A: Datasheet

Algorithm: recognito_000

Developer: Recognito

Submission Date: 2023_02_17

Template size: 1280 bytes

Template time (2.5 percentile): 924 msec

Template time (median): 925 msec

Template time (97.5 percentile): 932 msec

Investigation:

Frontal mugshot ranking 170 (out of 399) −− FNIR(1600000, 0, 1) = 0.0036 vs. lowest 0.0008 from intema_001

Mugshot webcam ranking 10 (out of 361) −− FNIR(1600000, 0, 1) = 0.0064 vs. lowest 0.0054 from sensetime_009

Mugshot profile ranking 23 (out of 330) −− FNIR(1600000, 0, 1) = 0.0637 vs. lowest 0.0517 from sensetime_009

Immigration visa−border ranking 6 (out of 288) −− FNIR(1600000, 0, 1) = 0.0008 vs. lowest 0.0006 from cloudwalk_mt_002

Immigration visa−kiosk ranking 3 (out of 233) −− FNIR(1600000, 0, 1) = 0.0424 vs. lowest 0.0387 from cloudwalk_mt_002

Identification:

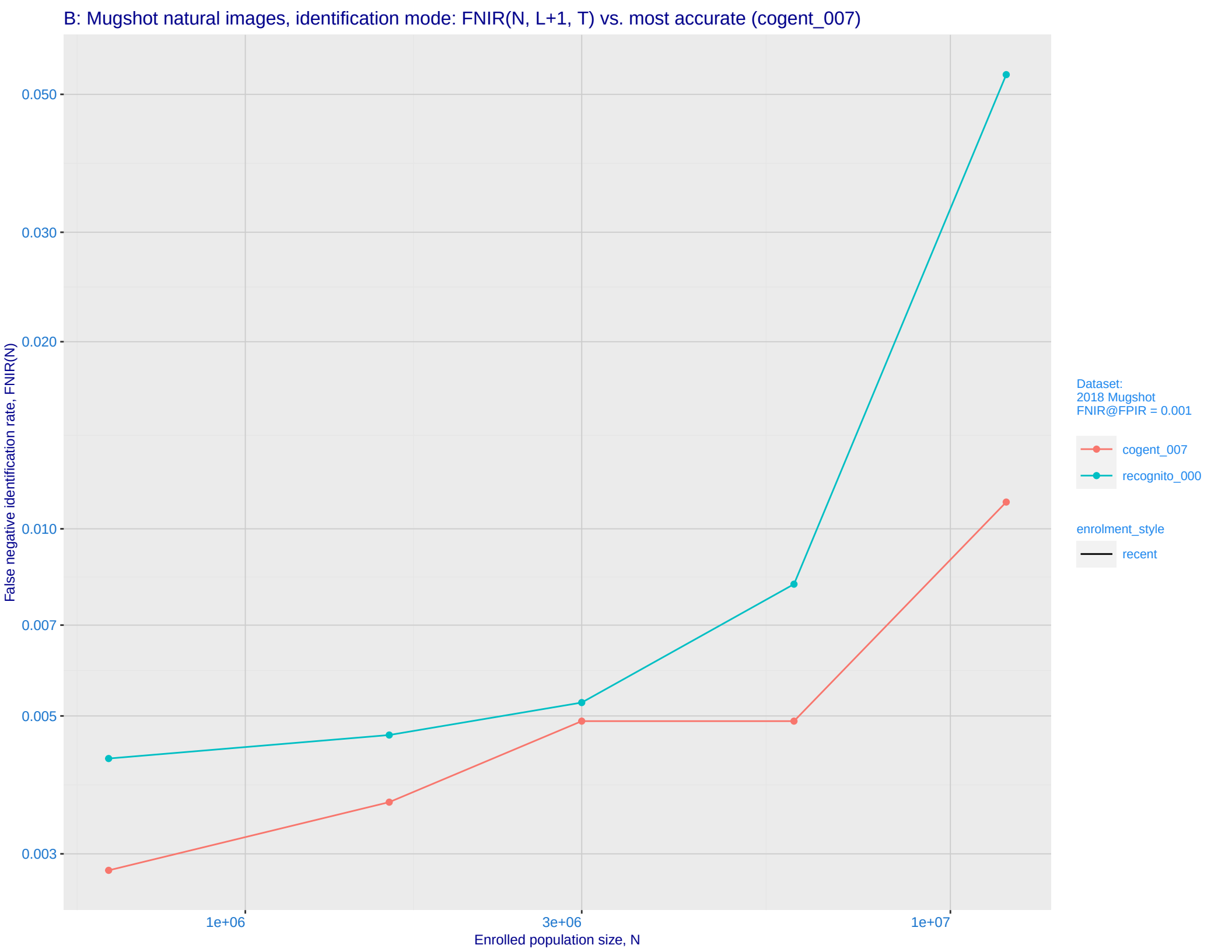
Frontal mugshot ranking 48 (out of 399) −− FNIR(1600000, T, L+1) = 0.0047, FPIR=0.001000 vs. lowest 0.0011 from idemia_010

Mugshot webcam ranking 8 (out of 359) −− FNIR(1600000, T, L+1) = 0.0119, FPIR=0.001000 vs. lowest 0.0072 from sensetime_009

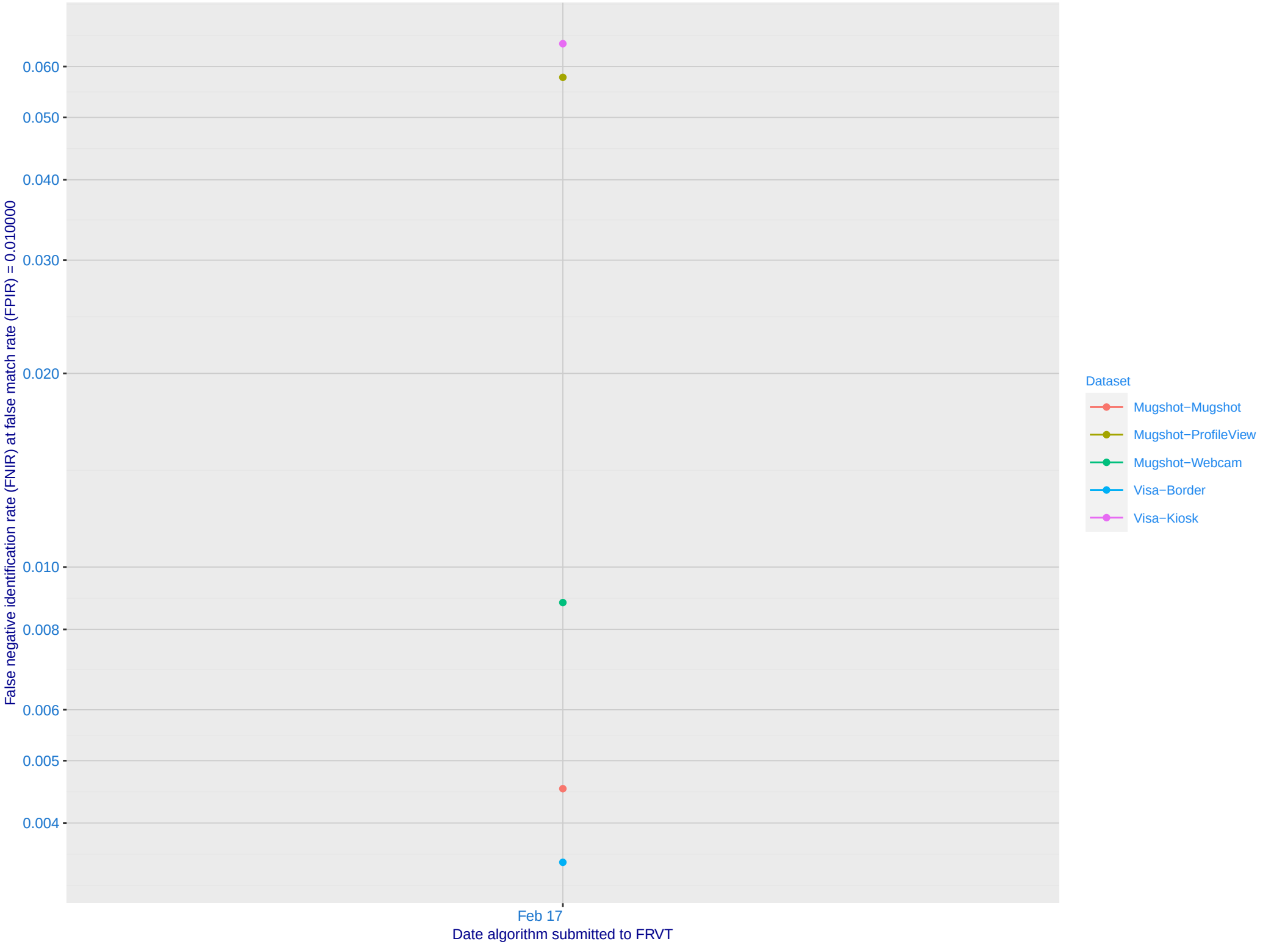
Mugshot profile ranking 12 (out of 329) −− FNIR(1600000, T, L+1) = 0.1842, FPIR=0.001000 vs. lowest 0.0634 from cloudwalk_mt_002

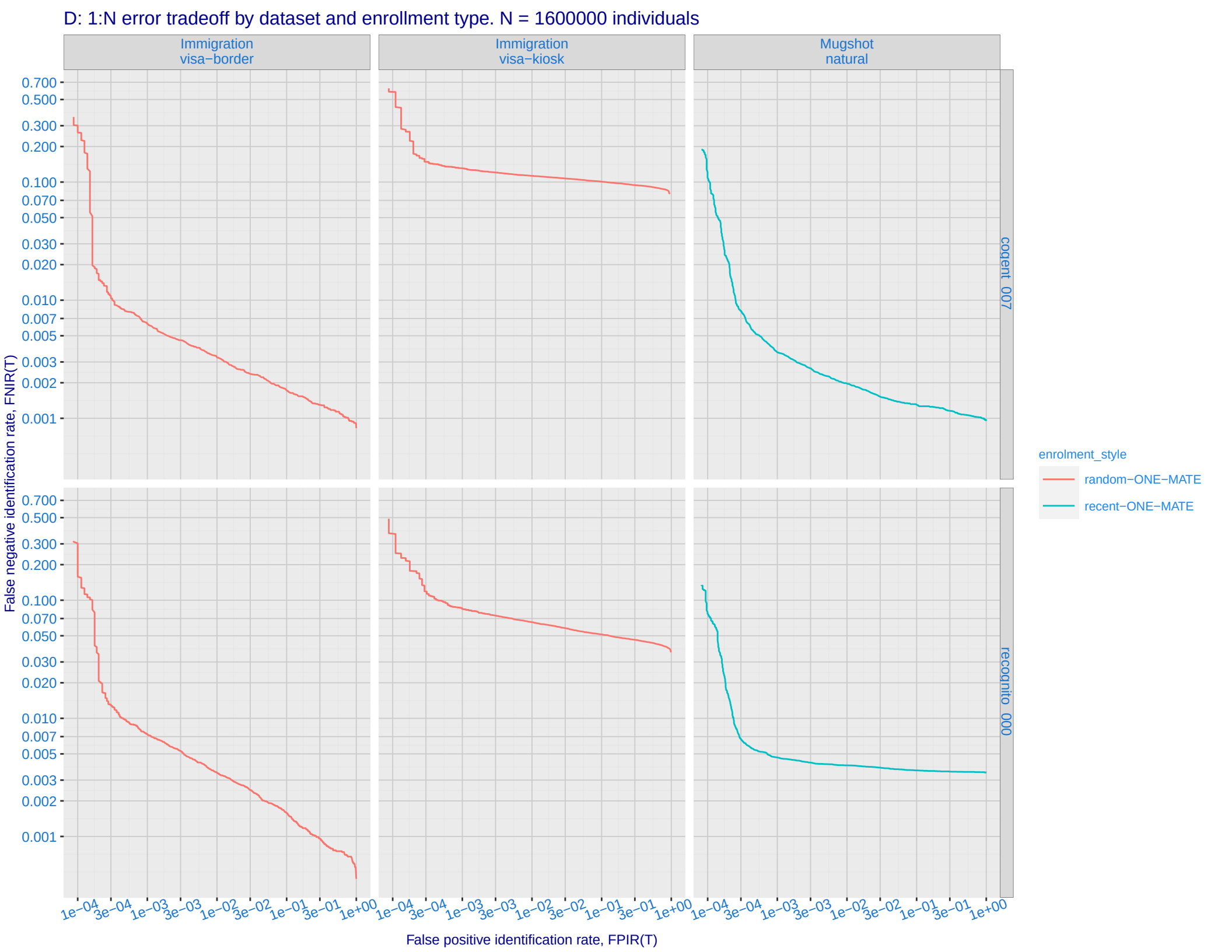
Immigration visa−border ranking 40 (out of 287) −− FNIR(1600000, T, L+1) = 0.0073, FPIR=0.001000 vs. lowest 0.0010 from cloudwalk_mt_002

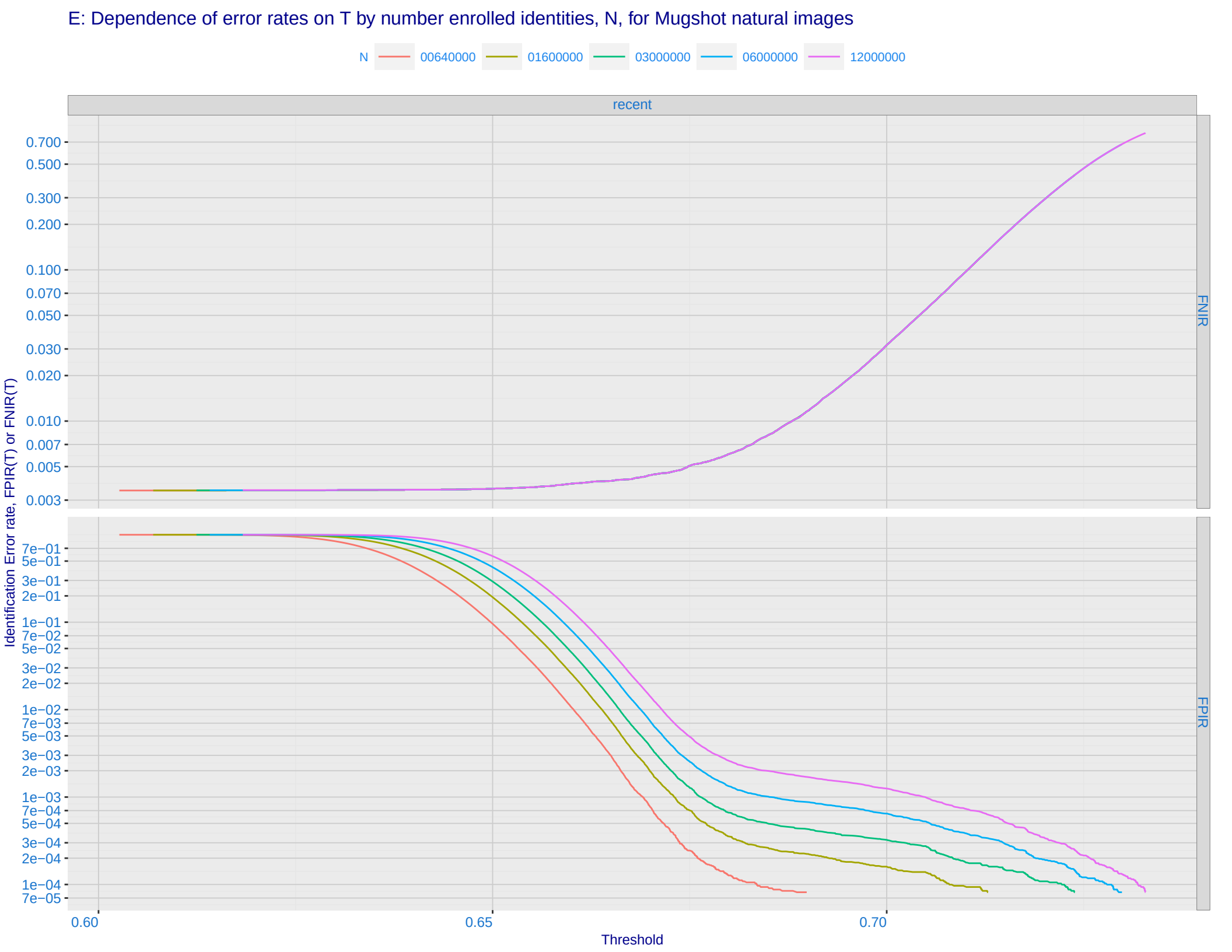
Immigration visa−kiosk ranking 20 (out of 233) −− FNIR(1600000, T, L+1) = 0.0858, FPIR=0.001000 vs. lowest 0.0517 from cloudwalk_mt_002

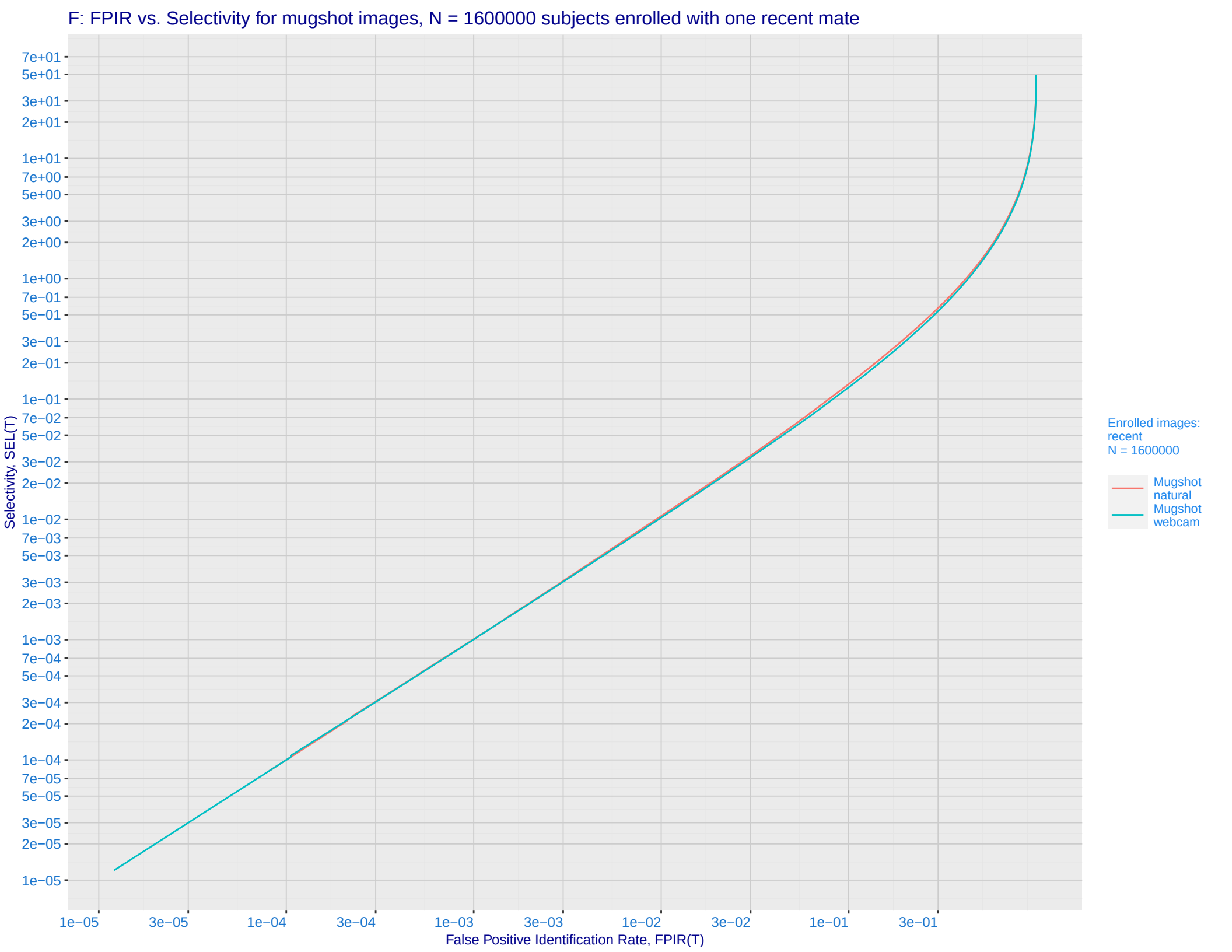

B: Mugshot natural images, identification mode: FNIR(N, L+1, T) vs. most accurate (cogent_007)
False negative identification rate, FNIR(N)
0.050
0.030
0.020
0.010
0.007
0.005
0.003
1e+06
3e+06
1e+07
Enrolled population size, N
Dataset:
2018 Mugshot
FNIR@FPIR = 0.001
cogent_007
recognito_000
enrolment_style
recent

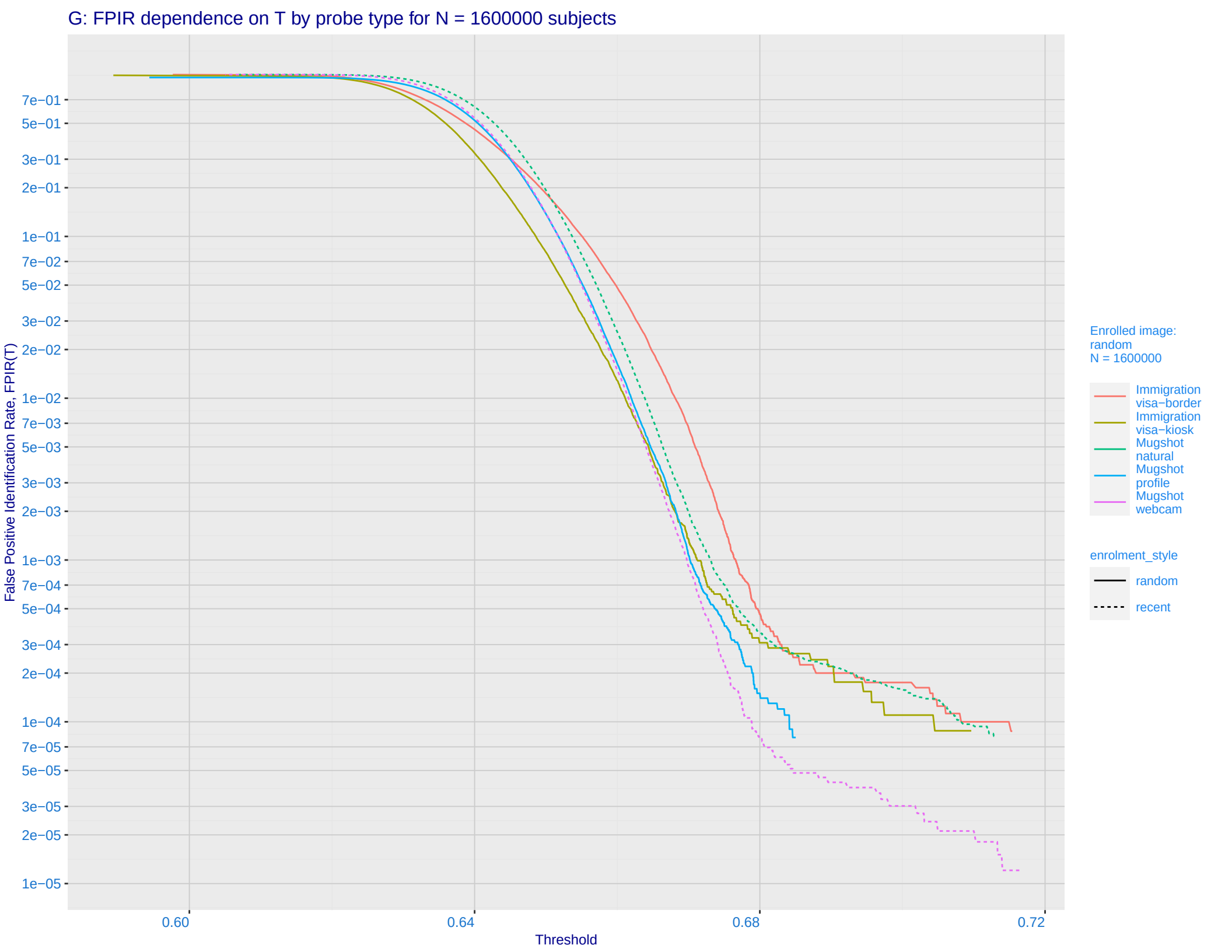
C: Evolution of accuracy for RECOGNITO algorithms on three datasets 2018 − present

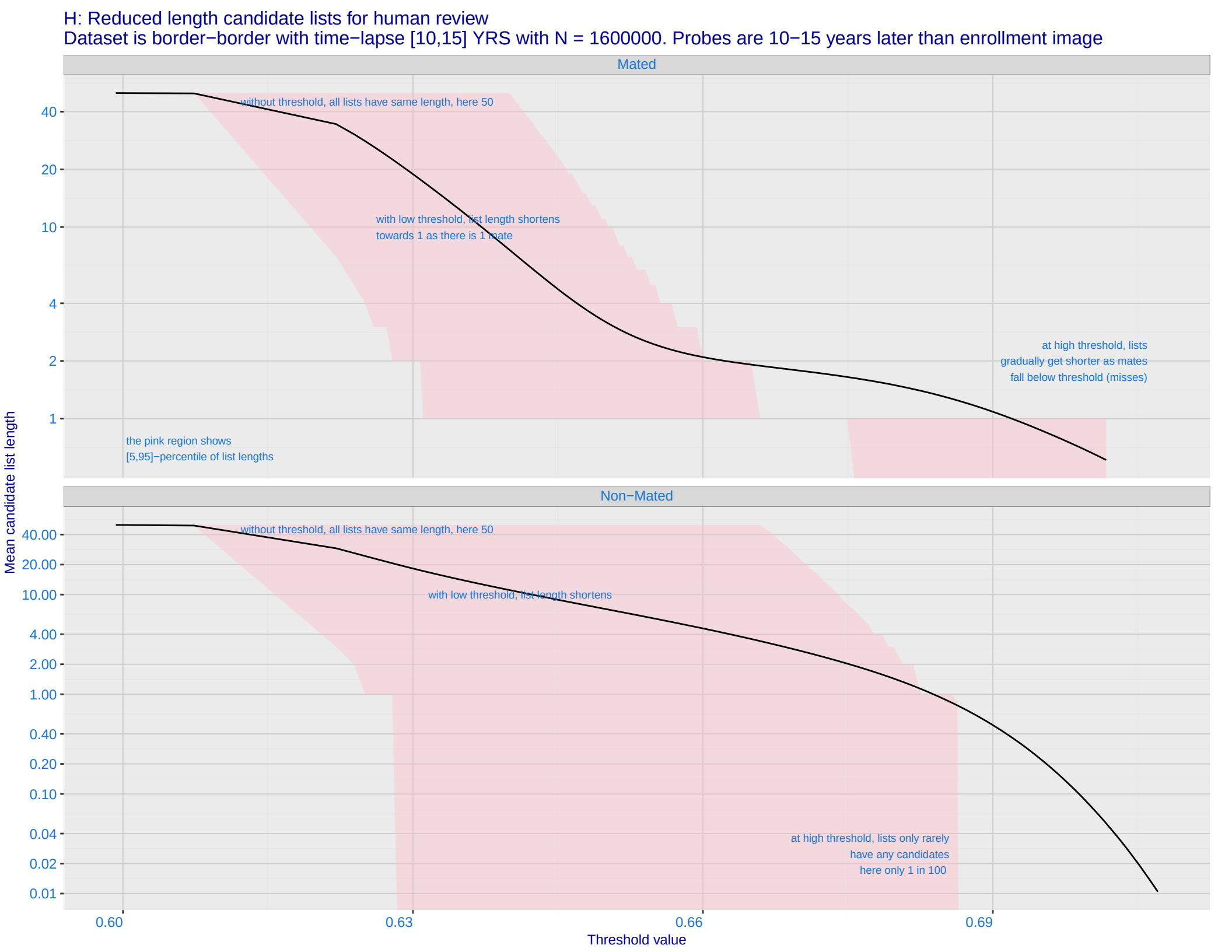


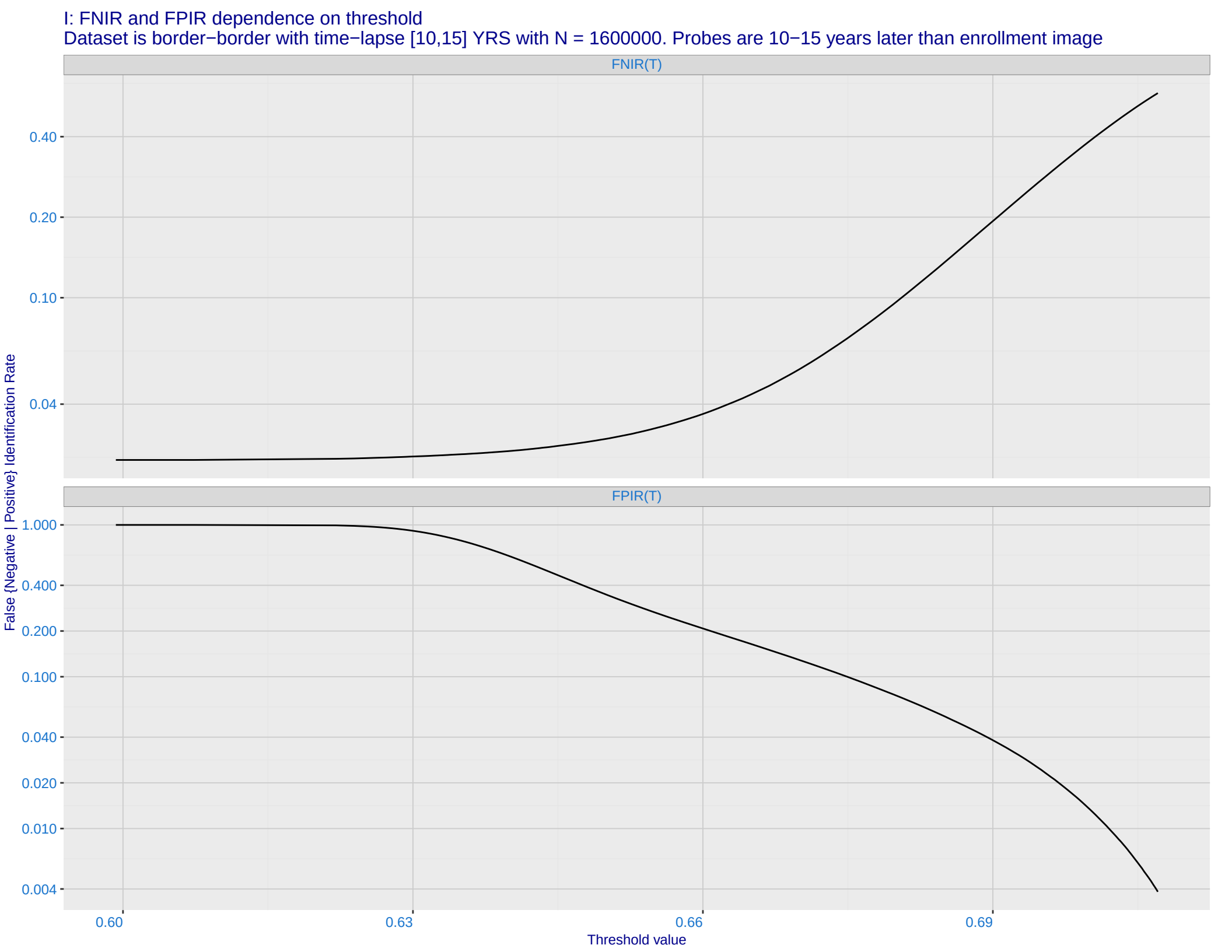

D: 1:N error tradeoff by dataset and enrollment type. N = 1600000 individuals
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
cogent_007
recognito_000
False negative identification rate, FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e−04
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

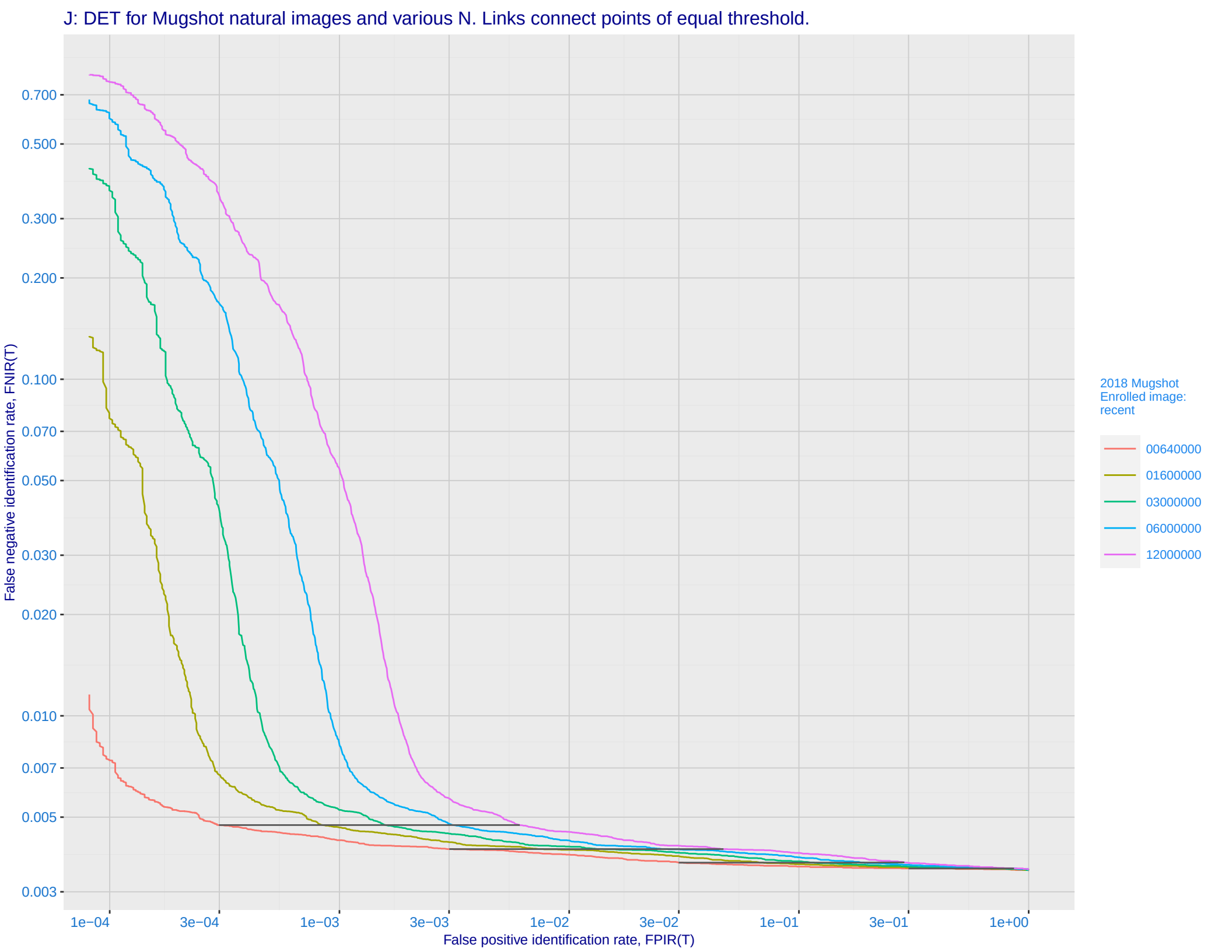

E: Dependence of error rates on T by number enrolled identities, N, for Mugshot natural images
N
00640000
01600000
03000000
06000000
12000000
recent
FNIR
FPIR
Identification Error rate, FPIR(T) or FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
7e−01
5e−01
3e−01
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
0.60
0.65
0.70
Threshold

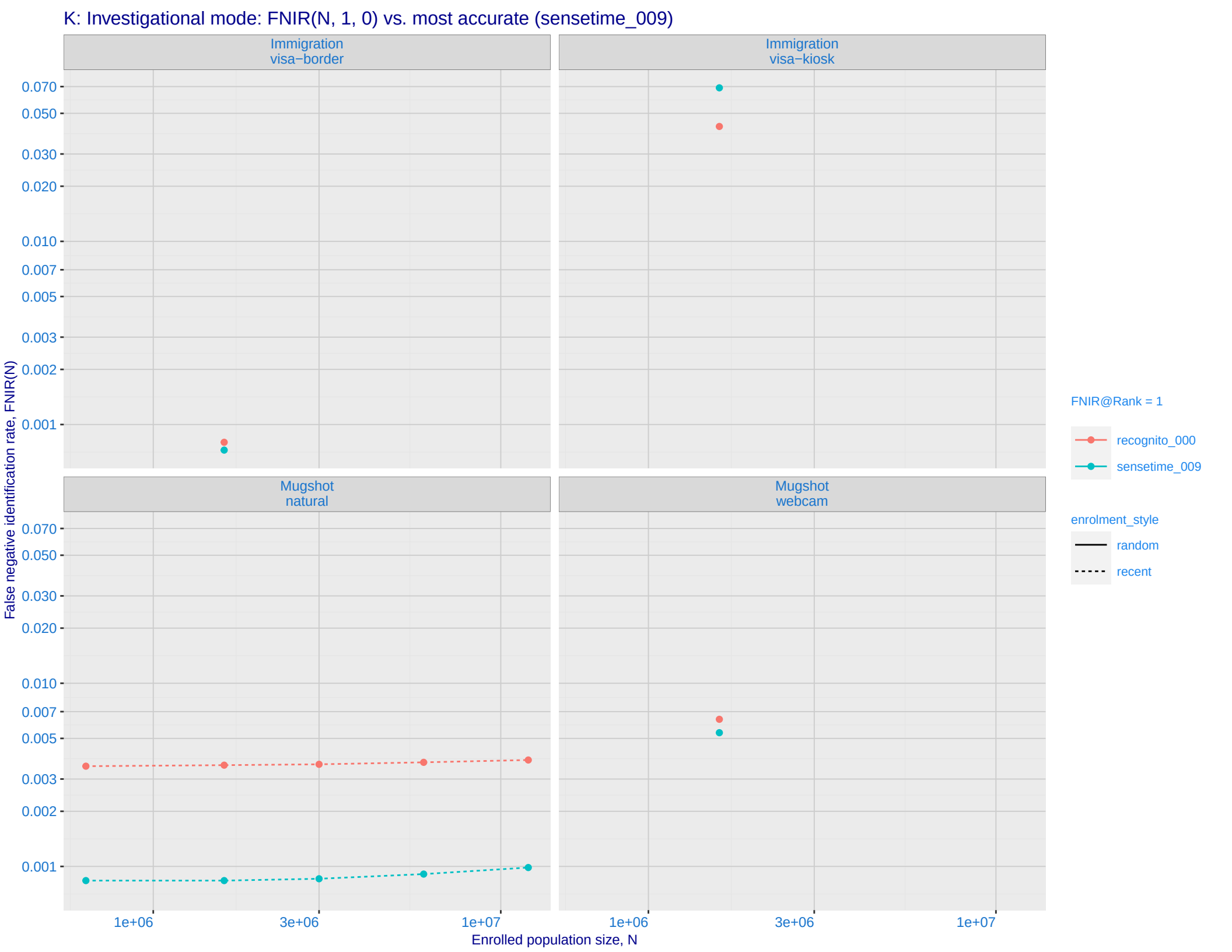

F: FPIR vs. Selectivity for mugshot images, N = 1600000 subjects enrolled with one recent mate
Selectivity, SEL(T)
7e+01
5e+01
3e+01
2e+01
1e+01
7e+00
5e+00
3e+00
2e+00
1e+00
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05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

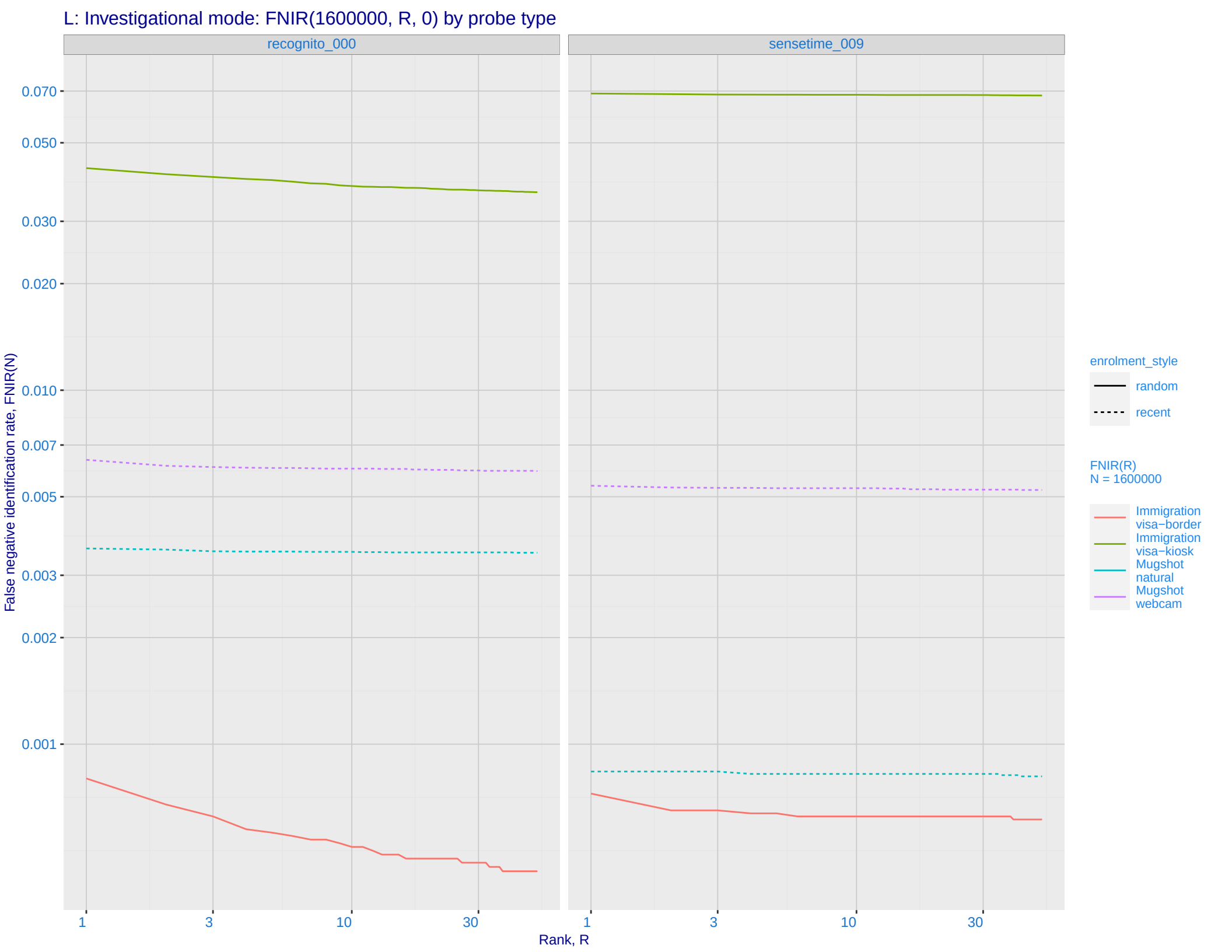

G: FPIR dependence on T by probe type for N = 1600000 subjects
False Positive Identification Rate, FPIR(T)
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05
5e−05
3e−05
2e−05
1e−05
0.60
0.64
0.68
0.72
Threshold
Enrolled image:
random
N = 1600000
Immigration
visa−border
Immigration
visa−kiosk
Mugshot
natural
Mugshot
profile
Mugshot
webcam
enrolment_style
random
recent

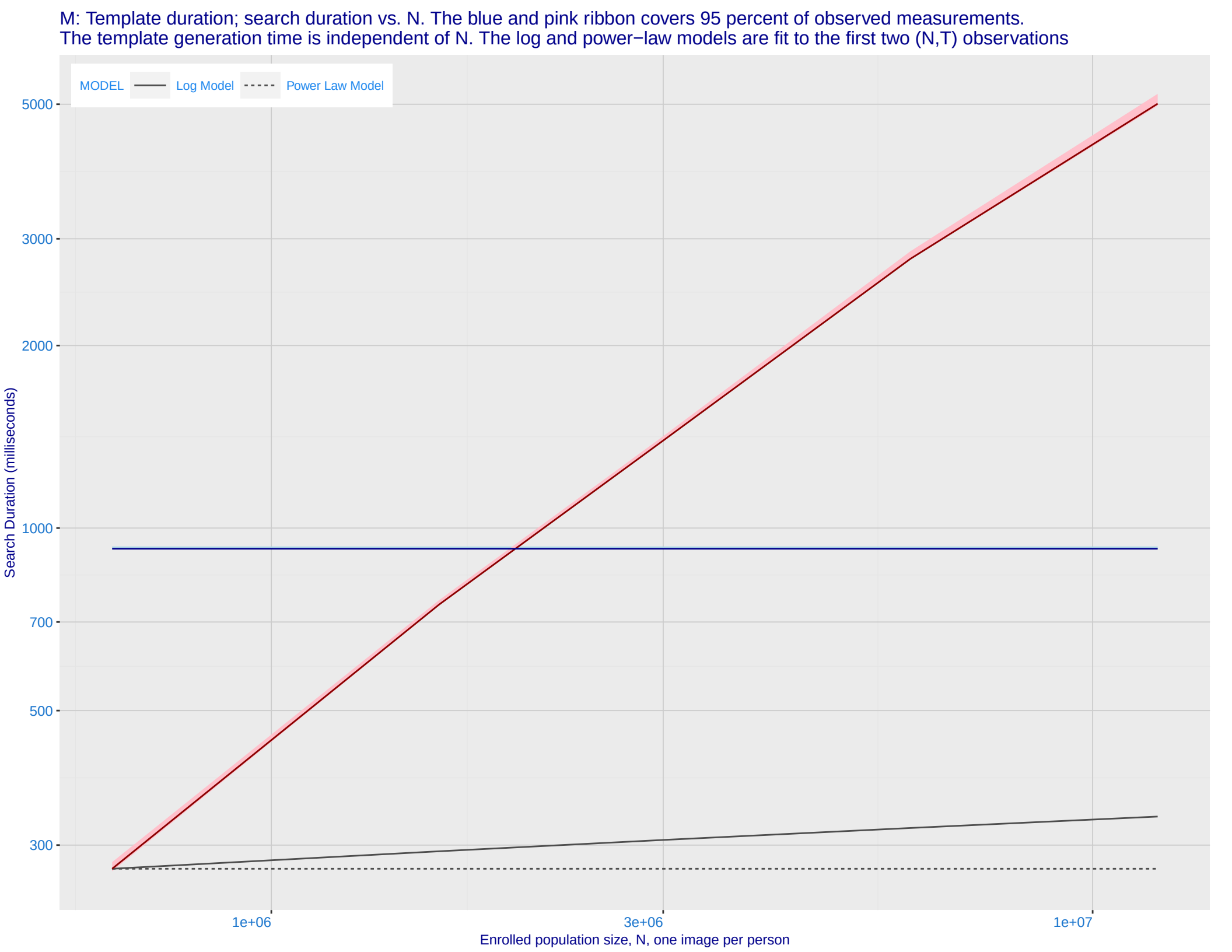

H: Reduced length candidate lists for human review
Dataset is border−border with time−lapse [10,15] YRS with N = 1600000. Probes are 10−15 years later than enrollment image
Mated
without threshold, all lists have same length, here 50
with low threshold, list length shortens
towards 1 as there is 1 mate
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
40
20
10
4
2
1
40.00
20.00
10.00
4.00
2.00
1.00
0.40
0.20
0.10
0.04
0.02
0.01
0.60
0.63
0.66
0.69

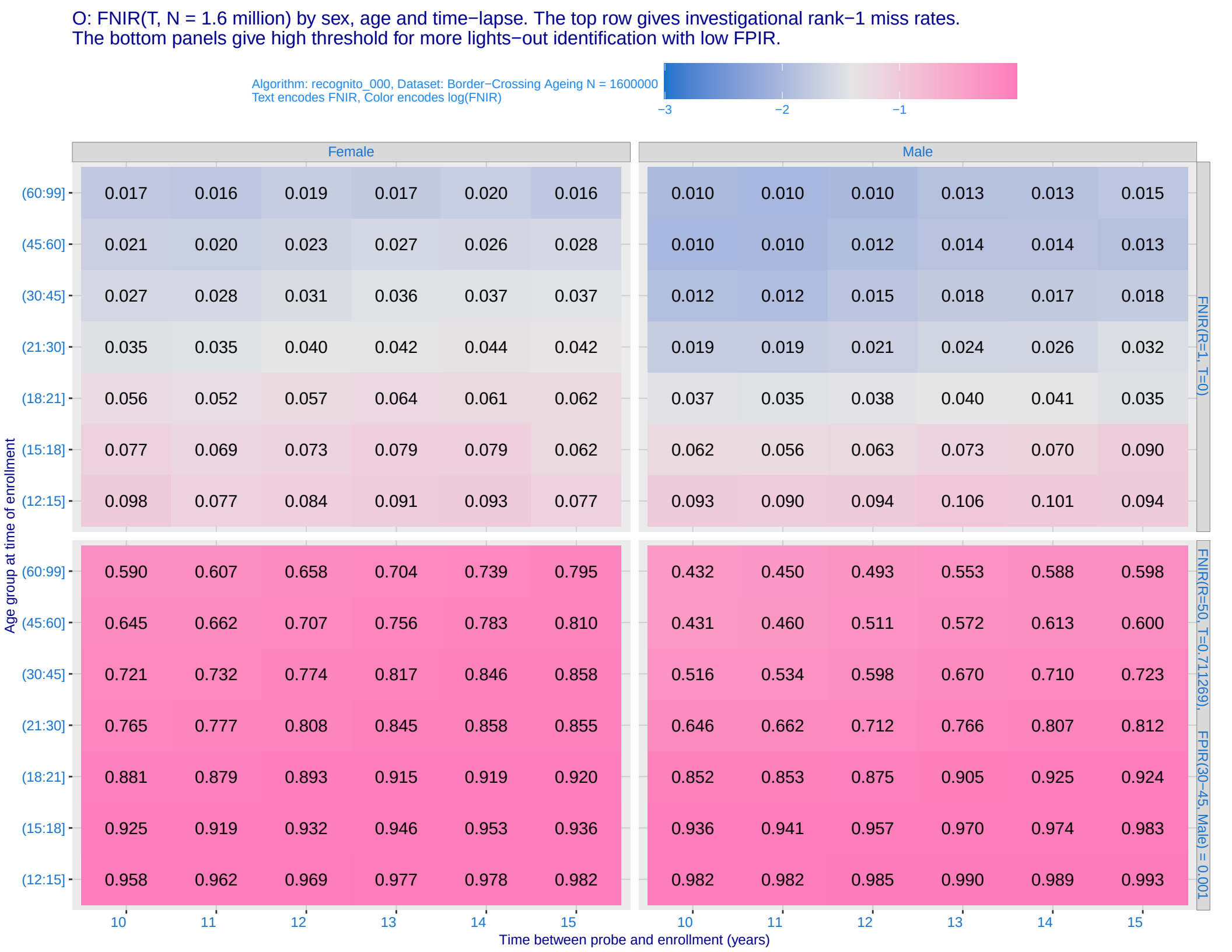

I: FNIR and FPIR dependence on threshold
Dataset is border−border with time−lapse [10,15] YRS with N = 1600000. Probes are 10−15 years later than enrollment image
FNIR(T)
FPIR(T)
False {Negative | Positive} Identification Rate
0.40
0.20
0.10
0.04
1.000
0.400
0.200
0.100
0.040
0.020
0.010
0.004
0.60
0.63
0.66
0.69
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
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_009)
Immigration
visa−border
Immigration
visa−kiosk
Mugshot
natural
Mugshot
webcam
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
False negative identification rate, FNIR(N)
1e+06
3e+06
1e+07
Enrolled population size, N
FNIR@Rank = 1
recognito_000
sensetime_009
enrolment_style
random
recent


L: Investigational mode: FNIR(1600000, R, 0) by probe type
recognito_000
sensetime_009
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
MODEL
Log Model
Power Law Model
5000
3000
2000
1000
700
500
300
Search Duration (milliseconds)
1e+06
3e+06
1e+07
Enrolled population size, N, one image per person

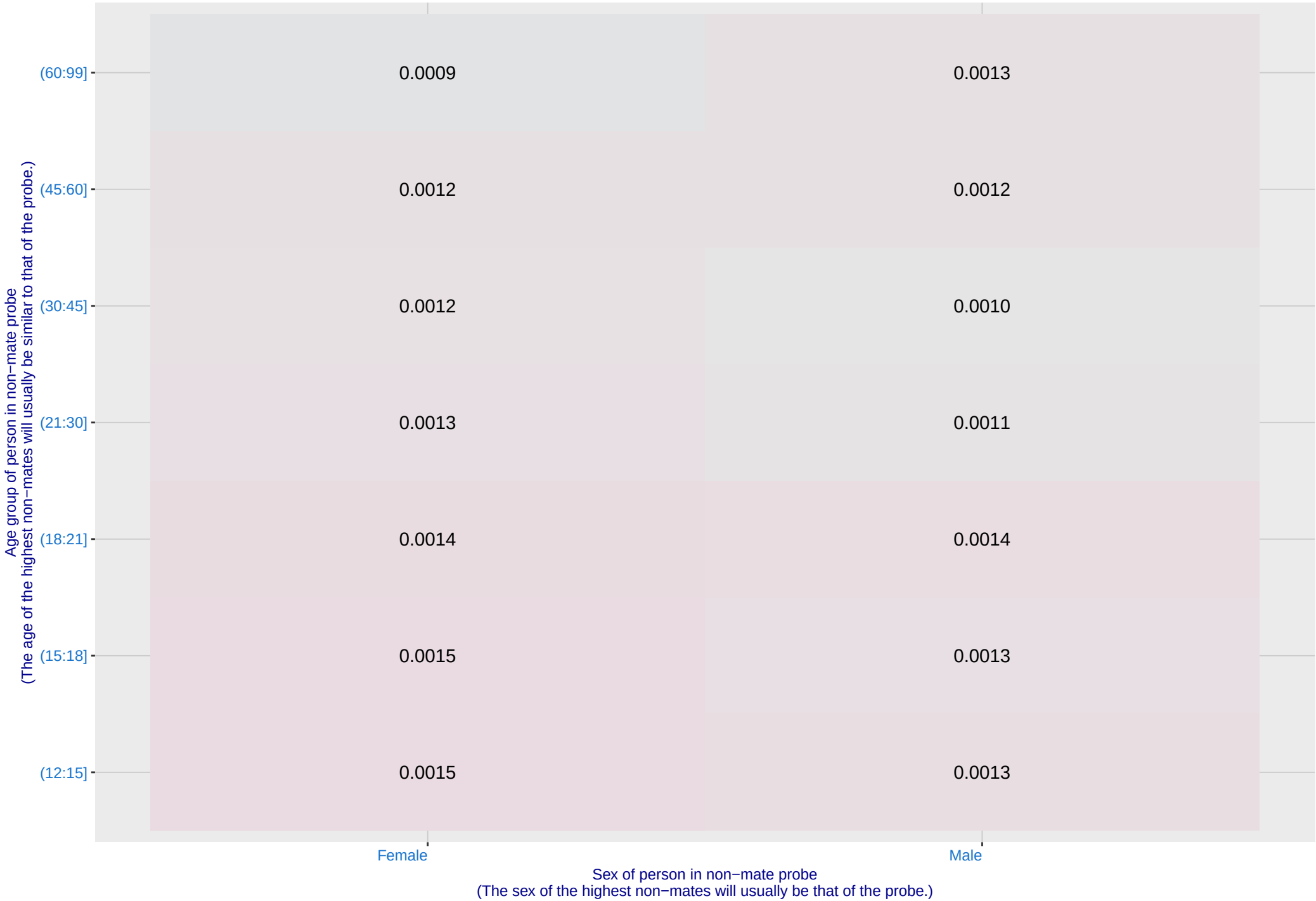

O: FNIR(T, N = 1.6 million) by sex, age and time−lapse. The top row gives investigational rank−1 miss rates.
The bottom panels give high threshold for more lights−out identification with low FPIR.
Algorithm: recognito_000, Dataset: Border−Crossing Ageing N = 1600000
Text encodes FNIR, Color encodes log(FNIR)
−3
−2
−1
Female
Male
(60:99]
(45:60]
(30:45]
(21:30]
(18:21]
(15:18]
(12:15]
0.017 0.016 0.019 0.017 0.020 0.016
0.021 0.020 0.023 0.027 0.026 0.028
0.027 0.028 0.031 0.036 0.037 0.037
0.035 0.035 0.040 0.042 0.044 0.042
0.056 0.052 0.057 0.064 0.061 0.062
0.077 0.069 0.073 0.079 0.079 0.062
0.098 0.077 0.084 0.091 0.093 0.077
0.010 0.010 0.010 0.013 0.013 0.015
0.010 0.010 0.012 0.014 0.014 0.013
0.012 0.012 0.015 0.018 0.017 0.018
0.019 0.019 0.021 0.024 0.026 0.032
0.037 0.035 0.038 0.040 0.041 0.035
0.062 0.056 0.063 0.073 0.070 0.090
0.093 0.090 0.094 0.106 0.101 0.094
FNIR(R=1, T=0)
0.590 0.607 0.658 0.704 0.739 0.795
0.645 0.662 0.707 0.756 0.783 0.810
0.721 0.732 0.774 0.817 0.846 0.858
0.765 0.777 0.808 0.845 0.858 0.855
0.881 0.879 0.893 0.915 0.919 0.920
0.925 0.919 0.932 0.946 0.953 0.936
0.958 0.962 0.969 0.977 0.978 0.982
0.432 0.450 0.493 0.553 0.588 0.598
0.431 0.460 0.511 0.572 0.613 0.600
0.516 0.534 0.598 0.670 0.710 0.723
0.646 0.662 0.712 0.766 0.807 0.812
0.852 0.853 0.875 0.905 0.925 0.924
0.936 0.941 0.957 0.970 0.974 0.983
0.982 0.982 0.985 0.990 0.989 0.993
FNIR(R=50, T=0.711269), 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.

Algorithm: recognito_000, Dataset: Border−Crossing Ageing
Threshold: 0.711269 set to achive FPIR(30−45, Male) = 0.001

Color encodes log(FPIR)

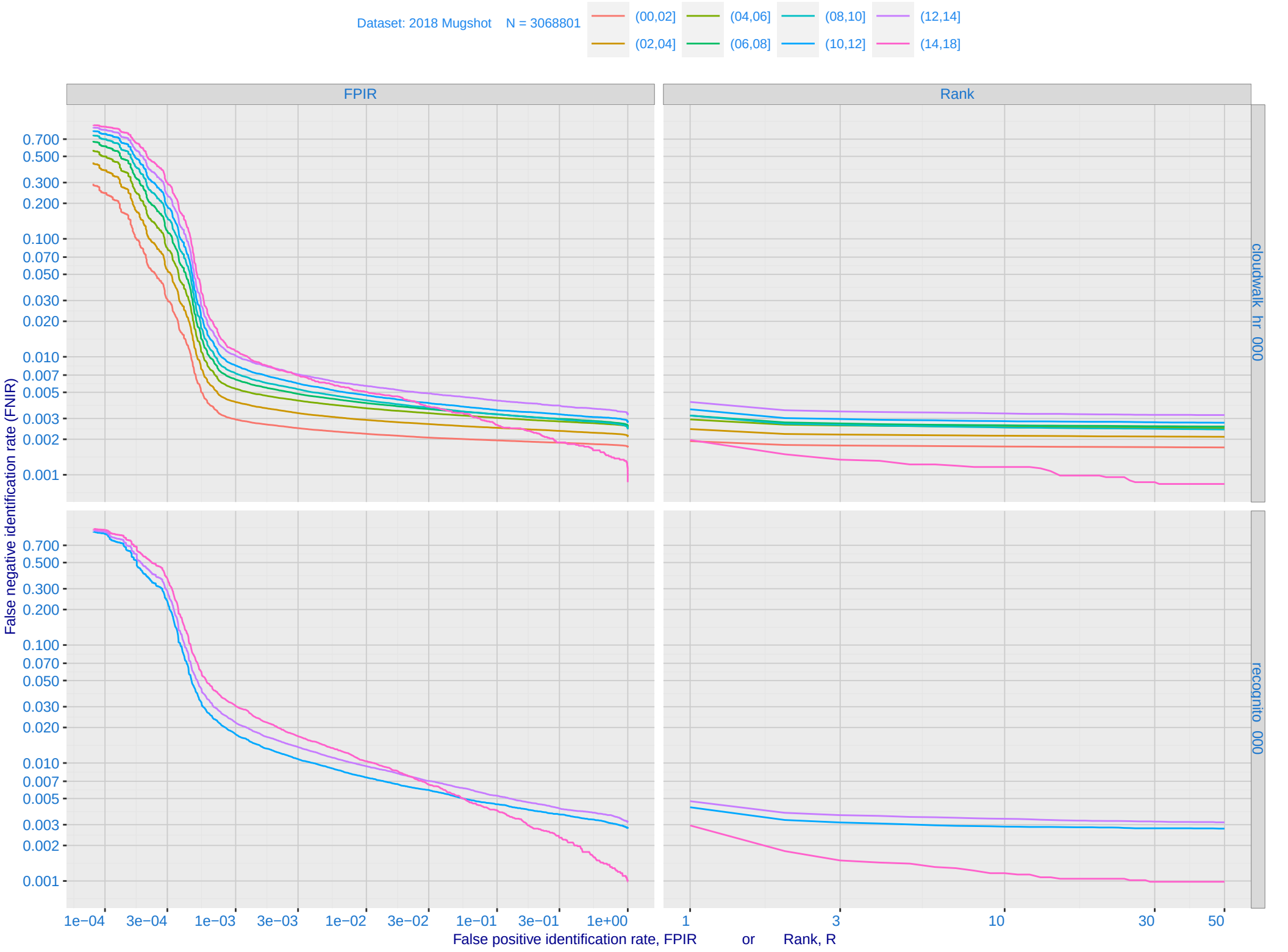
−4 −3 −2 −1

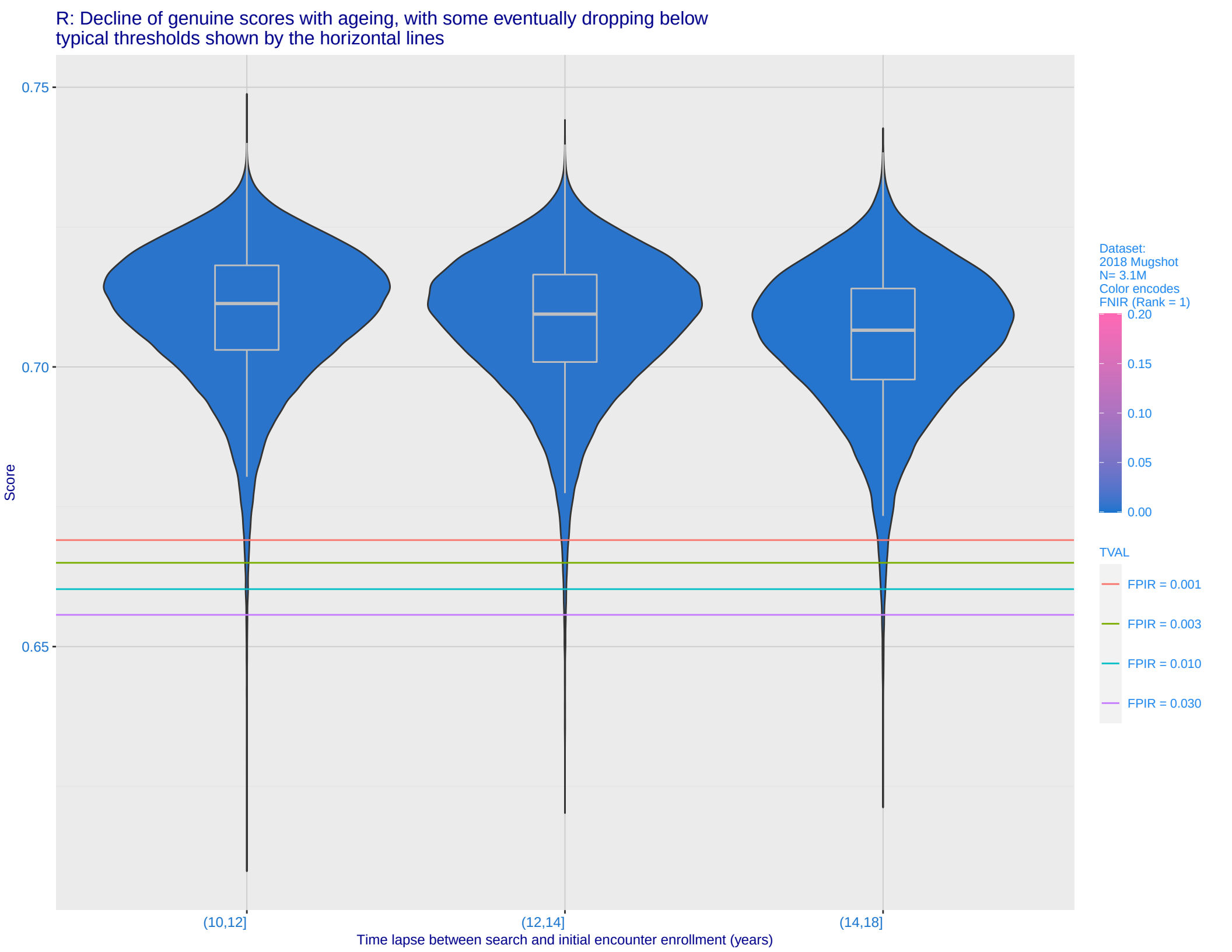


Age group of person in non−mate probe
(The age of the highest non−mates will usually be similar to that of the probe.)

Sex of person in non−mate probe
(The sex of the highest non−mates will usually be that of the probe.)

Q: Identification FNIR(N, T, L+1) and Investigational FNIR(N, 0, R) under ageing




R: Decline of genuine scores with ageing, with some eventually dropping below typical thresholds shown by the horizontal lines
0.75
0.70
0.65
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