A: Datasheet

Algorithm: line_000

Developer: Line Corporation

Submission Date: 2021_06_02

Template size: 2048 bytes

Template time (2.5 percentile): 480 msec

Template time (median): 481 msec

Template time (97.5 percentile): 485 msec

Investigation:

Frontal mugshot ranking 41 (out of 279) −− FNIR(1600000, 0, 1) = 0.0022 vs. lowest 0.0009 from sensetime_005

Mugshot webcam ranking 42 (out of 241) −− FNIR(1600000, 0, 1) = 0.0136 vs. lowest 0.0062 from sensetime_005

Mugshot profile ranking 26 (out of 210) −− FNIR(1600000, 0, 1) = 0.2235 vs. lowest 0.0587 from xforwardai_002

Immigration visa−border ranking 42 (out of 168) −− FNIR(1600000, 0, 1) = 0.0051 vs. lowest 0.0013 from visionlabs_010

Immigration visa−kiosk ranking 38 (out of 165) −− FNIR(1600000, 0, 1) = 0.1066 vs. lowest 0.0568 from cloudwalk_hr_000

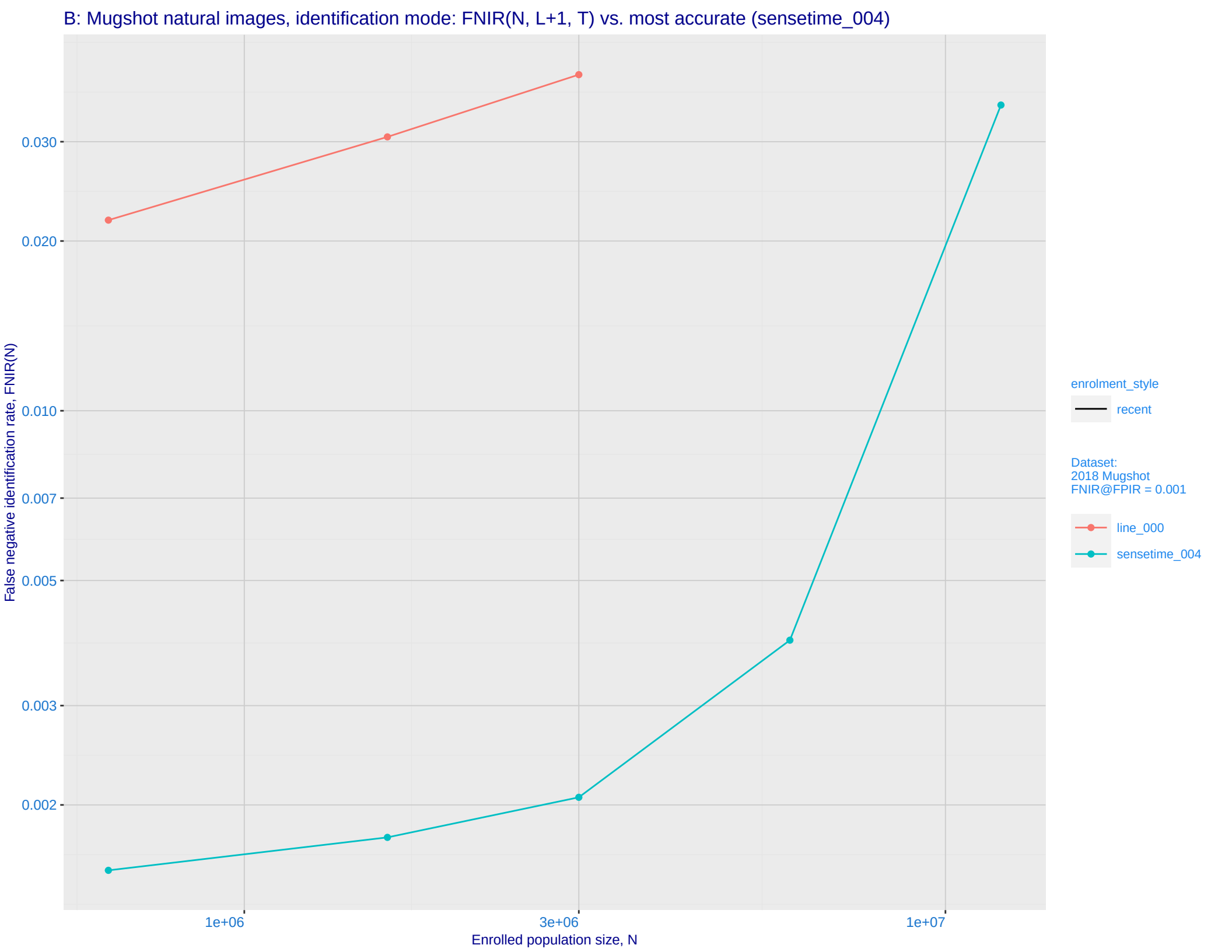
Identification:

Frontal mugshot ranking 61 (out of 279) −− FNIR(1600000, T, L+1) = 0.0306, FPIR=0.001000 vs. lowest 0.0018 from sensetime_004

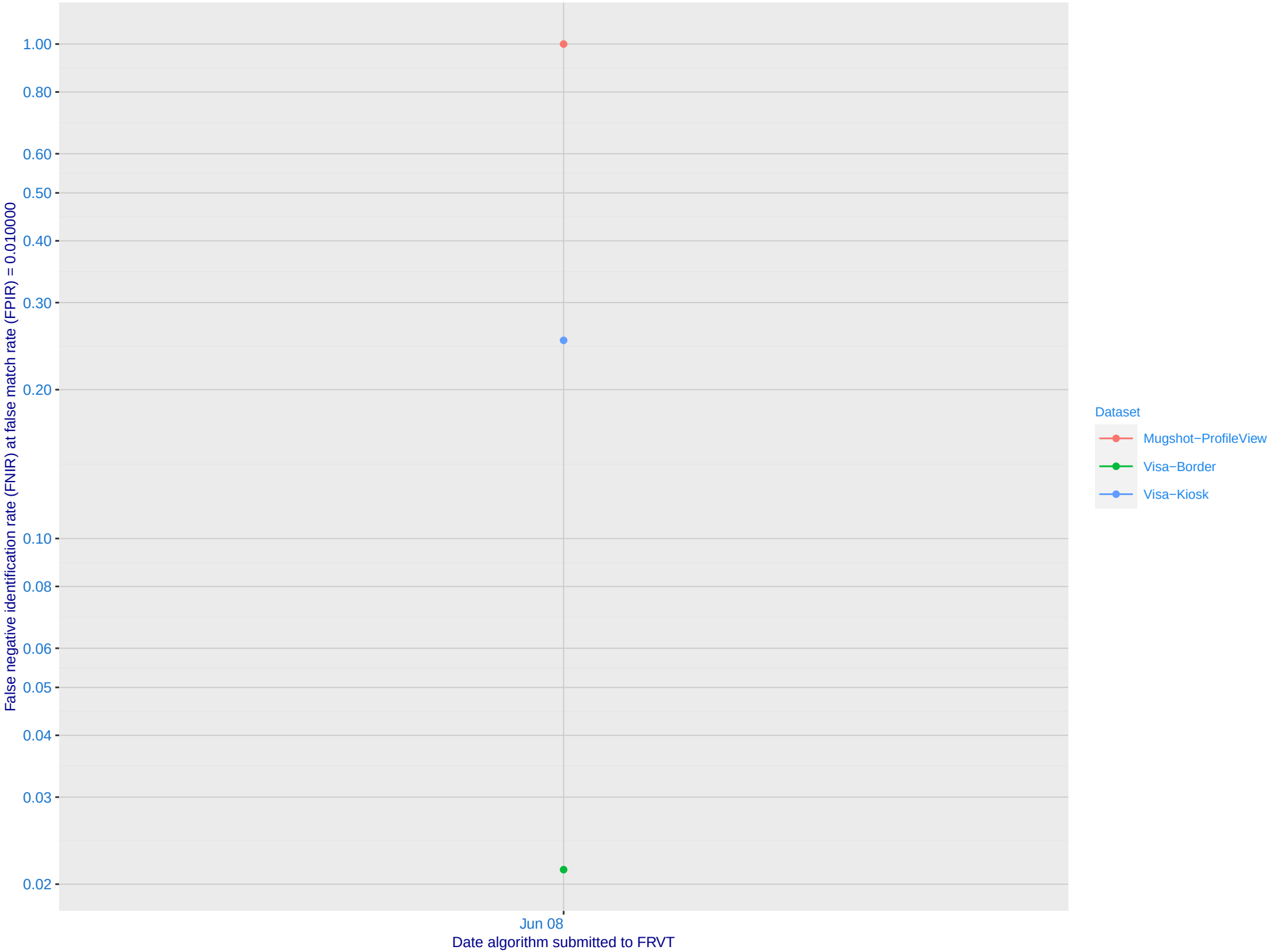
Mugshot profile ranking 187 (out of 209) −− FNIR(1600000, T, L+1) = 0.9999, FPIR=0.001000 vs. lowest 0.1331 from cloudwalk_hr_000

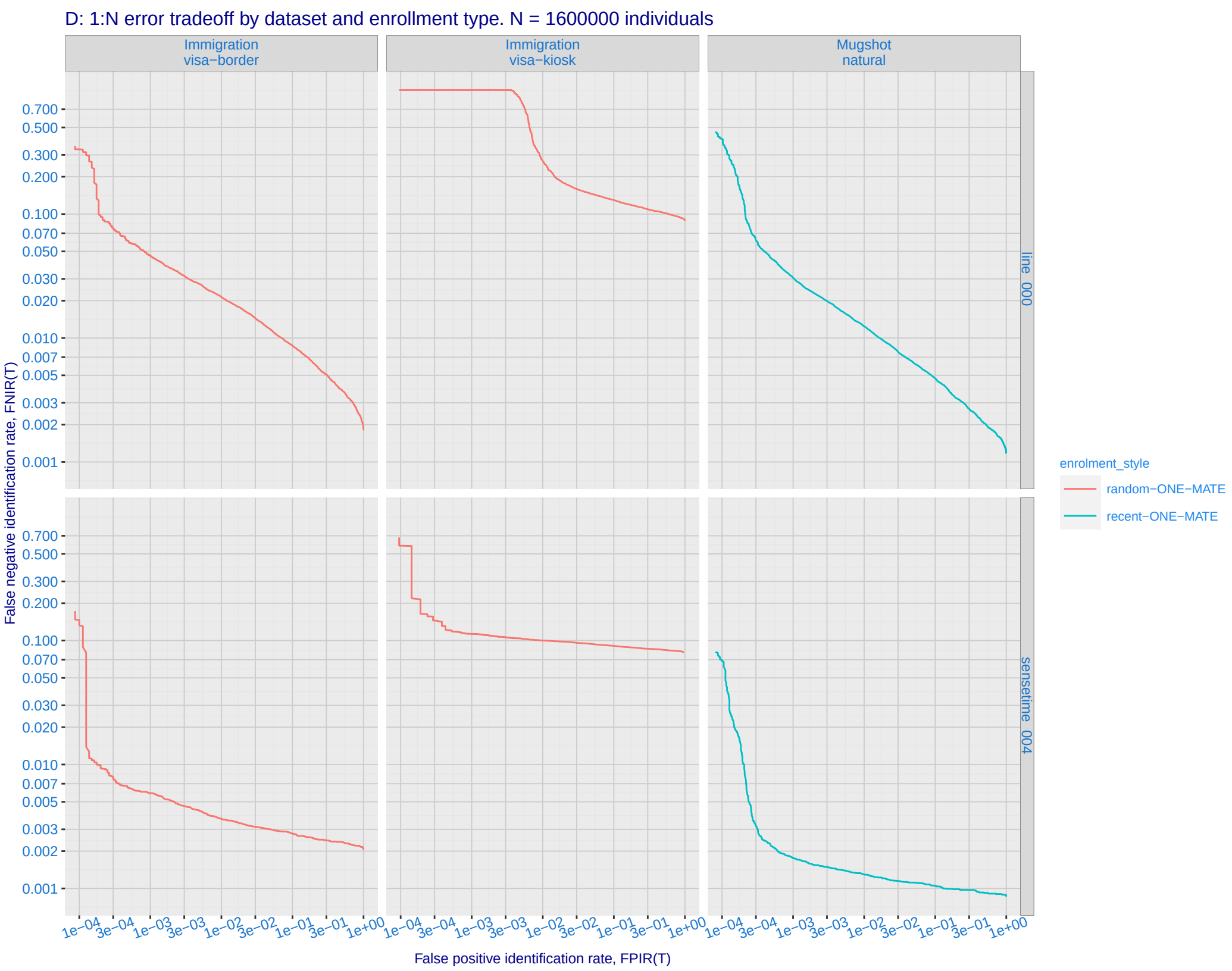
Immigration visa−border ranking 48 (out of 167) −− FNIR(1600000, T, L+1) = 0.0461, FPIR=0.001000 vs. lowest 0.0047 from idemia_008

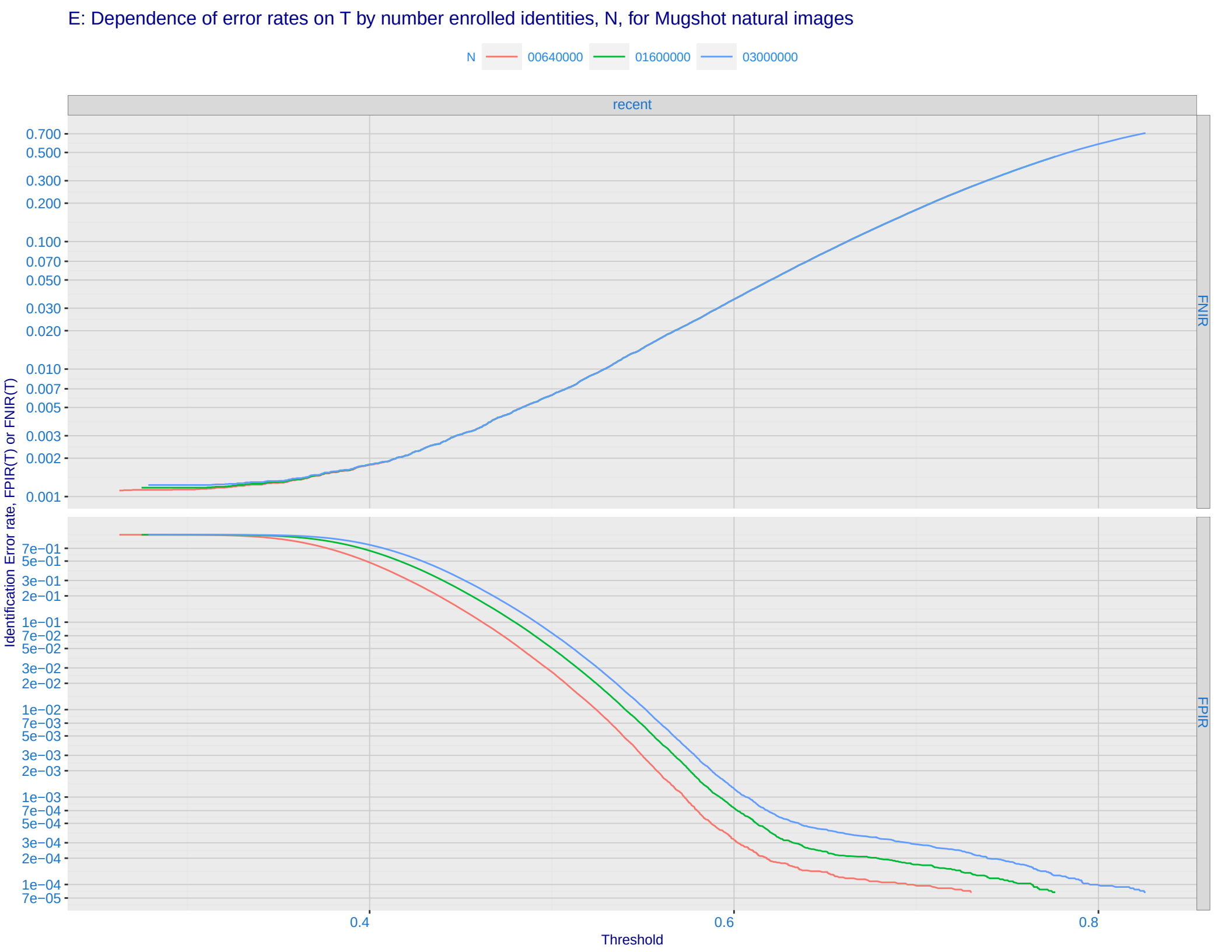
Immigration visa−kiosk ranking 154 (out of 162) −− FNIR(1600000, T, L+1) = 1.0000, FPIR=0.001000 vs. lowest 0.0996 from cloudwalk_hr_000

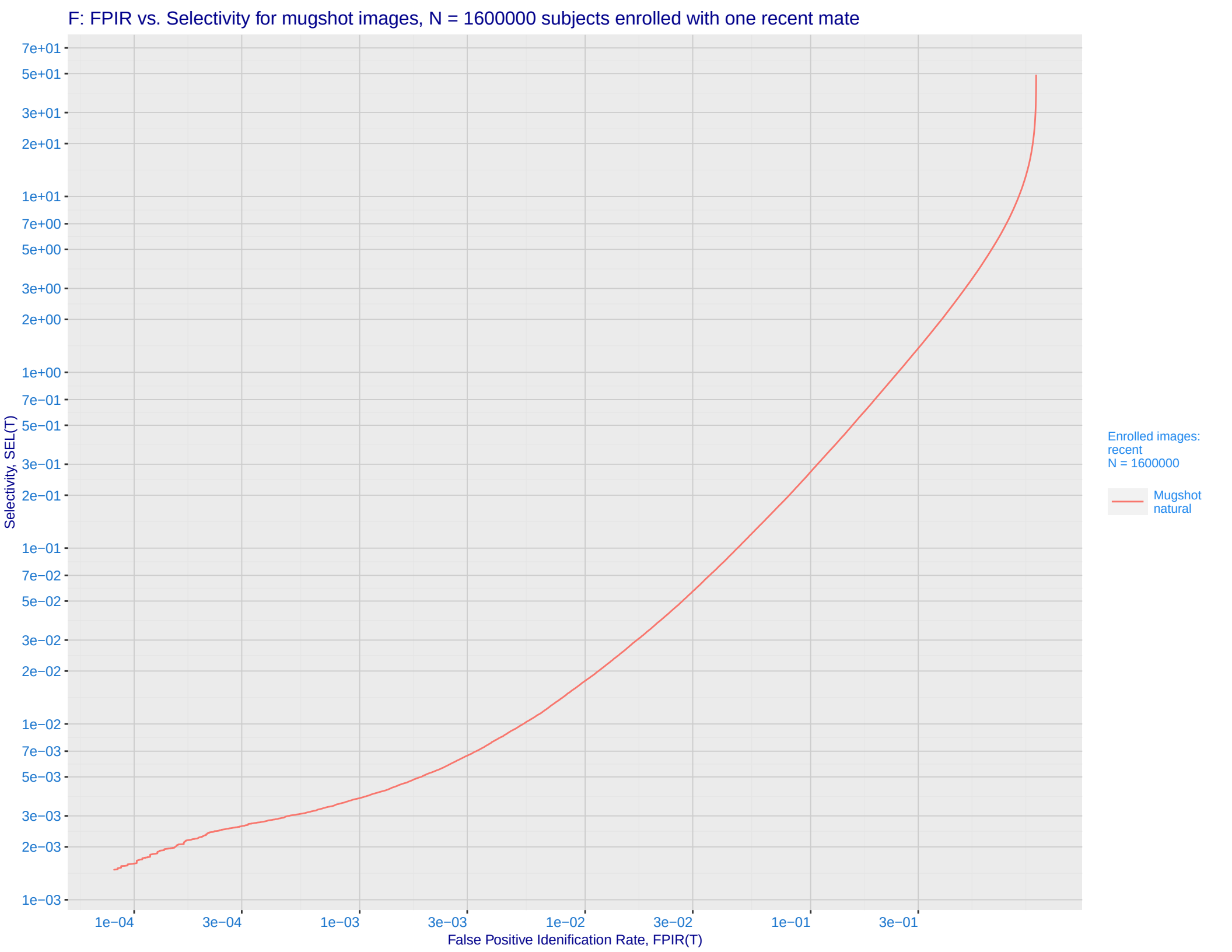

B: Mugshot natural images, identification mode: FNIR(N, L+1, T) vs. most accurate (sensetime_004)
False negative identification rate, FNIR(N)
0.030
0.020
0.010
0.007
0.005
0.003
0.002
1e+06
3e+06
1e+07
Enrolled population size, N
enrolment_style
recent
Dataset:
2018 Mugshot
FNIR@FPIR = 0.001
line_000
sensetime_004

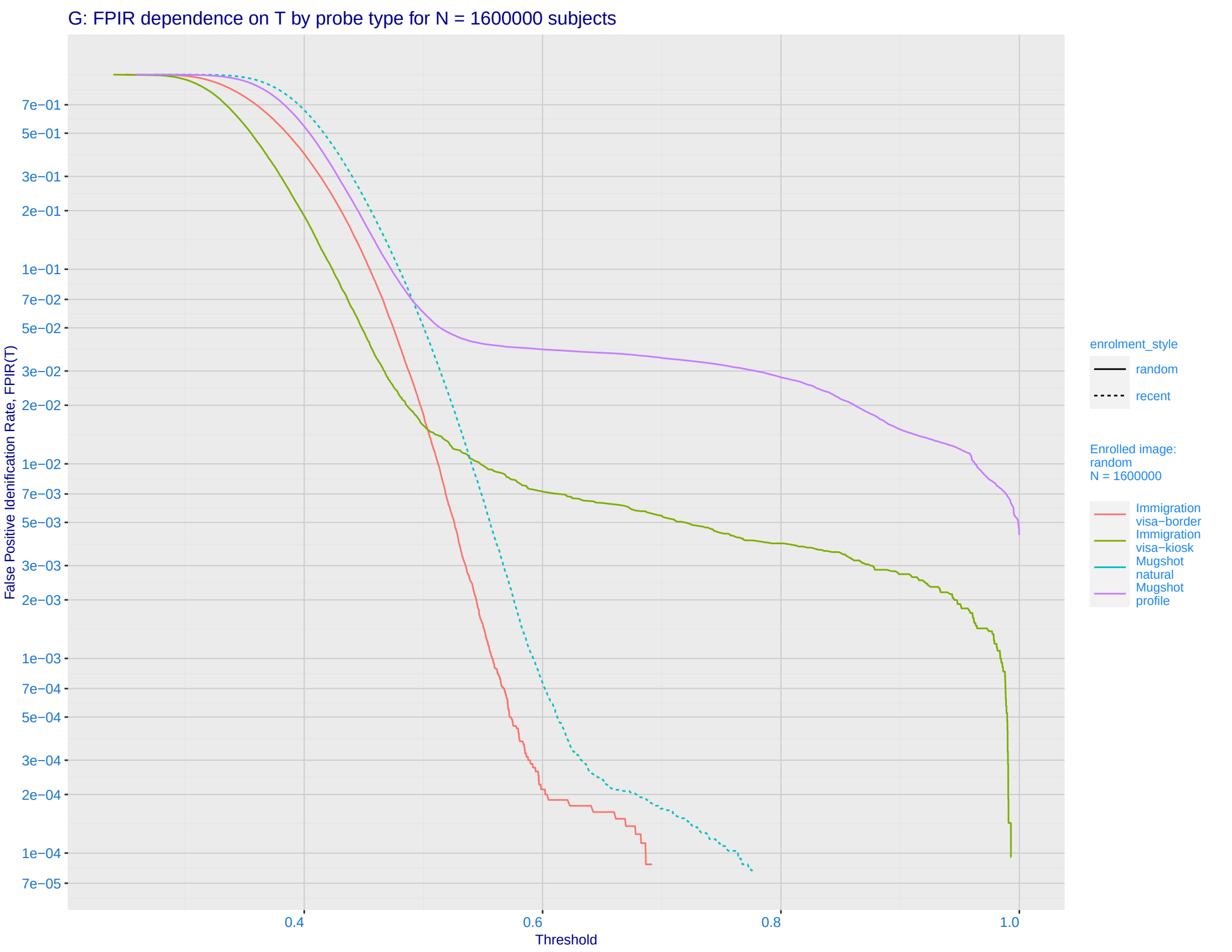
C: Evolution of accuracy for LINE algorithms on three datasets 2018 − present

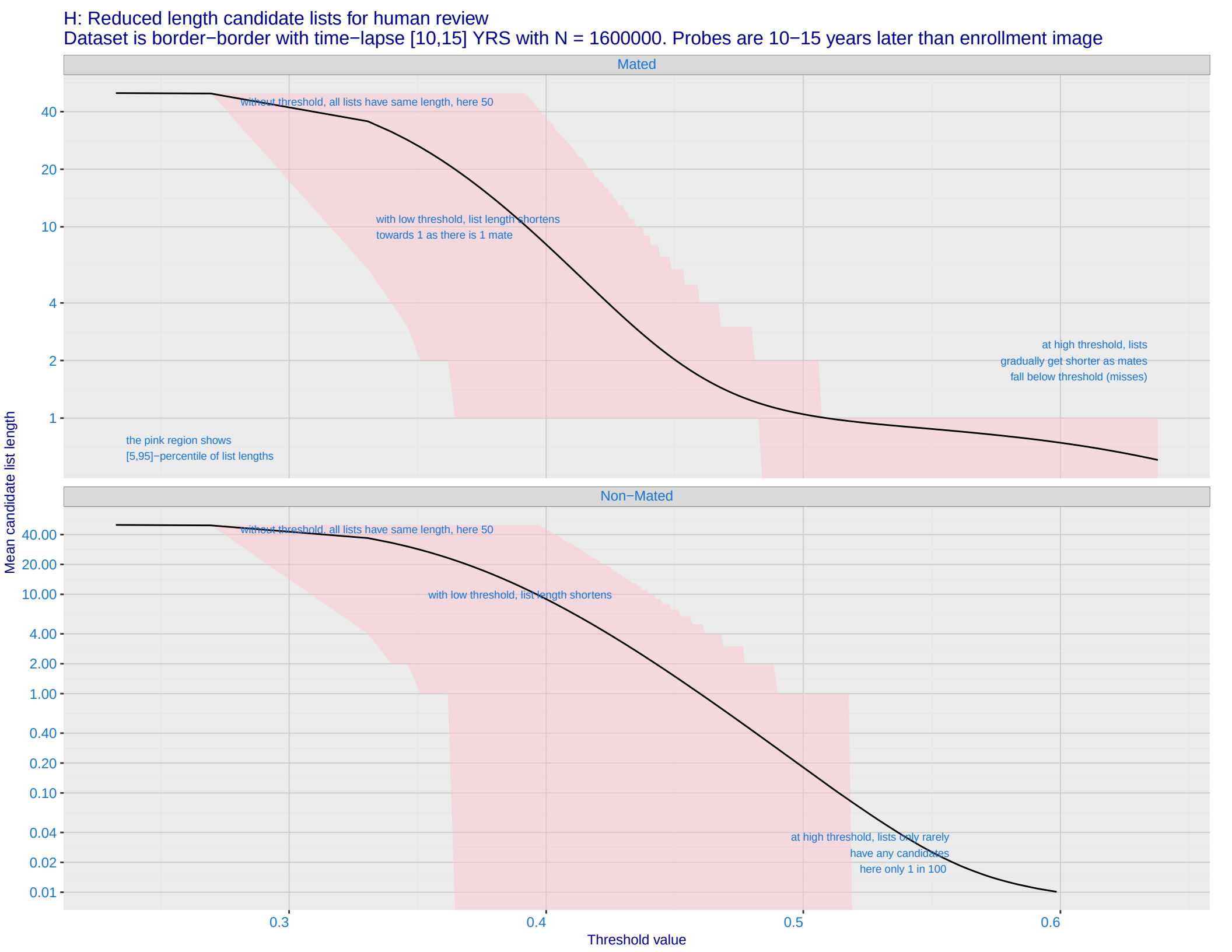


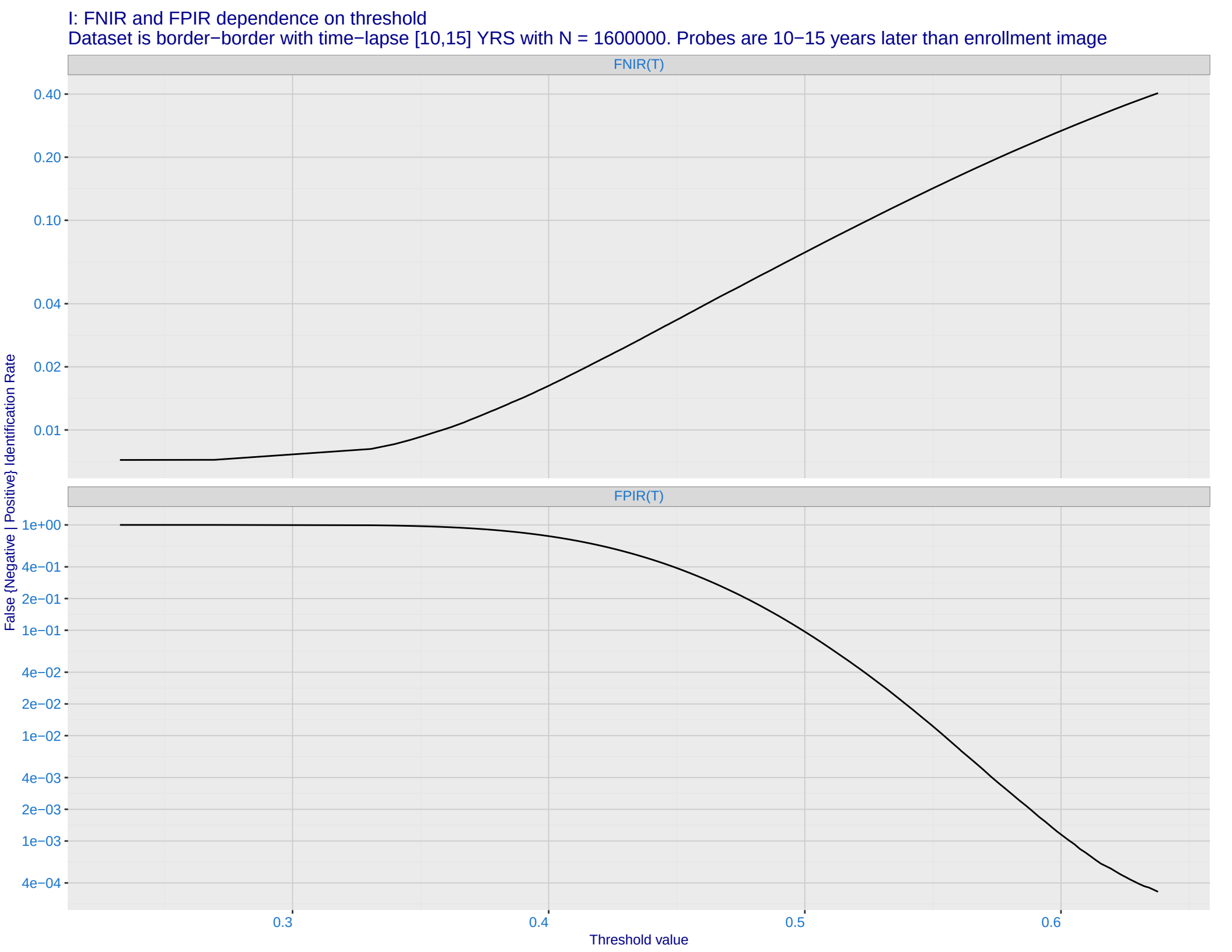

D: 1:N error tradeoff by dataset and enrollment type. N = 1600000 individuals
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
line_000
sensetime_004
False negative identification rate, FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e−04
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

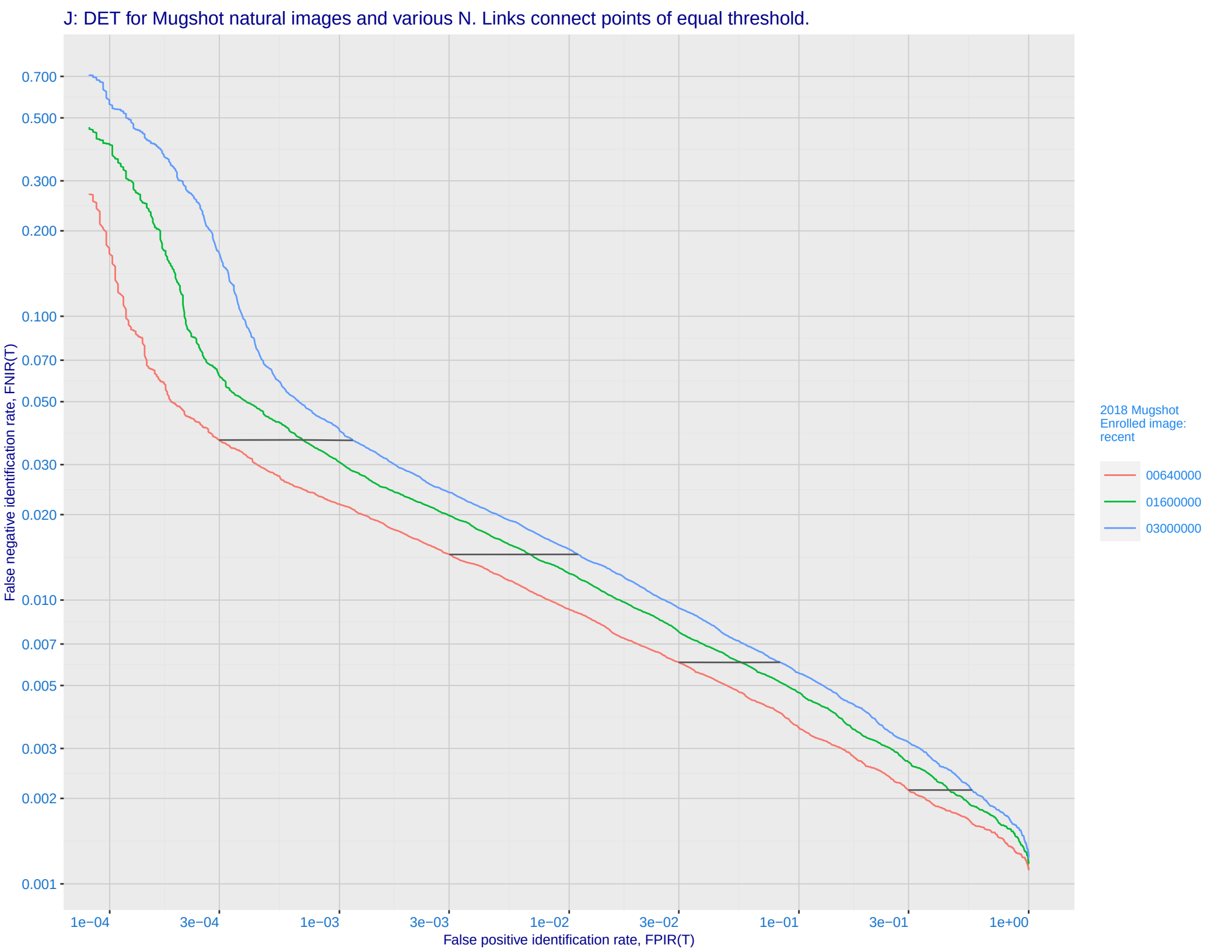

E: Dependence of error rates on T by number enrolled identities, N, for Mugshot natural images
N
00640000
01600000
03000000
recent
FNIR
FPIR
Identification Error rate, FPIR(T) or FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
7e−01
5e−01
3e−01
2e−01
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

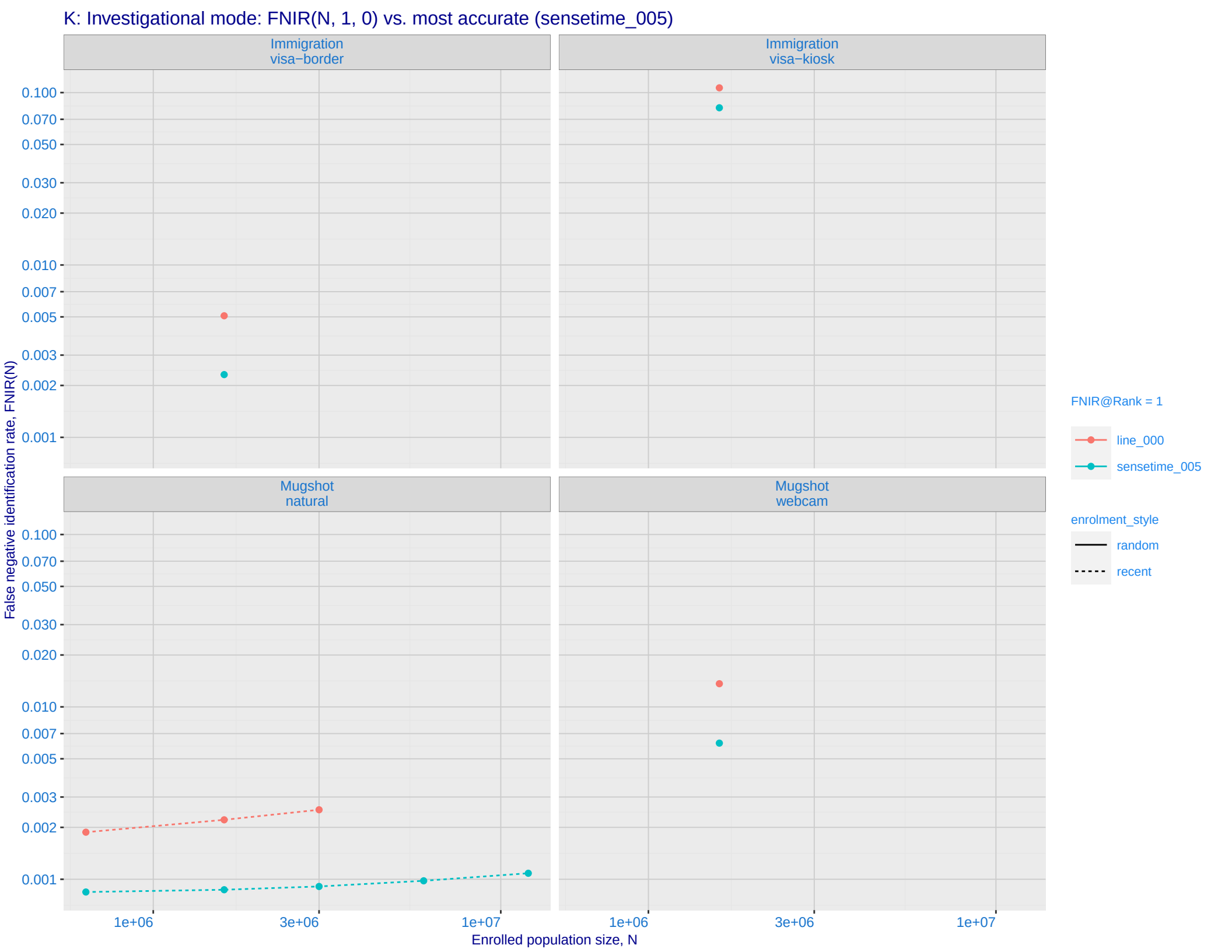

F: FPIR vs. Selectivity for mugshot images, N = 1600000 subjects enrolled with one recent mate
Selectivity, SEL(T)
7e+01
5e+01
3e+01
2e+01
1e+01
7e+00
5e+00
3e+00
2e+00
1e+00
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
1e−04
3e−04
1e−03
3e−03
1e−02
3e−02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

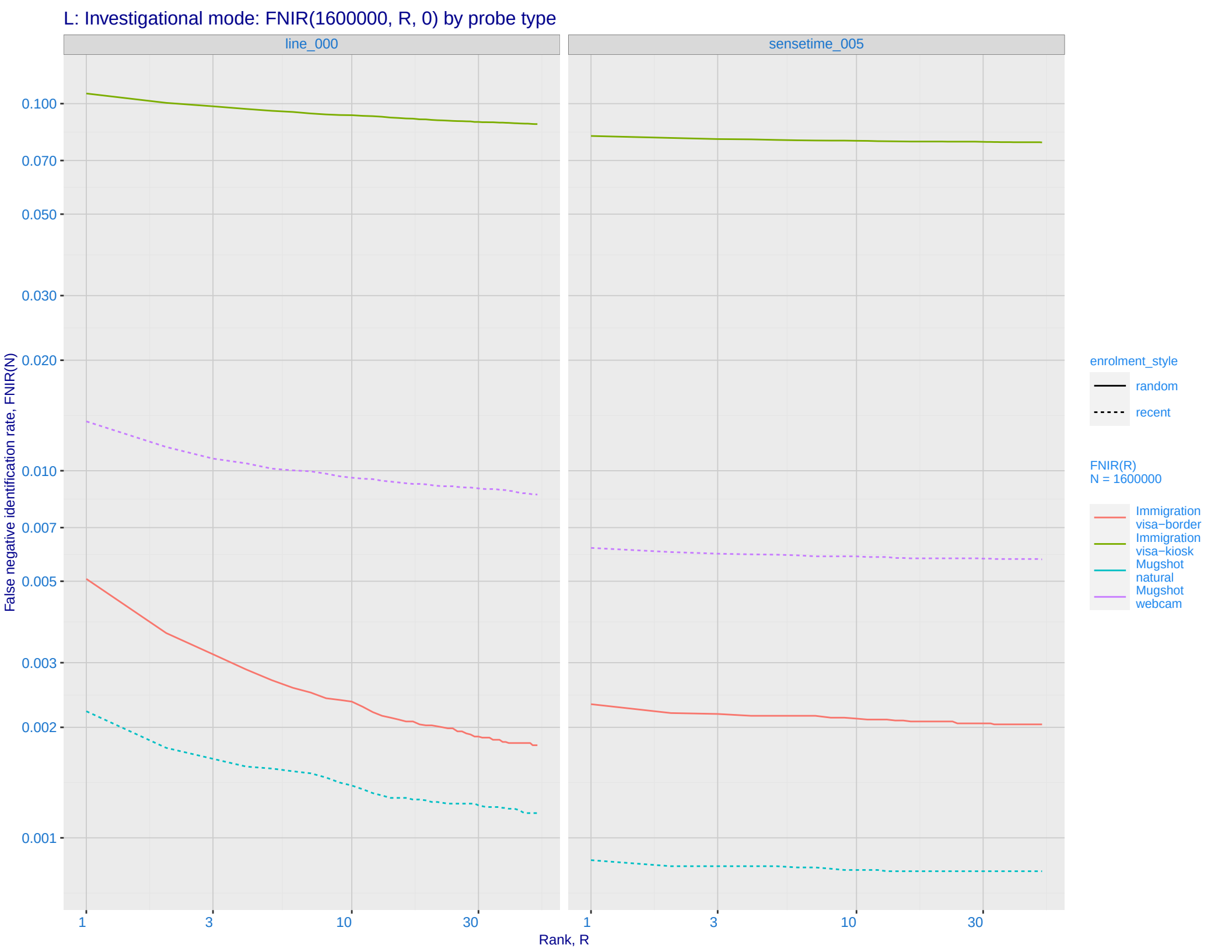

G: FPIR dependence on T by probe type for N = 1600000 subjects
False Positive Idenification Rate, FPIR(T)
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05
0.4
0.6
0.8
1.0
Threshold
enrolment_style
random
recent
Enrolled image: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


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

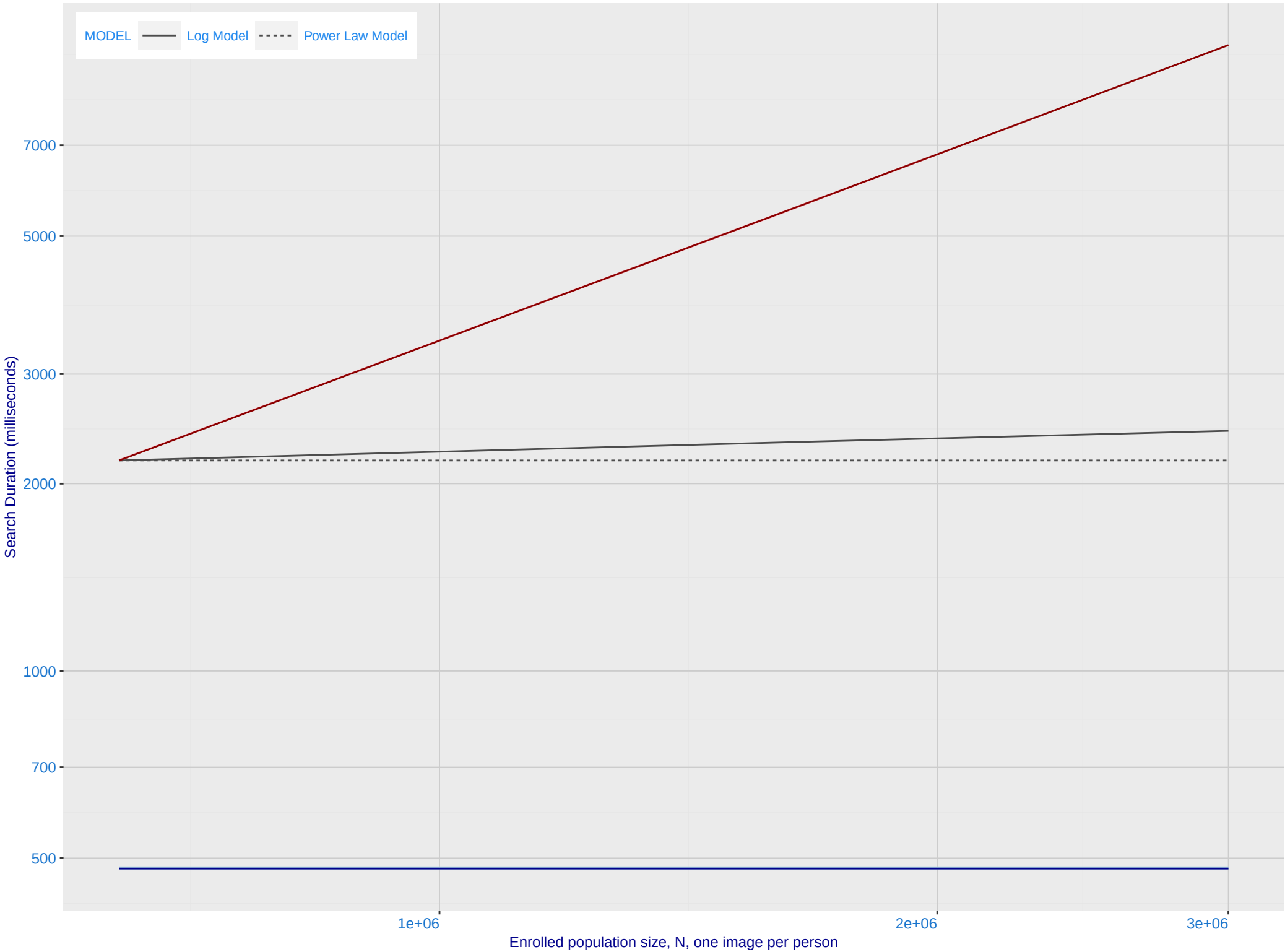

I: FNIR and FPIR dependence on threshold
Dataset is border−border with time−lapse [10,15] YRS with N = 1600000. Probes are 10−15 years later than enrollment image
FNIR(T)
0.40
0.20
0.10
0.04
0.02
0.01
FPIR(T)
1e+00
4e−01
2e−01
1e−01
4e−02
2e−02
1e−02
4e−03
2e−03
1e−03
4e−04
False {Negative | Positive} Identification Rate
0.3
0.4
0.5
0.6
Threshold value

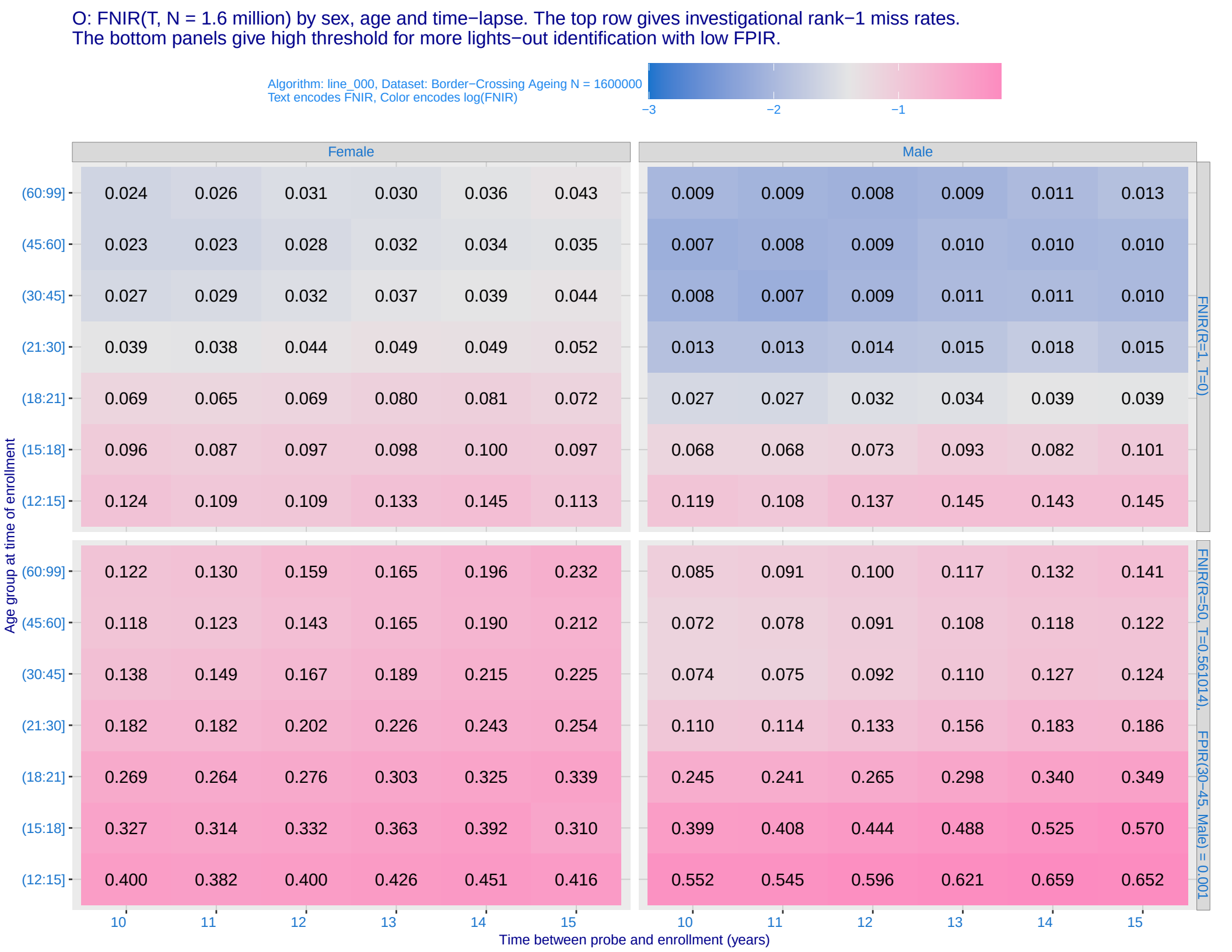

J: DET for Mugshot natural images and various N. Links connect points of equal threshold.
False negative identification rate, FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e−04
3e−04
1e−03
3e−03
1e−02
3e−02
1e−01
3e−01
1e+00
False positive identification rate, FPIR(T)
2018 Mugshot
Enrolled image:
recent
00640000
01600000
03000000


K: Investigational mode: FNIR(N, 1, 0) vs. most accurate (sensetime_005)
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
Mugshot webcam
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
0.001
1e+06
3e+06
1e+07
Enrolled population size, N
FNIR@Rank = 1
line_000
sensetime_005
enrolment_style
random
recent

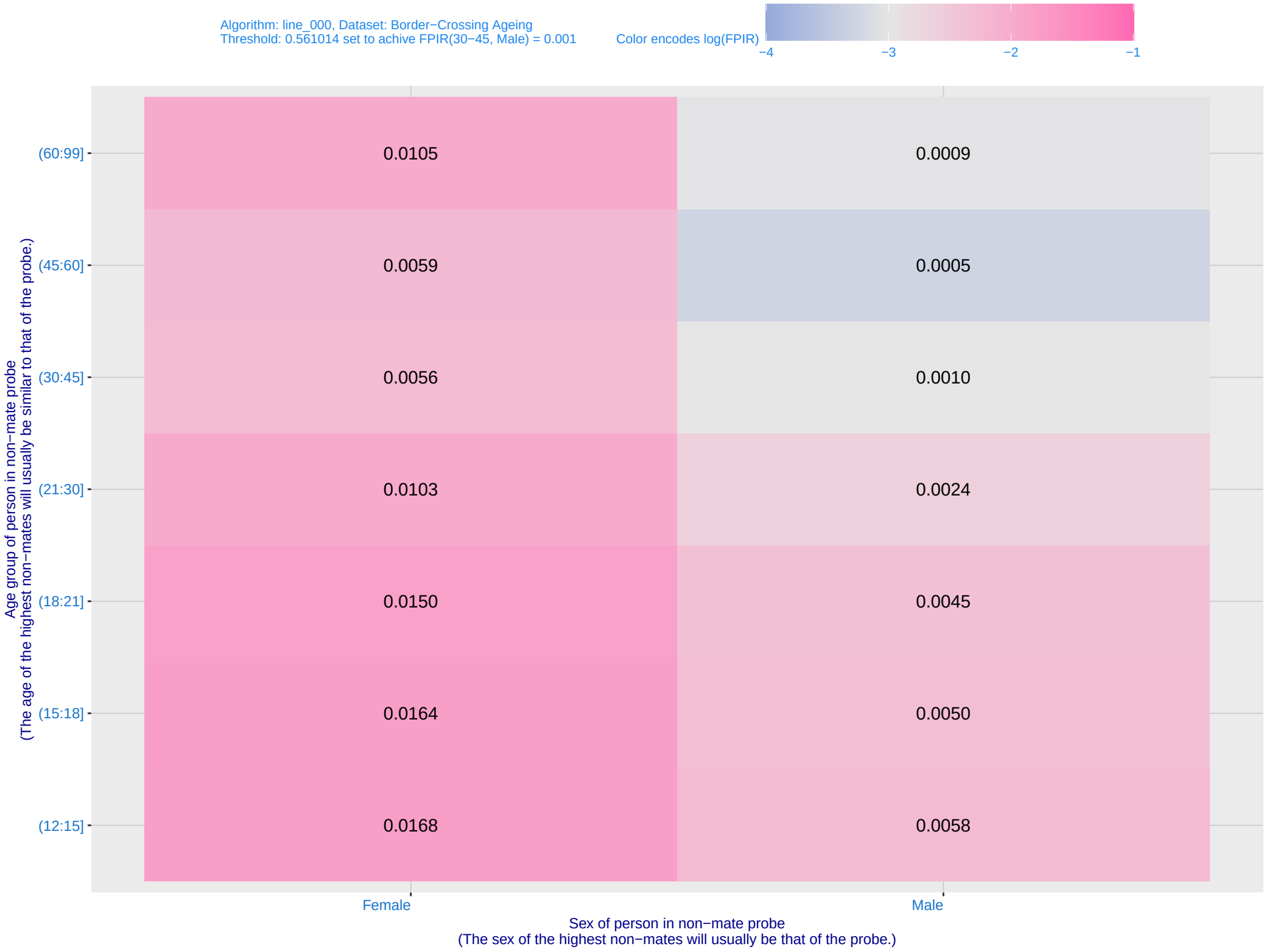

L: Investigational mode: FNIR(1600000, R, 0) by probe type
line_000
sensetime_005
False negative identification rate, FNIR(N)
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1
3
10
30
Rank, R
enrolment_style
random
recent
FNIR(R)
N = 1600000
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
Mugshot webcam

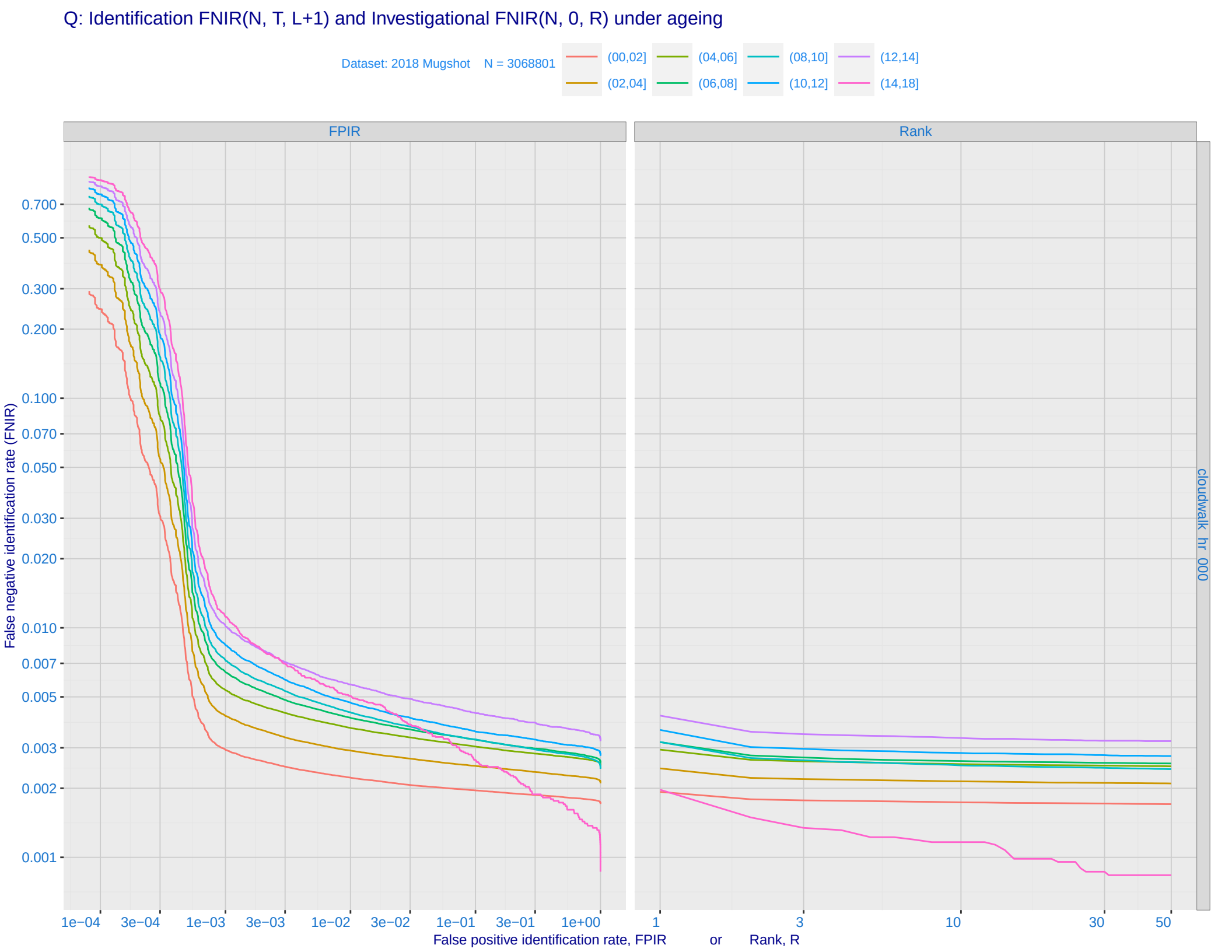
M: Template duration; search duration vs. N. The blue and pink ribbon covers 95 percent of observed measurements.
The template generation time is independent of N. The log and power−law models are fit to the first two (N,T) observations




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: line_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]
0.024 0.026 0.031 0.030 0.036 0.043
0.023 0.023 0.028 0.032 0.034 0.035
0.027 0.029 0.032 0.037 0.039 0.044
0.039 0.038 0.044 0.049 0.049 0.052
0.069 0.065 0.069 0.080 0.081 0.072
0.096 0.087 0.097 0.098 0.100 0.097
0.124 0.109 0.109 0.133 0.145 0.113
0.009 0.009 0.008 0.009 0.011 0.013
0.007 0.008 0.009 0.010 0.010 0.010
0.008 0.007 0.009 0.011 0.011 0.010
0.013 0.013 0.014 0.015 0.018 0.015
0.027 0.027 0.032 0.034 0.039 0.039
0.068 0.068 0.073 0.093 0.082 0.101
0.119 0.108 0.137 0.145 0.143 0.145
FNIR(R=1, T=0)
0.122 0.130 0.159 0.165 0.196 0.232
0.118 0.123 0.143 0.165 0.190 0.212
0.138 0.149 0.167 0.189 0.215 0.225
0.182 0.182 0.202 0.226 0.243 0.254
0.269 0.264 0.276 0.303 0.325 0.339
0.327 0.314 0.332 0.363 0.392 0.310
0.400 0.382 0.400 0.426 0.451 0.416
0.085 0.091 0.100 0.117 0.132 0.141
0.072 0.078 0.091 0.108 0.118 0.122
0.074 0.075 0.092 0.110 0.127 0.124
0.110 0.114 0.133 0.156 0.183 0.186
0.245 0.241 0.265 0.298 0.340 0.349
0.399 0.408 0.444 0.488 0.525 0.570
0.552 0.545 0.596 0.621 0.659 0.652
FNIR(R=50, T=0.561014), 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