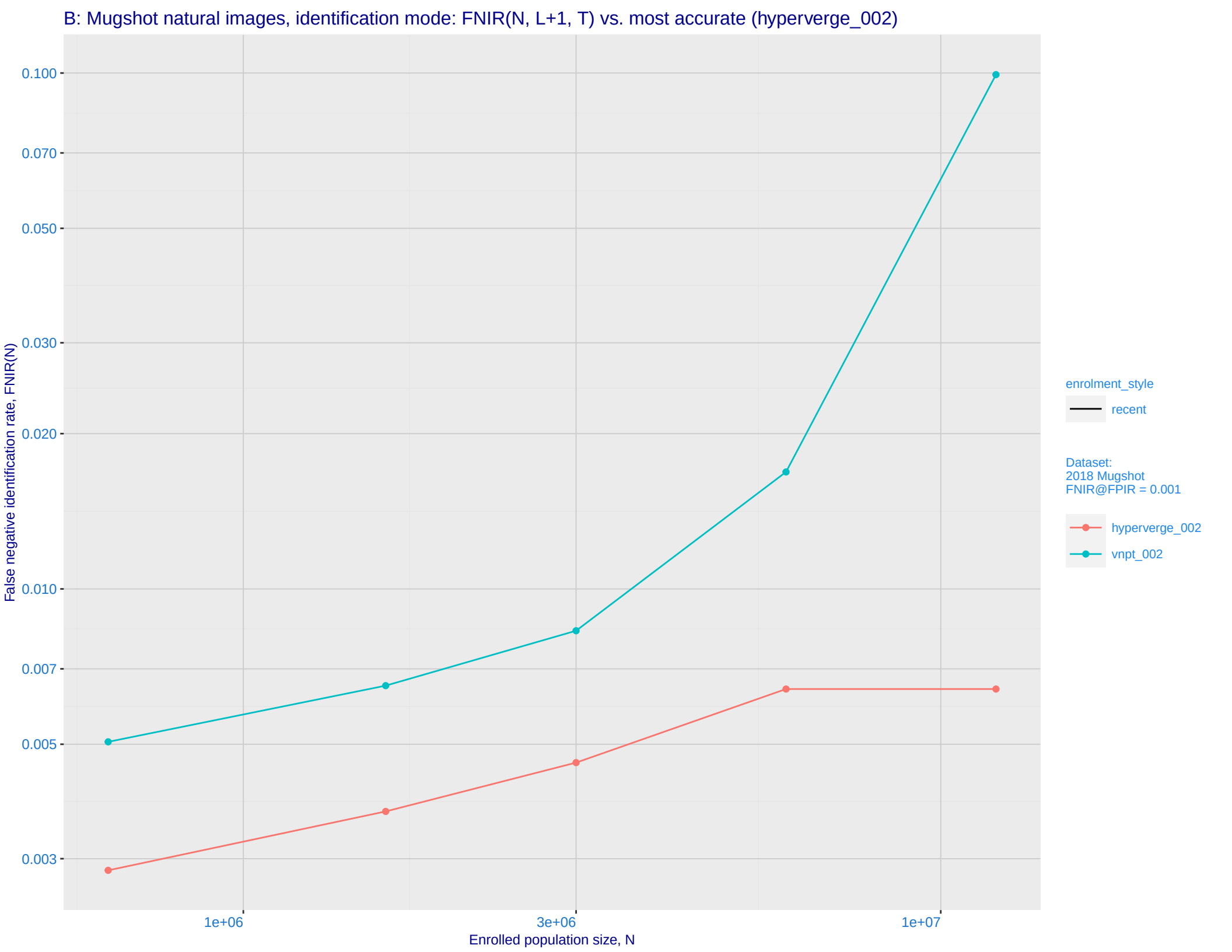
Frontal mugshot ranking 45 (out of 369) −− FNIR(1600000, T, L+1) = 0.0065, FPIR=0.001000 vs. lowest 0.0013 from sensetime_008

Mugshot webcam ranking 48 (out of 329) −− FNIR(1600000, T, L+1) = 0.0318, FPIR=0.001000 vs. lowest 0.0090 from sensetime_008

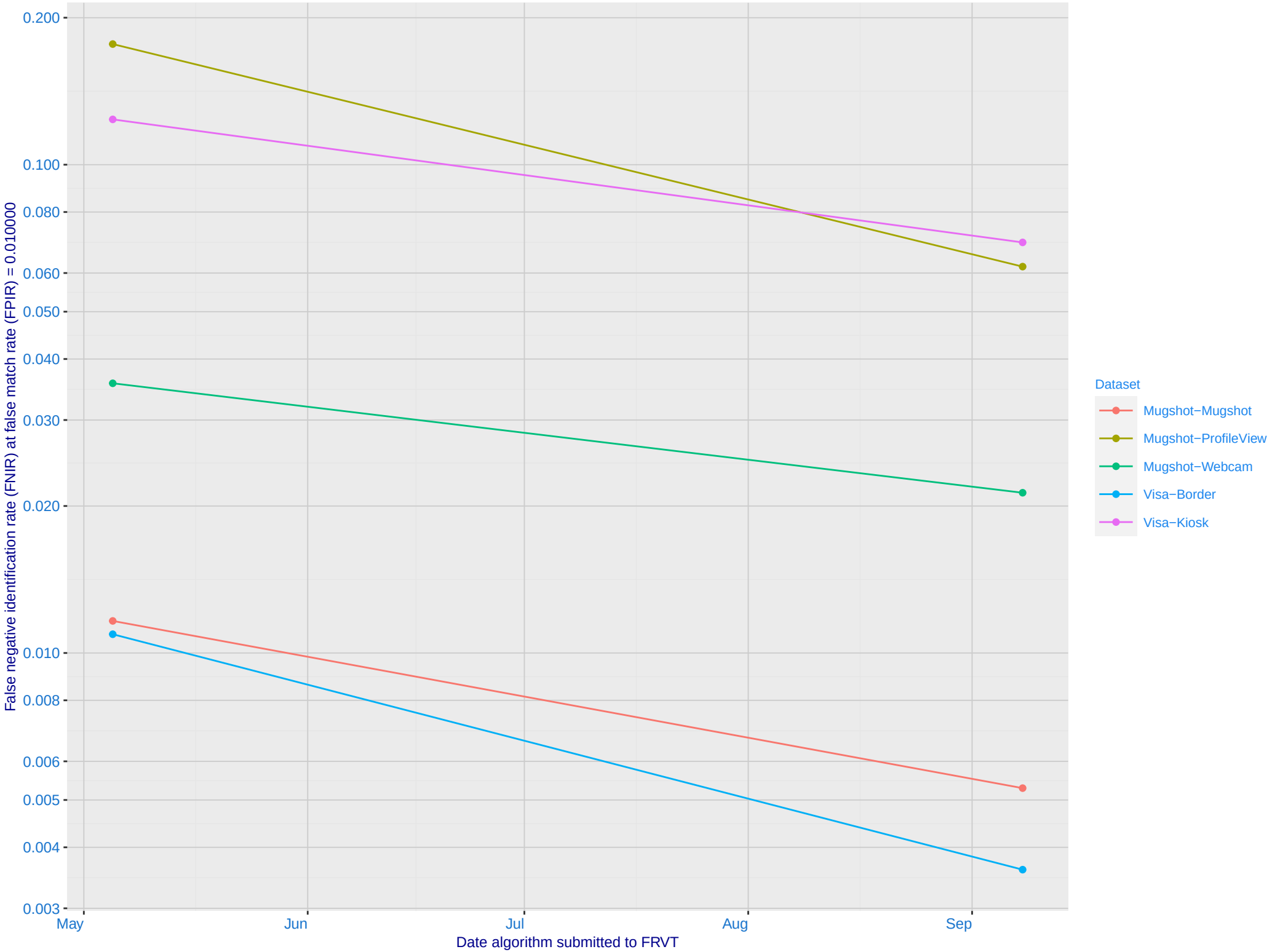
Mugshot profile ranking 17 (out of 299) −− FNIR(1600000, T, L+1) = 0.2921, FPIR=0.001000 vs. lowest 0.0698 from cloudwalk_mt_001

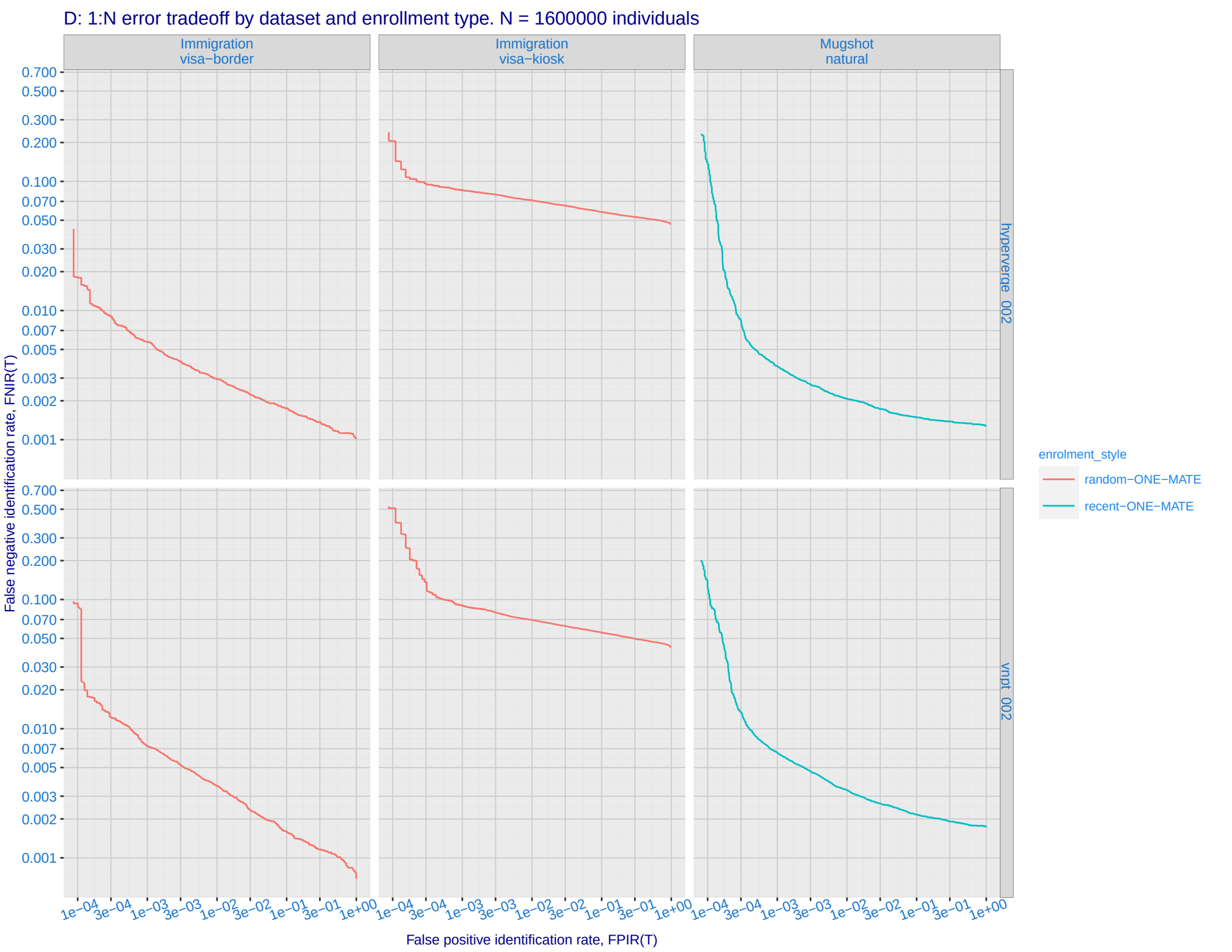
Immigration visa−border ranking 27 (out of 257) −− FNIR(1600000, T, L+1) = 0.0073, FPIR=0.001000 vs. lowest 0.0013 from cloudwalk_mt_001

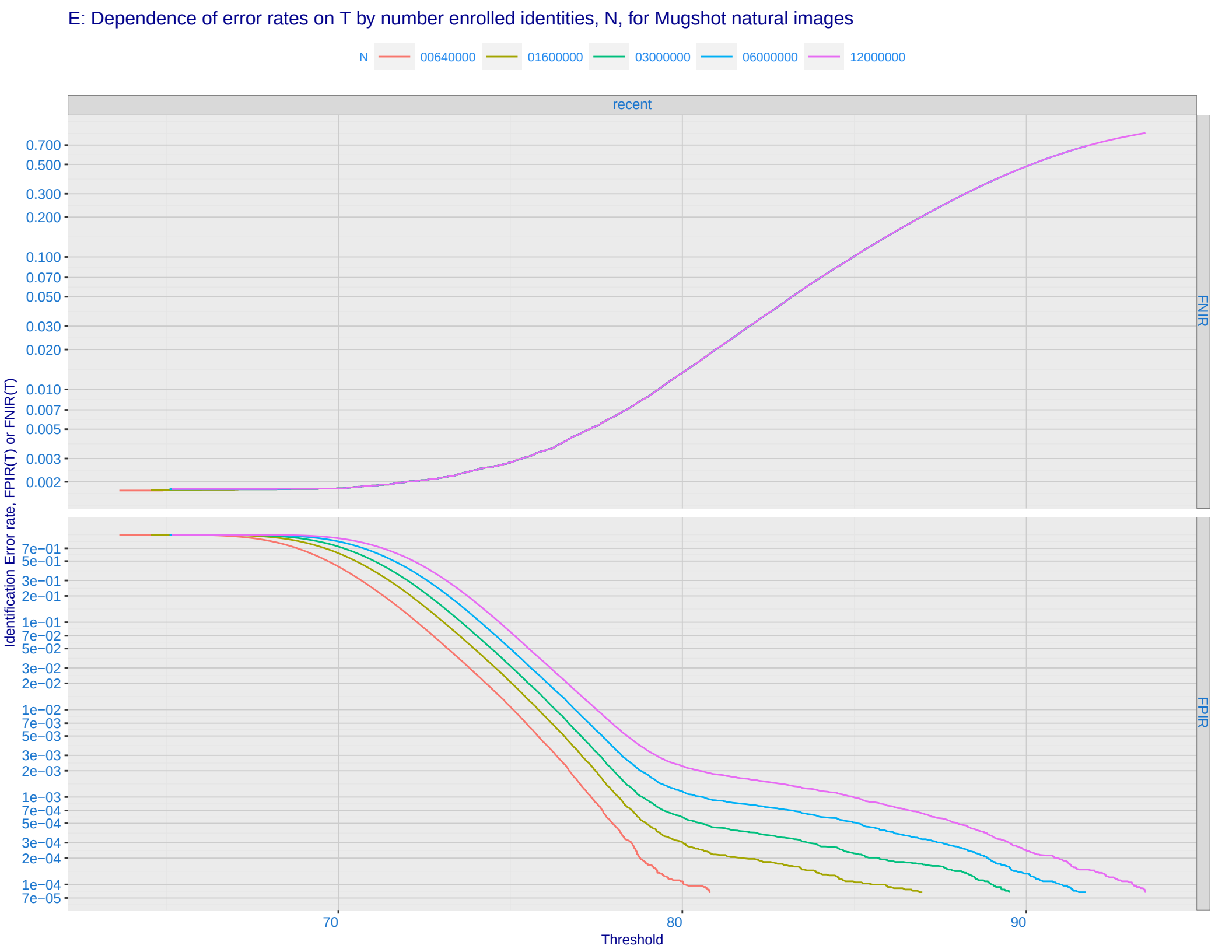
Immigration visa−kiosk ranking 15 (out of 203) −− FNIR(1600000, T, L+1) = 0.0899, FPIR=0.001000 vs. lowest 0.0532 from cloudwalk_mt_001

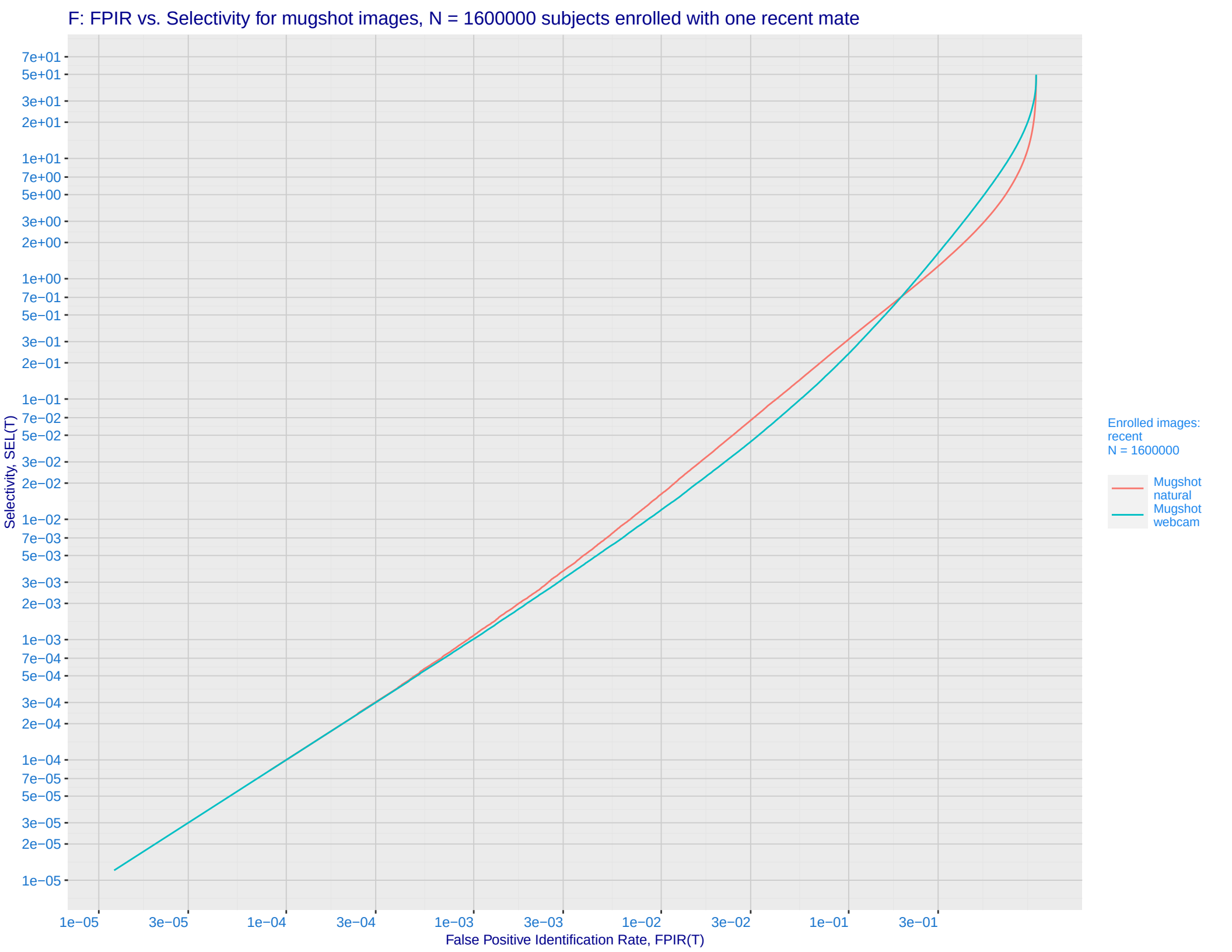

B: Mugshot natural images, identification mode: FNIR(N, L+1, T) vs. most accurate (hyperverge_002)
False negative identification rate, FNIR(N)
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
1e+06
3e+06
1e+07
Enrolled population size, N
enrolment_style
recent
Dataset:
2018 Mugshot
FNIR@FPIR = 0.001
hyperverge_002
vnpt_002

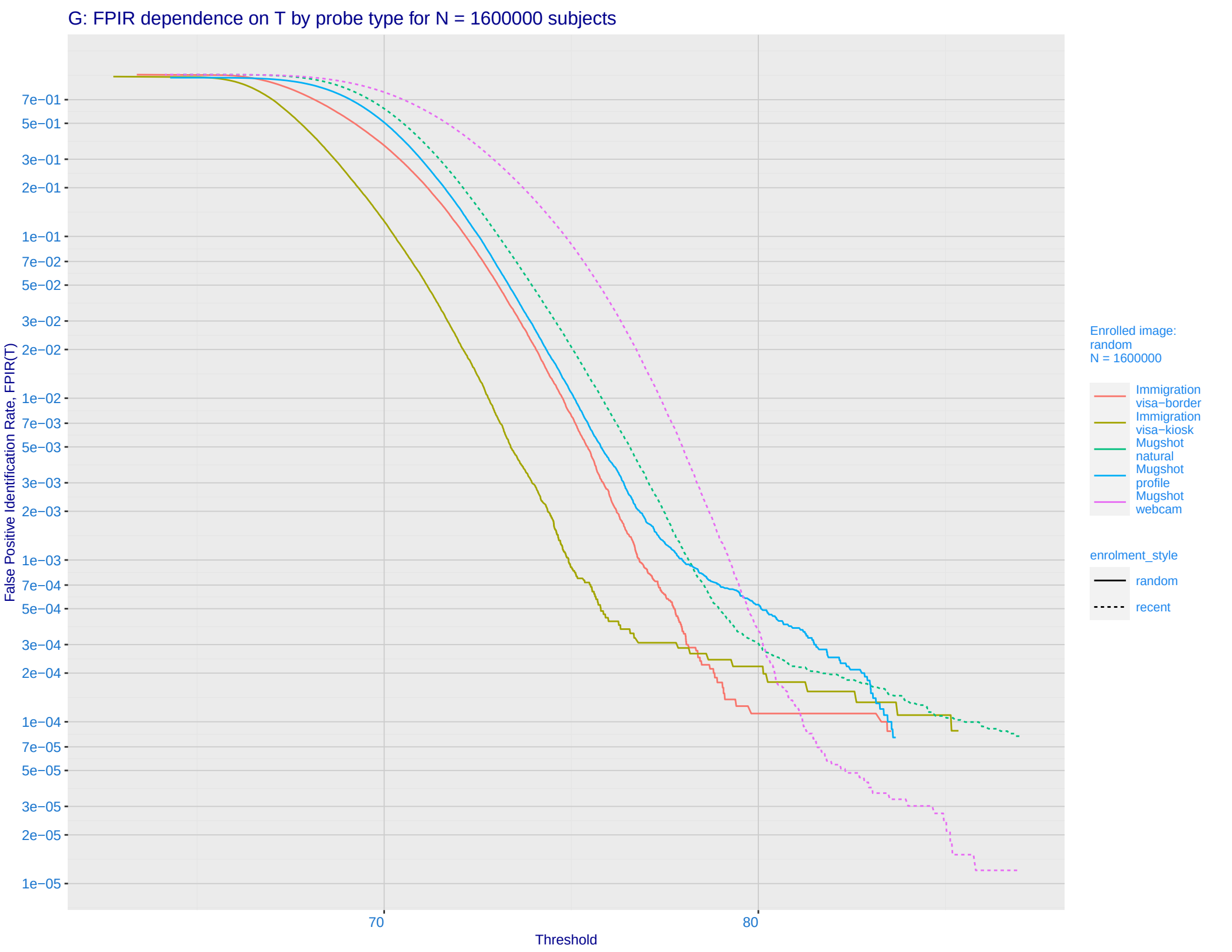
C: Evolution of accuracy for VNPT algorithms on three datasets 2018 − present

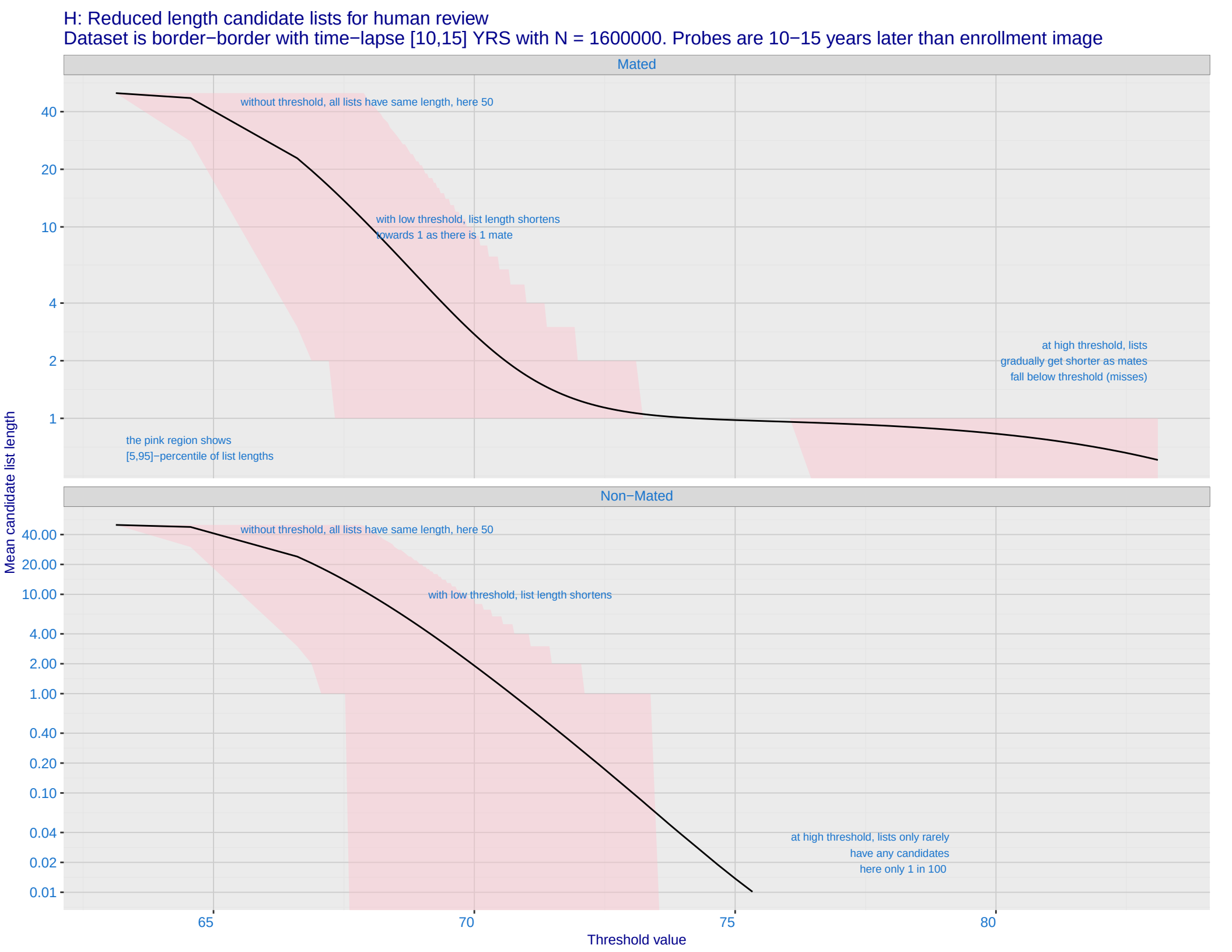


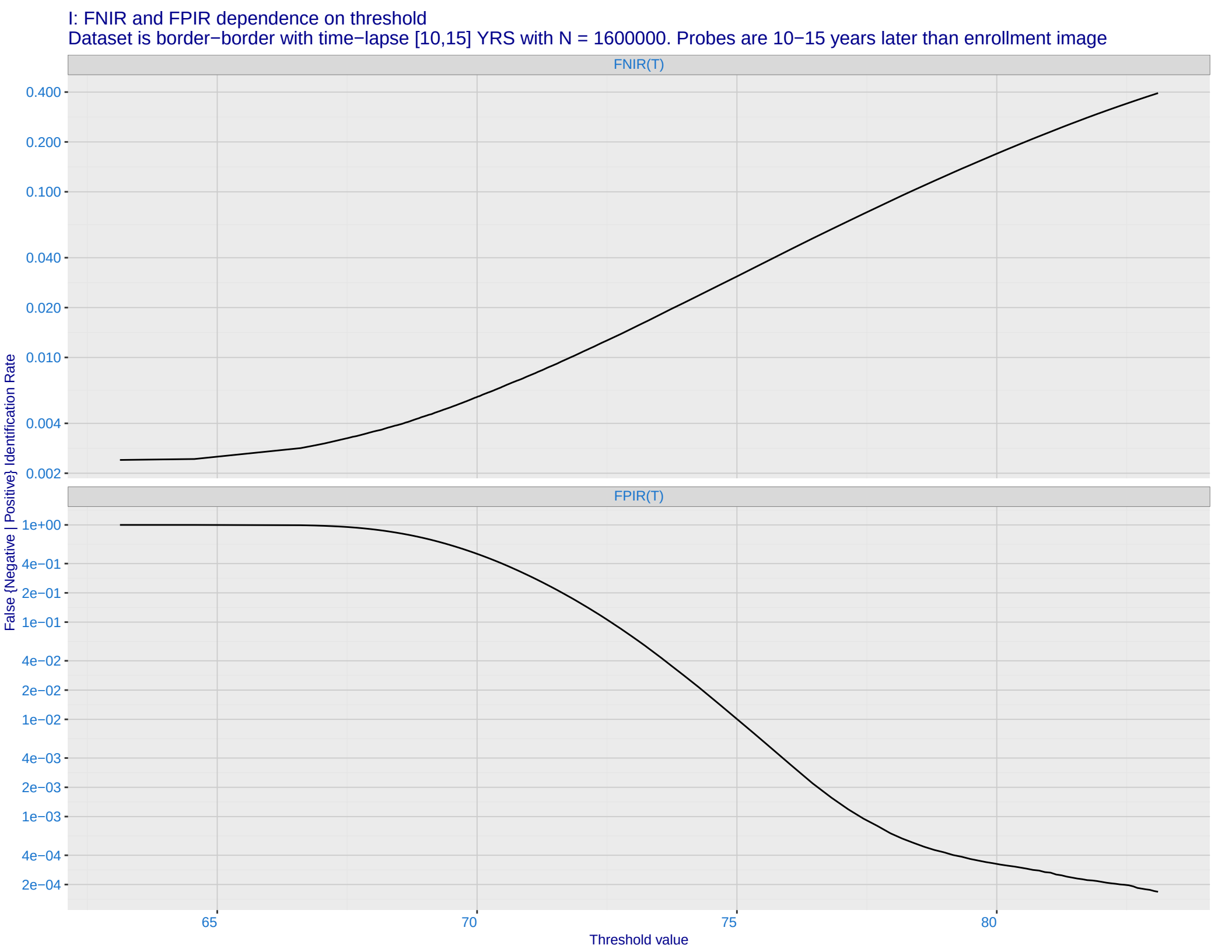

D: 1:N error tradeoff by dataset and enrollment type. N = 1600000 individuals
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
hyperverge_002
vnpt_002
False negative identification rate, FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e−04
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

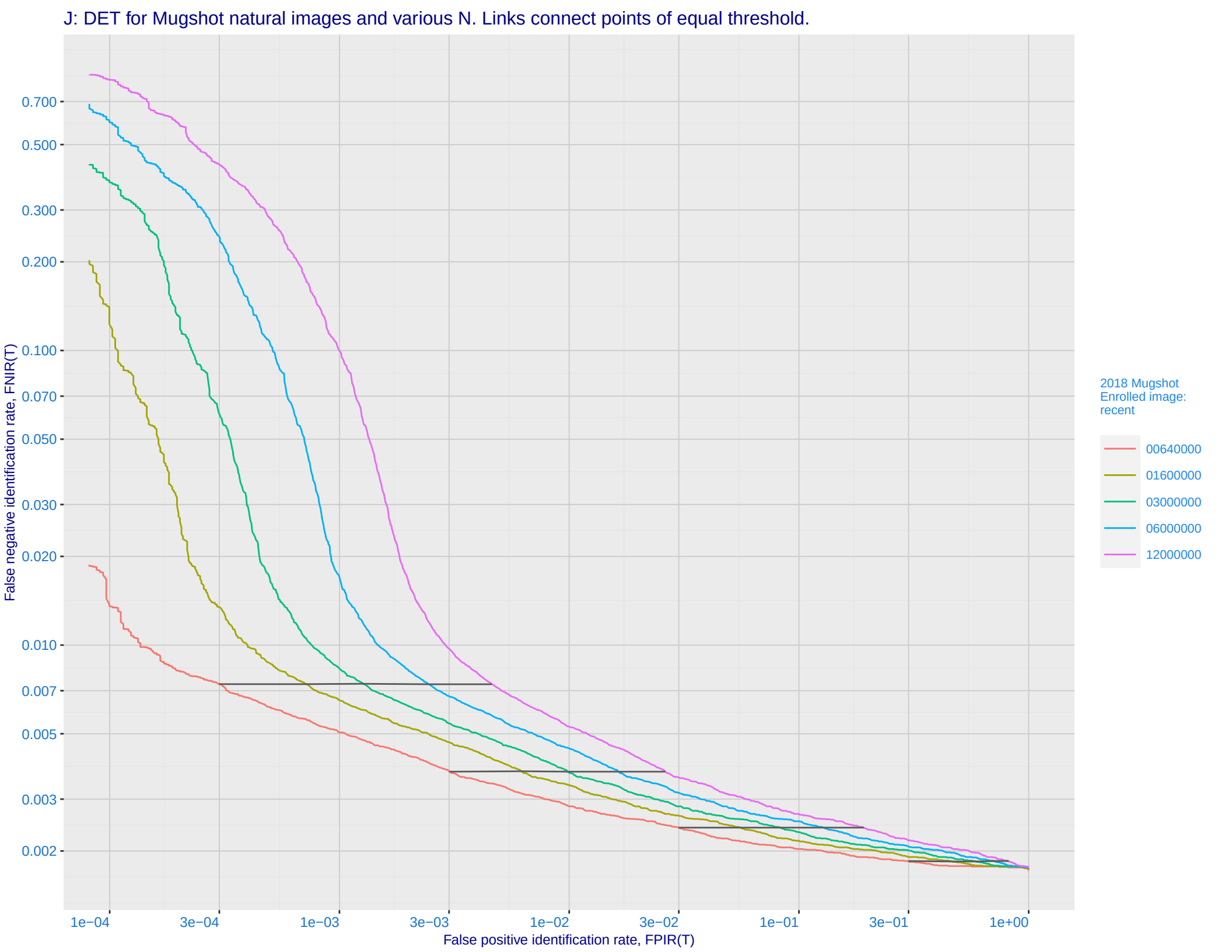

E: Dependence of error rates on T by number enrolled identities, N, for Mugshot natural images
N
00640000
01600000
03000000
06000000
12000000
recent
FNIR
FPIR
Identification Error rate, FPIR(T) or FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
7e−01
5e−01
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
70
80
90
Threshold

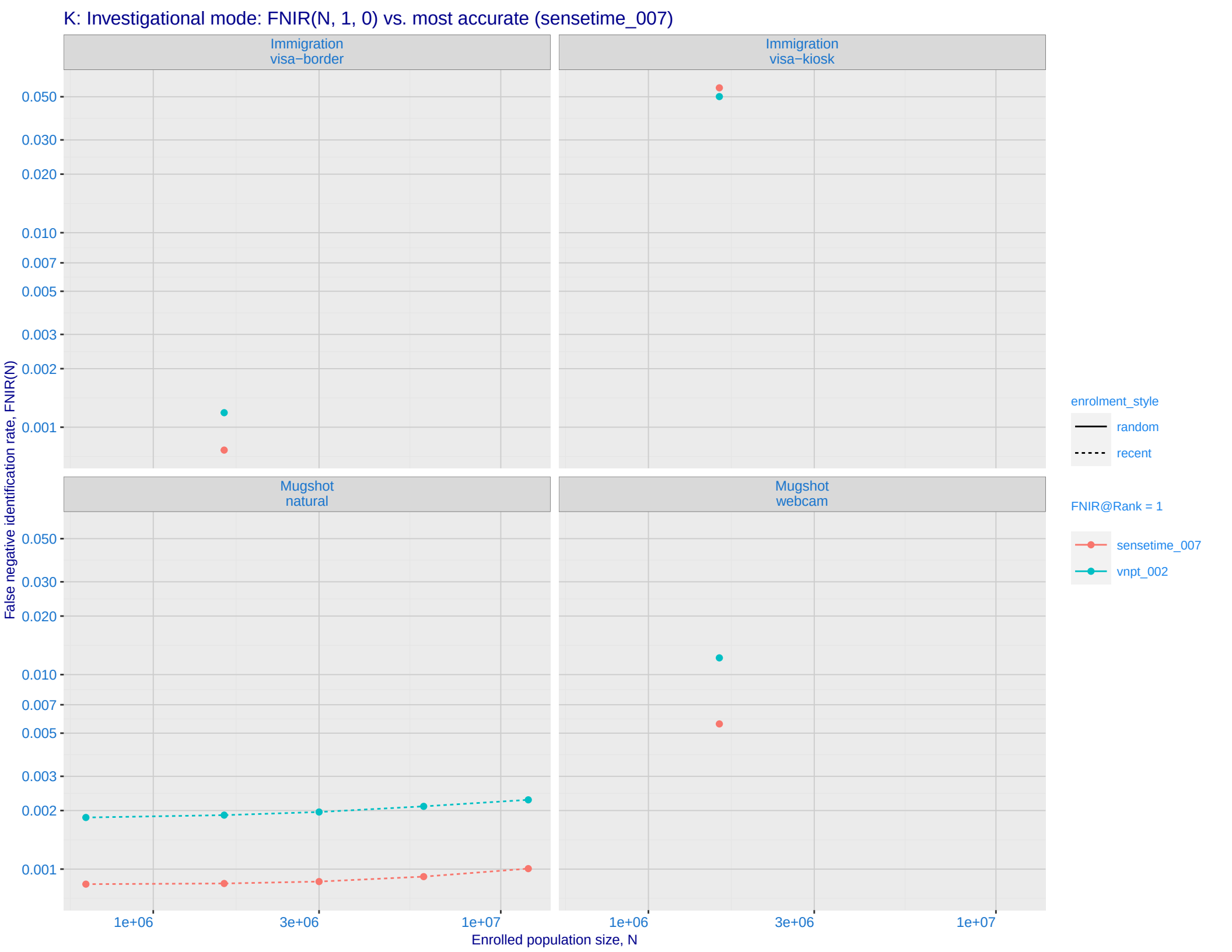

F: FPIR vs. Selectivity for mugshot images, N = 1600000 subjects enrolled with one recent mate
Selectivity, SEL(T)
7e+01
5e+01
3e+01
2e+01
1e+01
7e+00
5e+00
3e+00
2e+00
1e+00
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05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

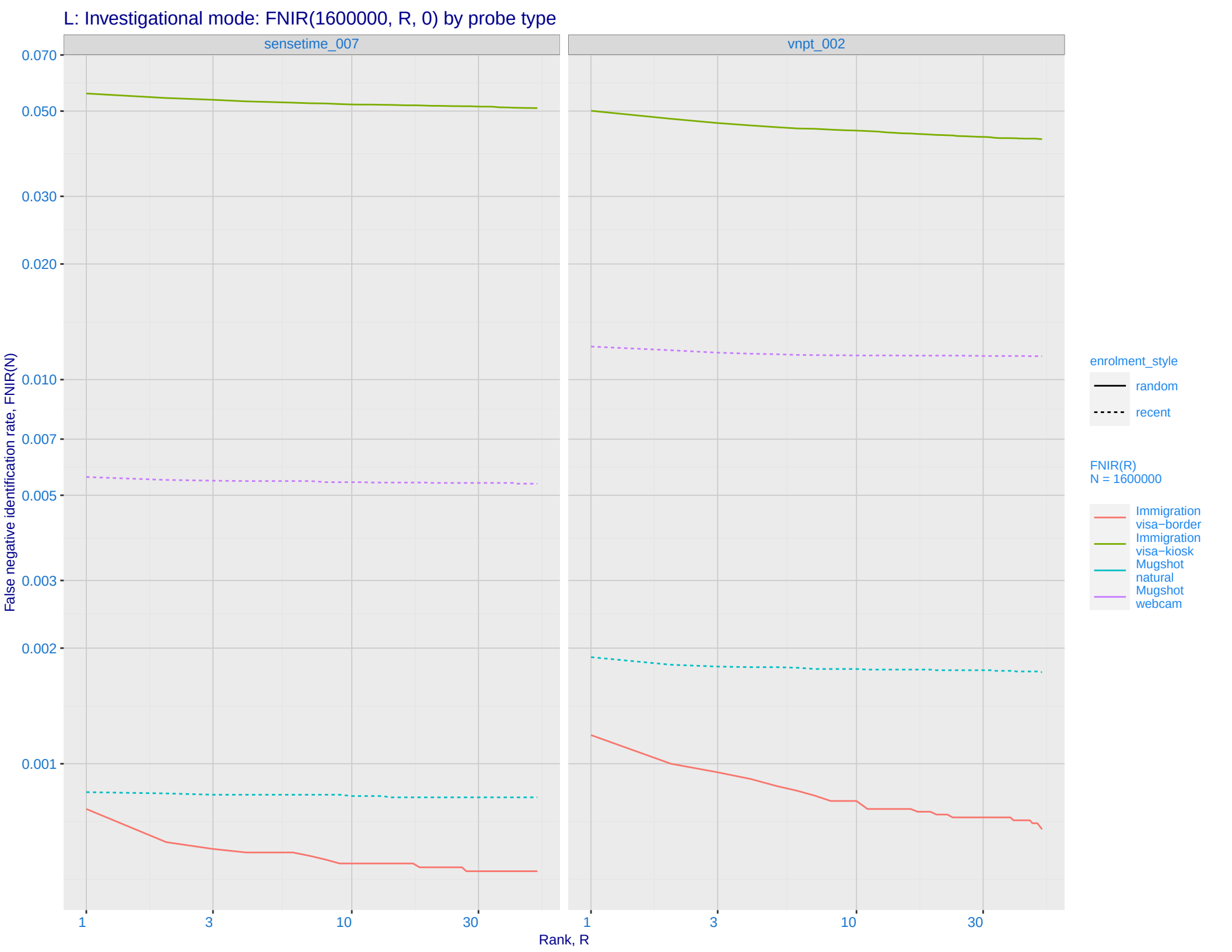

G: FPIR dependence on T by probe type for N = 1600000 subjects
False Positive Identification Rate, FPIR(T)
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05
5e−05
3e−05
2e−05
1e−05
70
80
Threshold
Enrolled image:
random
N = 1600000
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

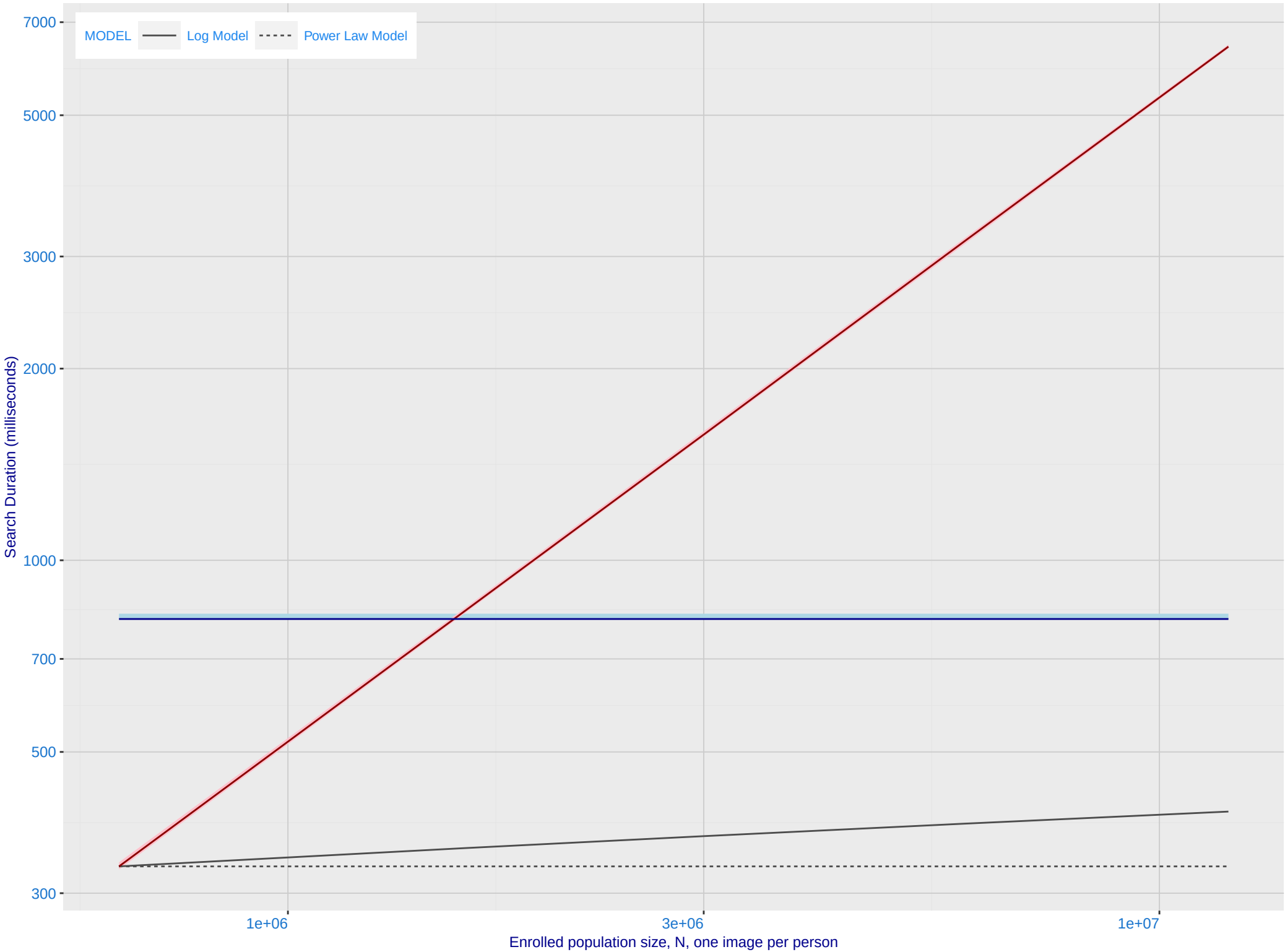

I: FNIR and FPIR dependence on threshold
Dataset is border−border with time−lapse [10,15] YRS with N = 1600000. Probes are 10−15 years later than enrollment image
FNIR(T)
0.400
0.200
0.100
0.040
0.020
0.010
0.004
0.002
FPIR(T)
1e+00
4e−01
2e−01
1e−01
4e−02
2e−02
1e−02
4e−03
2e−03
1e−03
4e−04
2e−04
False {Negative | Positive} Identification Rate
65
70
75
80
Threshold value

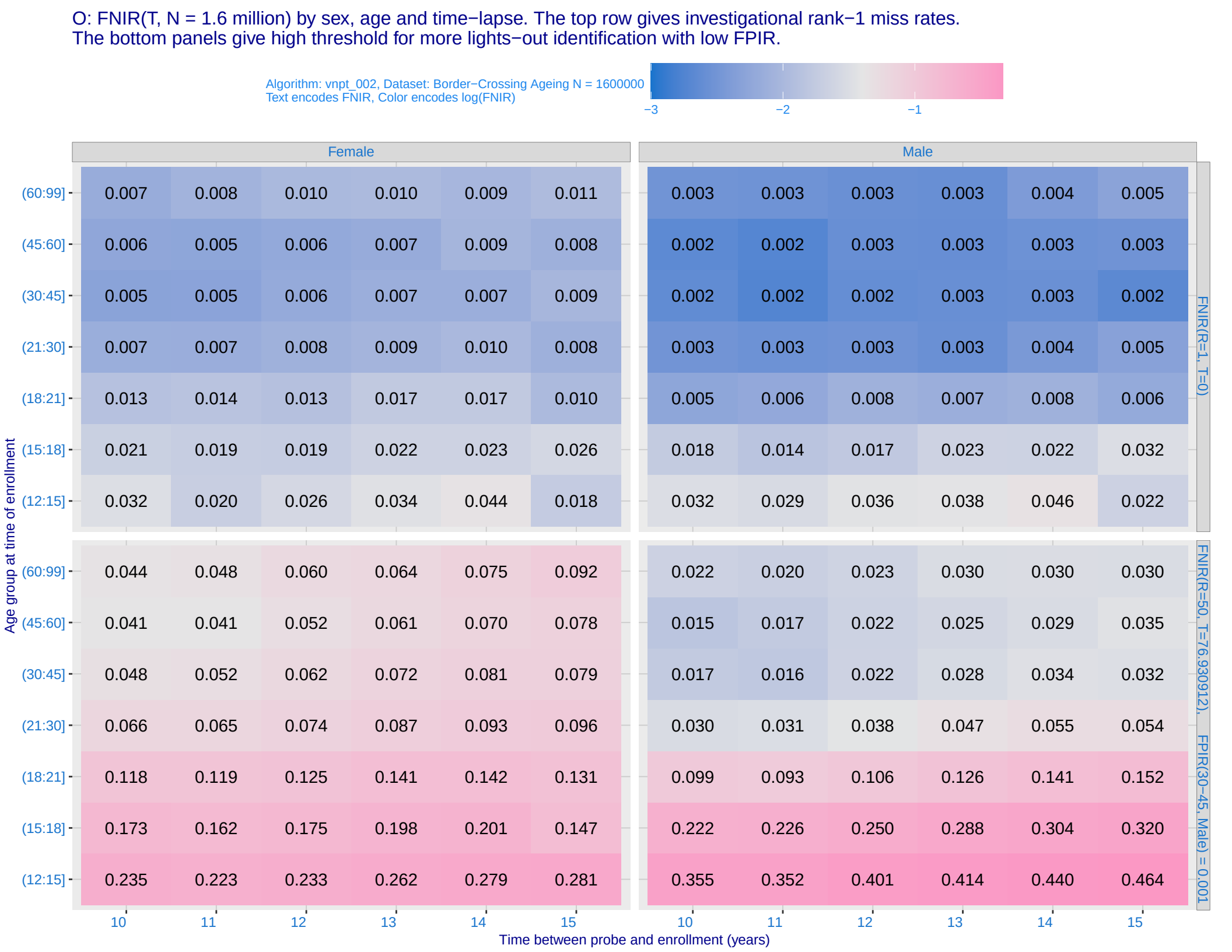

J: DET for Mugshot natural images and various N. Links connect points of equal threshold.
False negative identification rate, FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
1e−04
3e−04
1e−03
3e−03
1e−02
3e−02
1e−01
3e−01
1e+00
False positive identification rate, FPIR(T)
2018 Mugshot
Enrolled image:
recent
00640000
01600000
03000000
06000000
12000000


K: Investigational mode: FNIR(N, 1, 0) vs. most accurate (sensetime_007)
Immigration
visa−border
Immigration
visa−kiosk
Mugshot
natural
Mugshot
webcam
False negative identification rate, FNIR(N)
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_007
vnpt_002

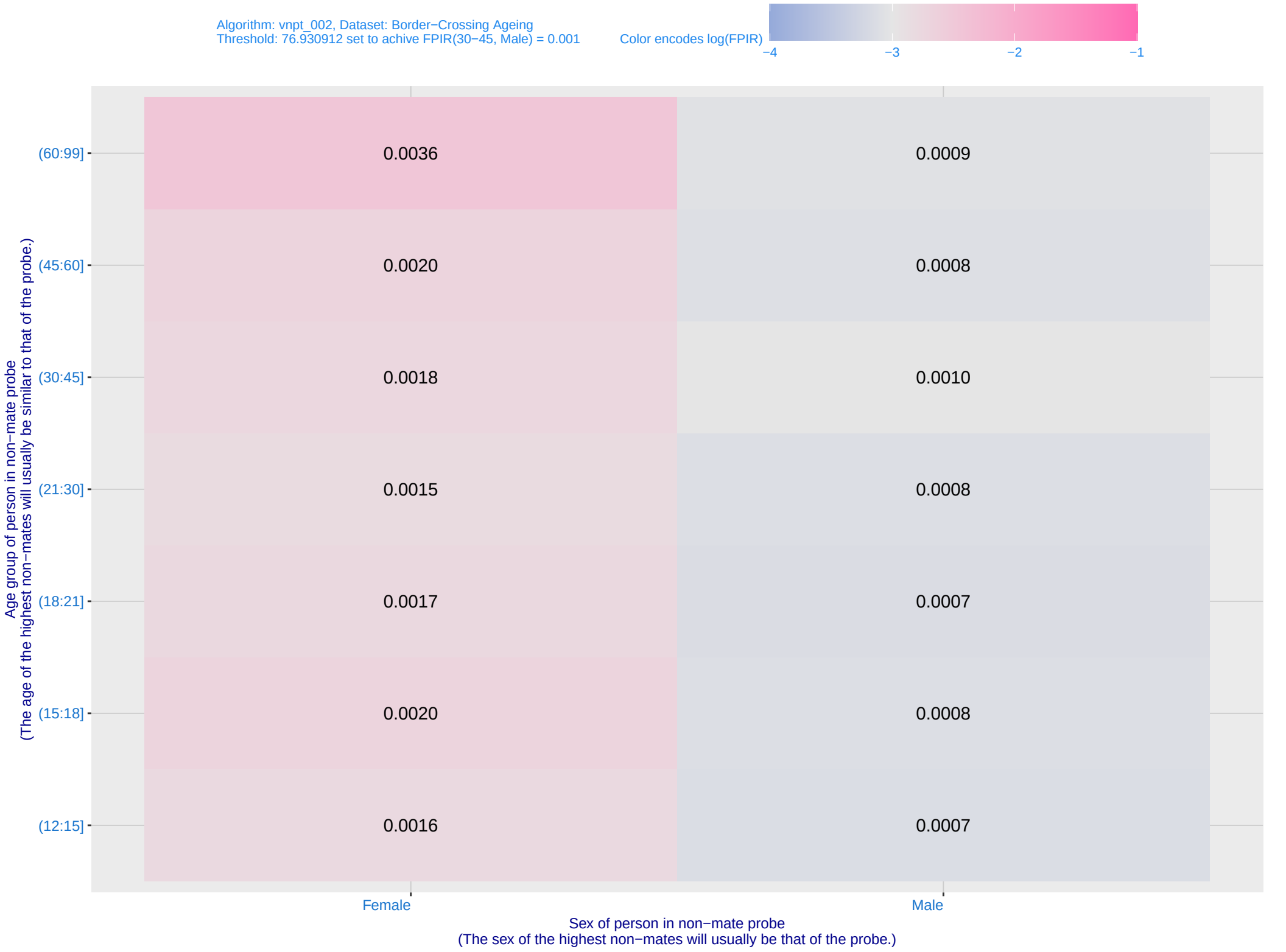

L: Investigational mode: FNIR(1600000, R, 0) by probe type
sensetime_007
vnpt_002
False negative identification rate, FNIR(N)
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1
3
10
30
Rank, R
enrolment_style
random
recent
FNIR(R)
N = 1600000
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
Mugshot webcam

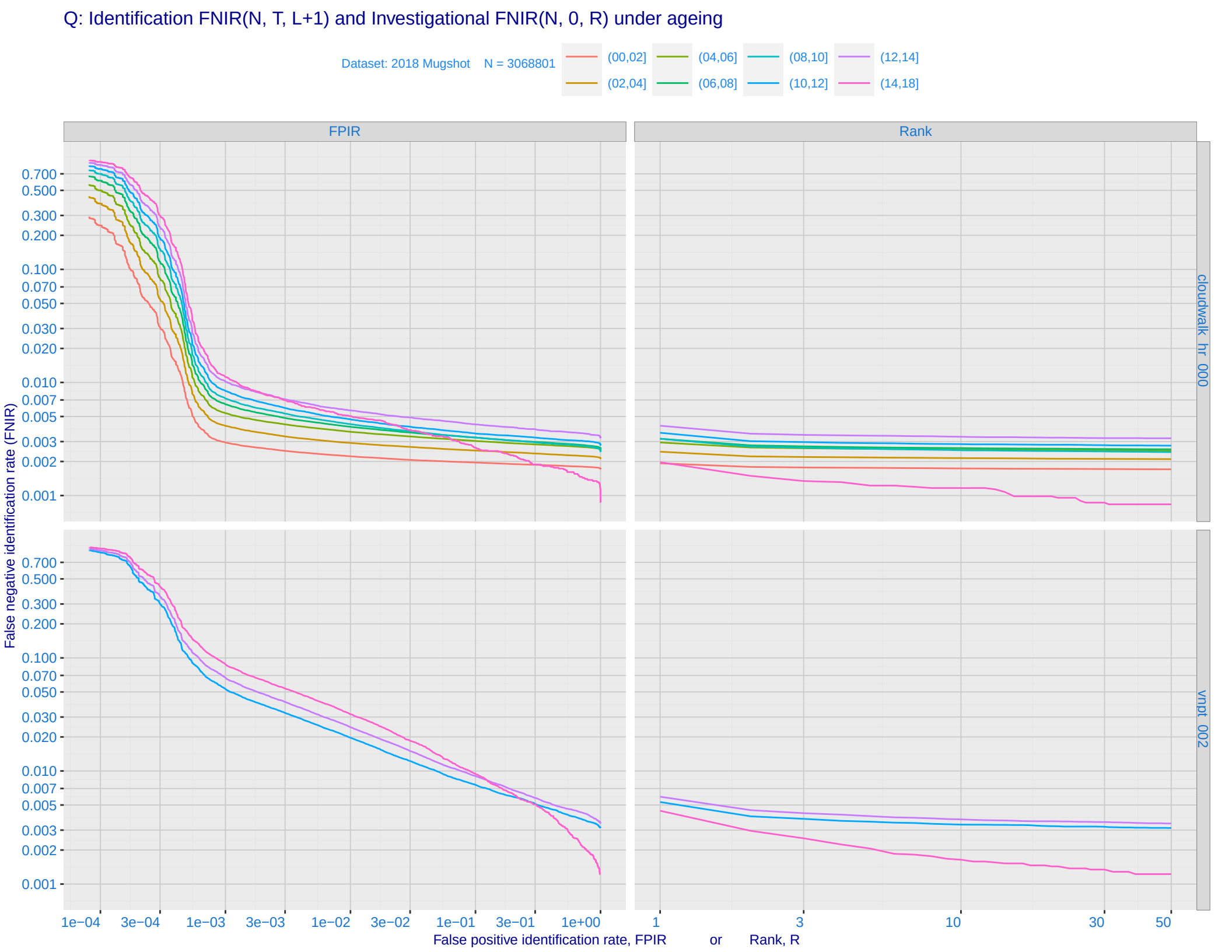
M: Template duration; search duration vs. N. The blue and pink ribbon covers 95 percent of observed measurements.
The template generation time is independent of N. The log and power−law models are fit to the first two (N,T) observations

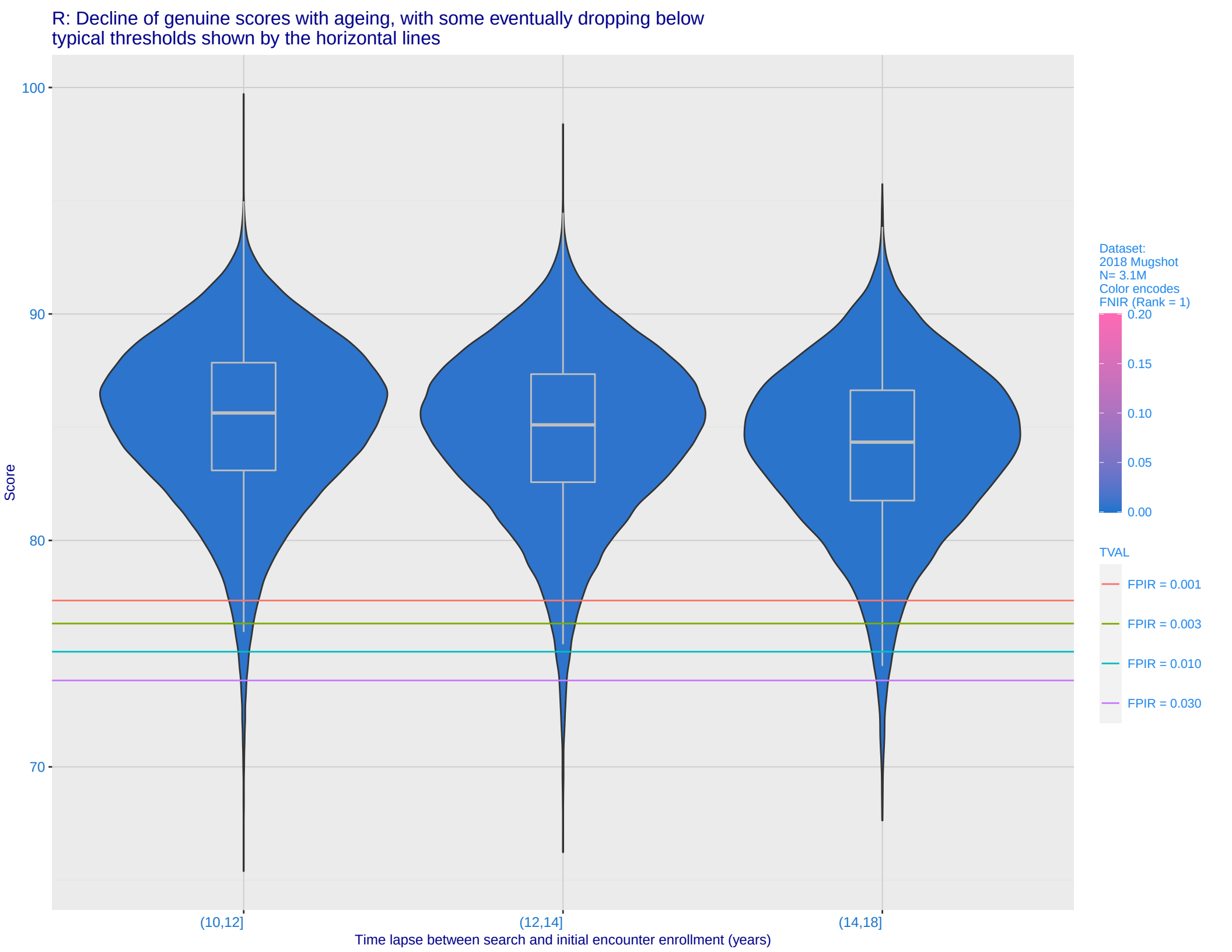



O: FNIR(T, N = 1.6 million) by sex, age and time−lapse. The top row gives investigational rank−1 miss rates.
The bottom panels give high threshold for more lights−out identification with low FPIR.
Algorithm: vnpt_002, Dataset: Border−Crossing Ageing N = 1600000
Text encodes FNIR, Color encodes log(FNIR)
−3
−2
−1
Female
Male
(60:99]
(45:60]
(30:45]
(21:30]
(18:21]
(15:18]
(12:15]
0.007 0.008 0.010 0.010 0.009 0.011
0.006 0.005 0.006 0.007 0.009 0.008
0.005 0.005 0.006 0.007 0.007 0.009
0.007 0.007 0.008 0.009 0.010 0.008
0.013 0.014 0.013 0.017 0.017 0.010
0.021 0.019 0.019 0.022 0.023 0.026
0.032 0.020 0.026 0.034 0.044 0.018
0.003 0.003 0.003 0.003 0.004 0.005
0.002 0.002 0.003 0.003 0.003 0.003
0.002 0.002 0.002 0.003 0.003 0.002
0.003 0.003 0.003 0.003 0.004 0.005
0.005 0.006 0.008 0.007 0.008 0.006
0.018 0.014 0.017 0.023 0.022 0.032
0.032 0.029 0.036 0.038 0.046 0.022
FNIR(R=1, T=0)
0.044 0.048 0.060 0.064 0.075 0.092
0.041 0.041 0.052 0.061 0.070 0.078
0.048 0.052 0.062 0.072 0.081 0.079
0.066 0.065 0.074 0.087 0.093 0.096
0.118 0.119 0.125 0.141 0.142 0.131
0.173 0.162 0.175 0.198 0.201 0.147
0.235 0.223 0.233 0.262 0.279 0.281
0.022 0.020 0.023 0.030 0.030 0.030
0.015 0.017 0.022 0.025 0.029 0.035
0.017 0.016 0.022 0.028 0.034 0.032
0.030 0.031 0.038 0.047 0.055 0.054
0.099 0.093 0.106 0.126 0.141 0.152
0.222 0.226 0.250 0.288 0.304 0.320
0.355 0.352 0.401 0.414 0.440 0.464
FNIR(R=50, T=76.930912), 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
cloudwalk hr 000
vnpt 002
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


R: Decline of genuine scores with ageing, with some eventually dropping below typical thresholds shown by the horizontal lines
100
90
80
70
Score
(10,12]
(12,14]
(14,18]
Time lapse between search and initial encounter enrollment (years)
Dataset:
2018 Mugshot
N= 3.1M
Color encodes
FNIR (Rank = 1)
0.20
0.15
0.10
0.05
0.00
TVAL
FPIR = 0.001
FPIR = 0.003
FPIR = 0.010
FPIR = 0.030