A: Datasheet

Algorithm: rankone_014

Developer: Rank One Computing

Submission Date: 2022_12_21

Template size: 261 bytes

Template time (2.5 percentile): 698 msec

Template time (median): 701 msec

Template time (97.5 percentile): 716 msec

Investigation:

Frontal mugshot ranking 8 (out of 388) −− FNIR(1600000, 0, 1) = 0.0010 vs. lowest 0.0008 from sensetime_009

Mugshot webcam ranking 6 (out of 350) −− FNIR(1600000, 0, 1) = 0.0063 vs. lowest 0.0054 from sensetime_009

Mugshot profile ranking 28 (out of 319) −− FNIR(1600000, 0, 1) = 0.0674 vs. lowest 0.0517 from sensetime_009

Immigration visa−border ranking 9 (out of 277) −− FNIR(1600000, 0, 1) = 0.0009 vs. lowest 0.0006 from cloudwalk_mt_001

Immigration visa−kiosk ranking 5 (out of 222) −− FNIR(1600000, 0, 1) = 0.0464 vs. lowest 0.0395 from cloudwalk_mt_001

Identification:

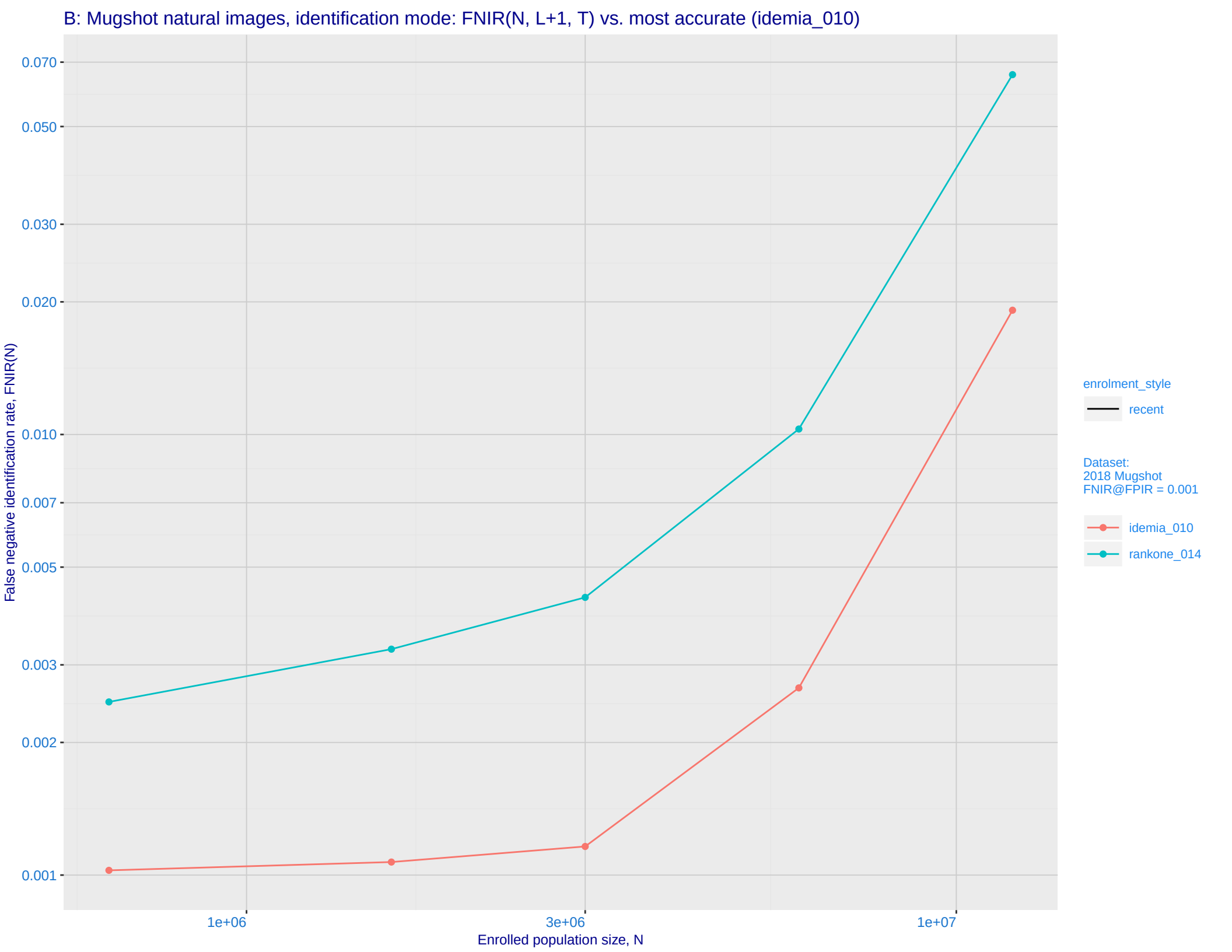
Frontal mugshot ranking 27 (out of 388) −− FNIR(1600000, T, L+1) = 0.0033, FPIR=0.001000 vs. lowest 0.0011 from idemia_010

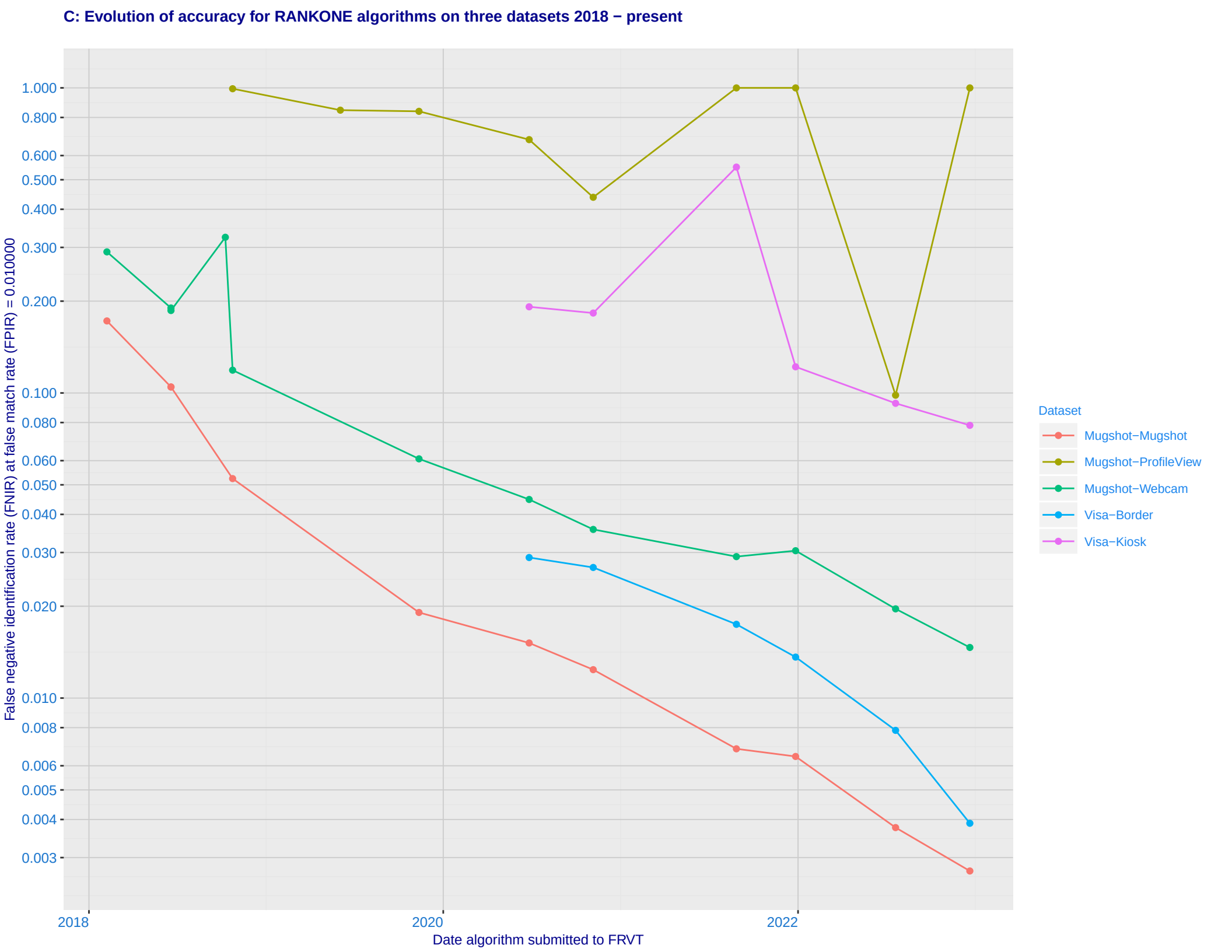
Mugshot webcam ranking 35 (out of 348) −− FNIR(1600000, T, L+1) = 0.0241, FPIR=0.001000 vs. lowest 0.0072 from sensetime_009

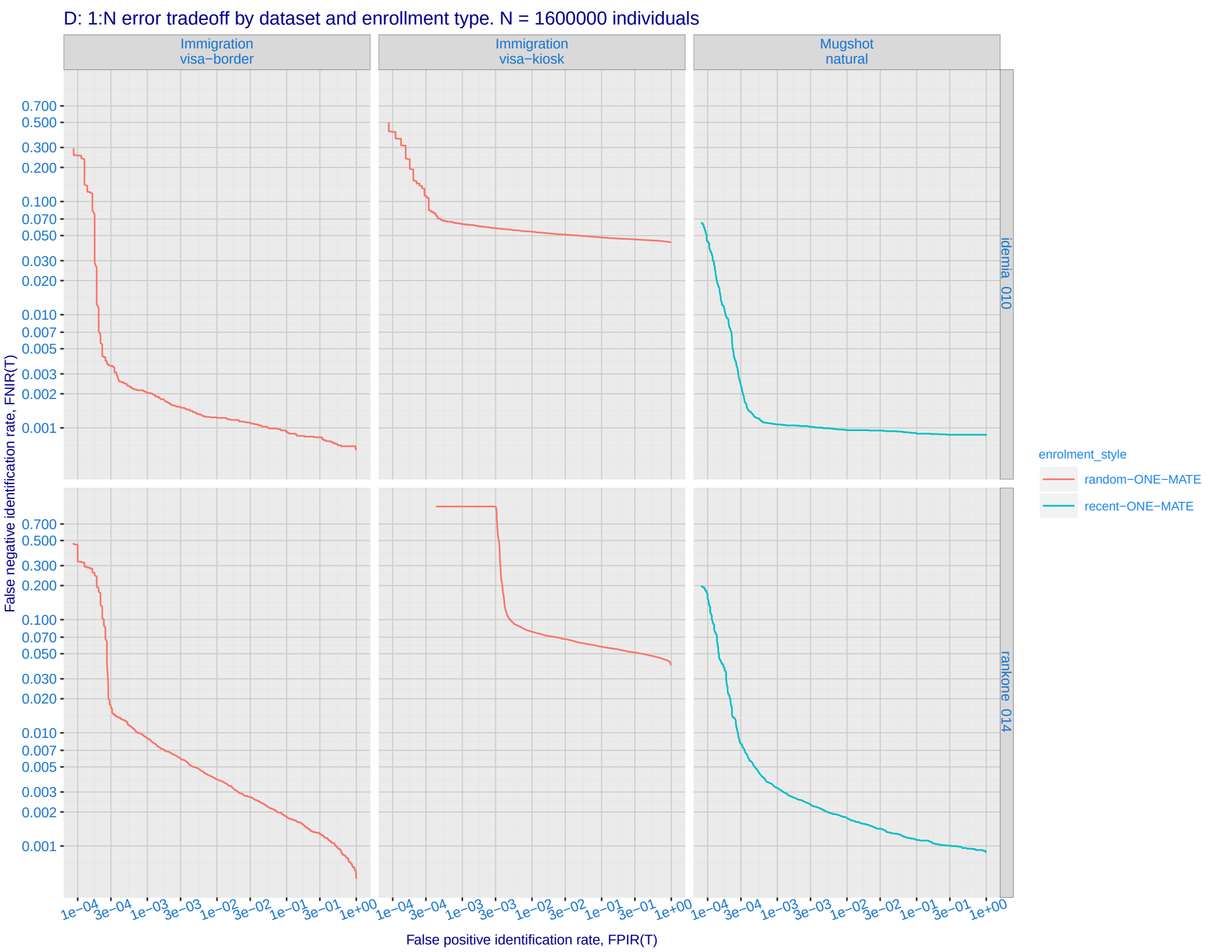
Mugshot profile ranking 264 (out of 318) −− FNIR(1600000, T, L+1) = 0.9998, FPIR=0.001000 vs. lowest 0.0698 from cloudwalk_mt_001

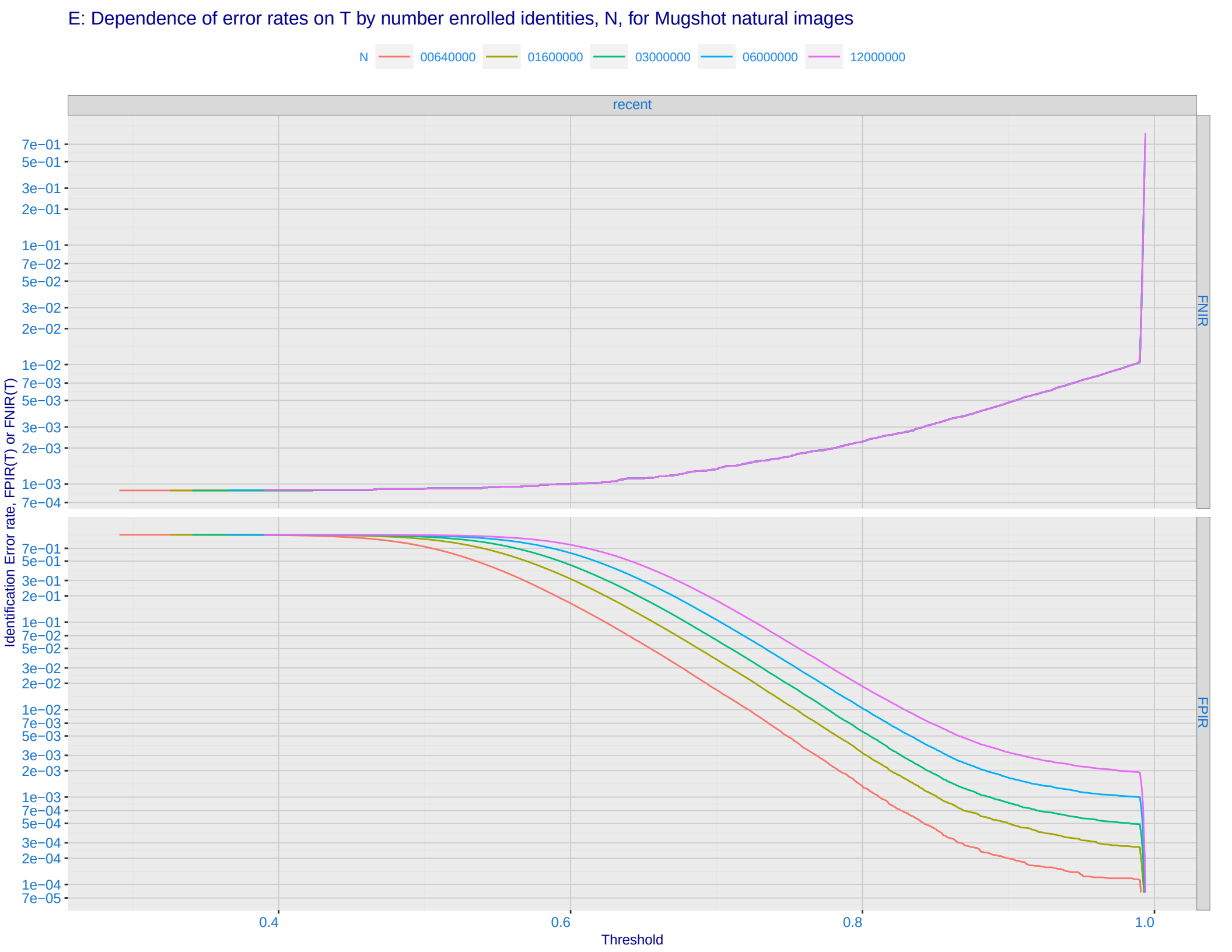
Immigration visa−border ranking 47 (out of 276) −− FNIR(1600000, T, L+1) = 0.0089, FPIR=0.001000 vs. lowest 0.0013 from cloudwalk_mt_001

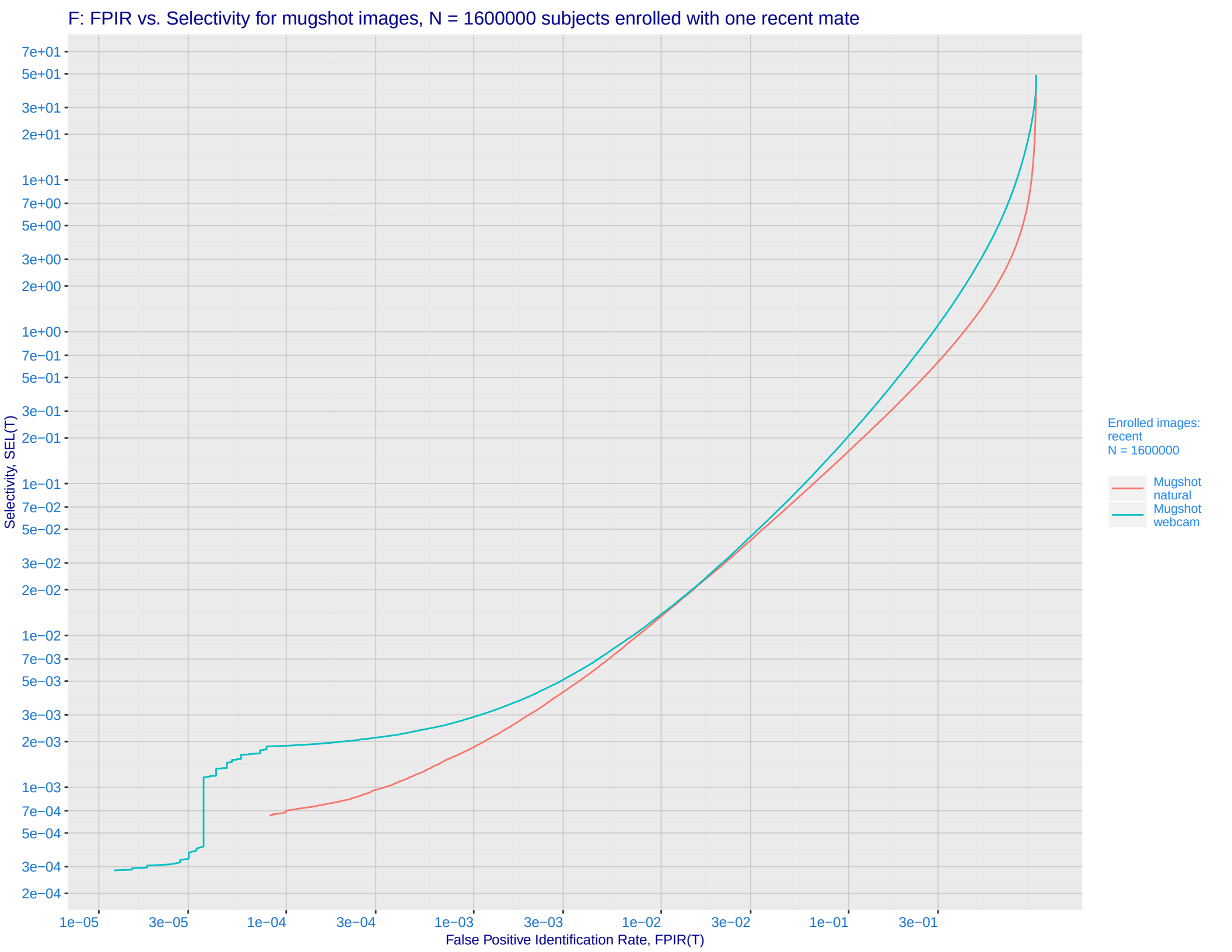
Immigration visa−kiosk ranking 216 (out of 222) −− FNIR(1600000, T, L+1) = 1.0000, FPIR=0.001000 vs. lowest 0.0532 from cloudwalk_mt_001

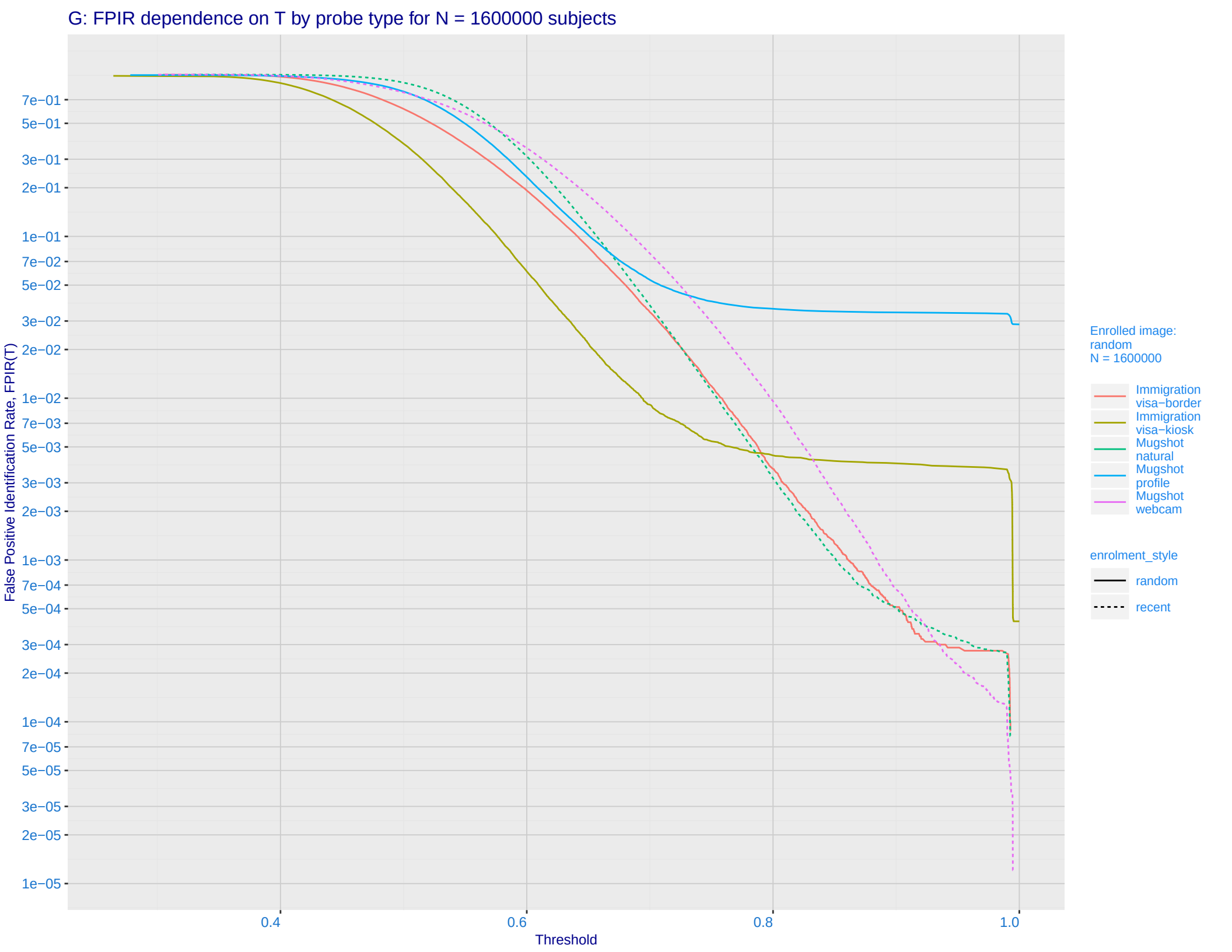

B: Mugshot natural images, identification mode: FNIR(N, L+1, T) vs. most accurate (idemia_010)
False negative identification rate, FNIR(N)
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e+06
3e+06
1e+07
Enrolled population size, N
enrolment_style
recent
Dataset:
2018 Mugshot
FNIR@FPIR = 0.001
idemia_010
rankone_014

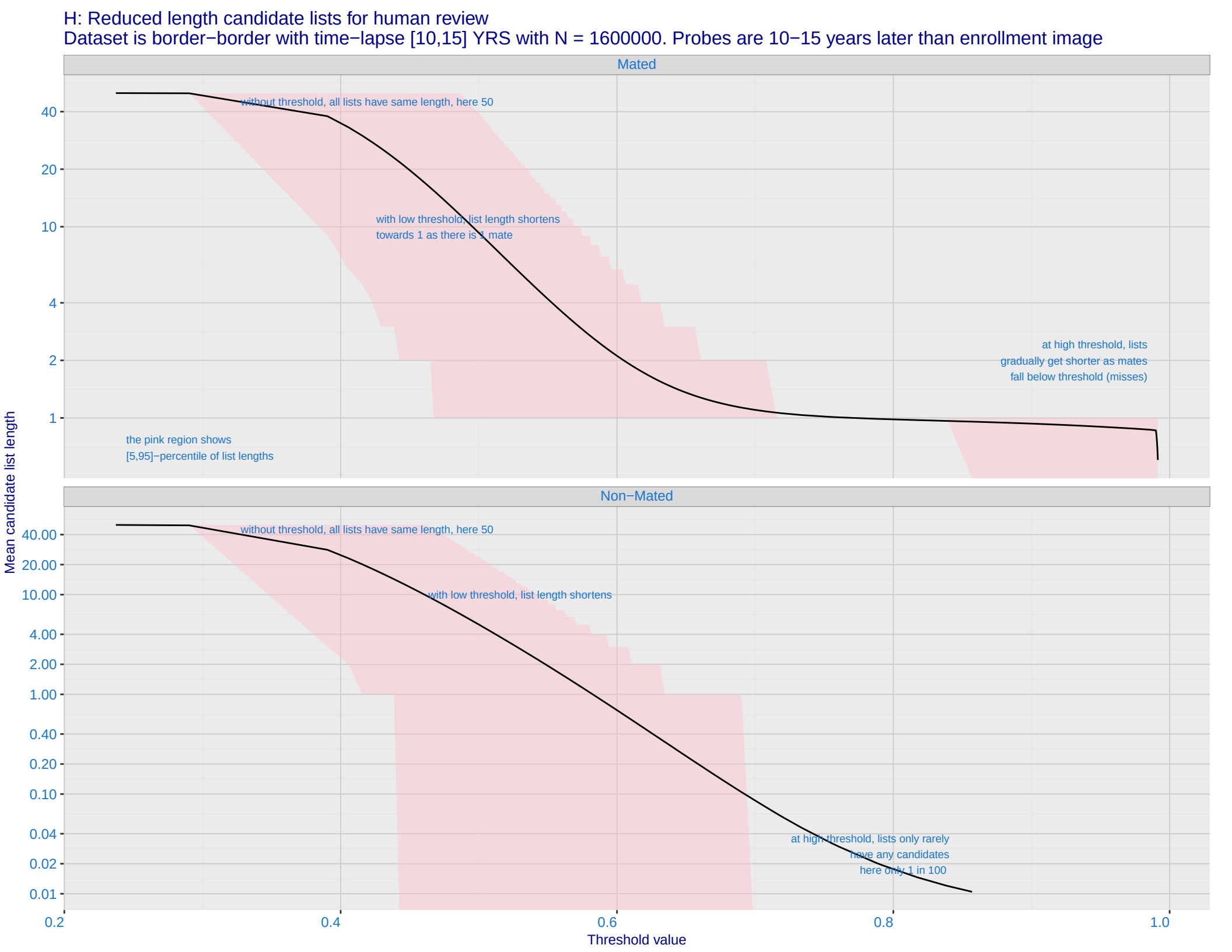

C: Evolution of accuracy for RANKONE algorithms on three datasets 2018 − present
False negative identification rate (FNIR) at false match rate (FPIR) = 0.010000
1.000
0.800
0.600
0.500
0.400
0.300
0.200
0.100
0.080
0.060
0.050
0.040
0.030
0.020
0.010
0.008
0.006
0.005
0.004
0.003
2018
2020
2022
Date algorithm submitted to FRVT
Dataset
Mugshot−Mugshot
Mugshot−ProfileView
Mugshot−Webcam
Visa−Border
Visa−Kiosk

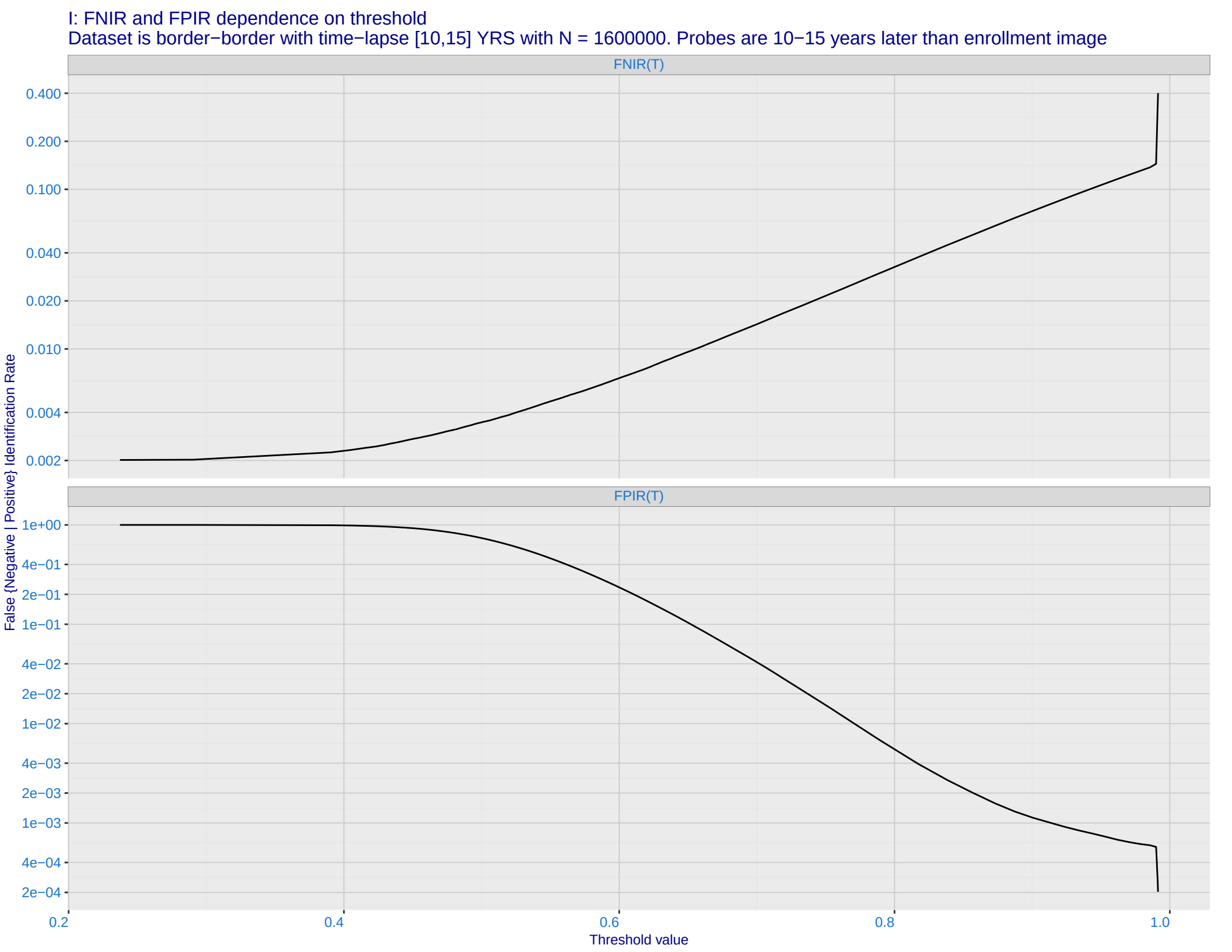

D: 1:N error tradeoff by dataset and enrollment type. N = 1600000 individuals
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
idemia 010
rankone 014
False negative identification rate, FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e−04
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

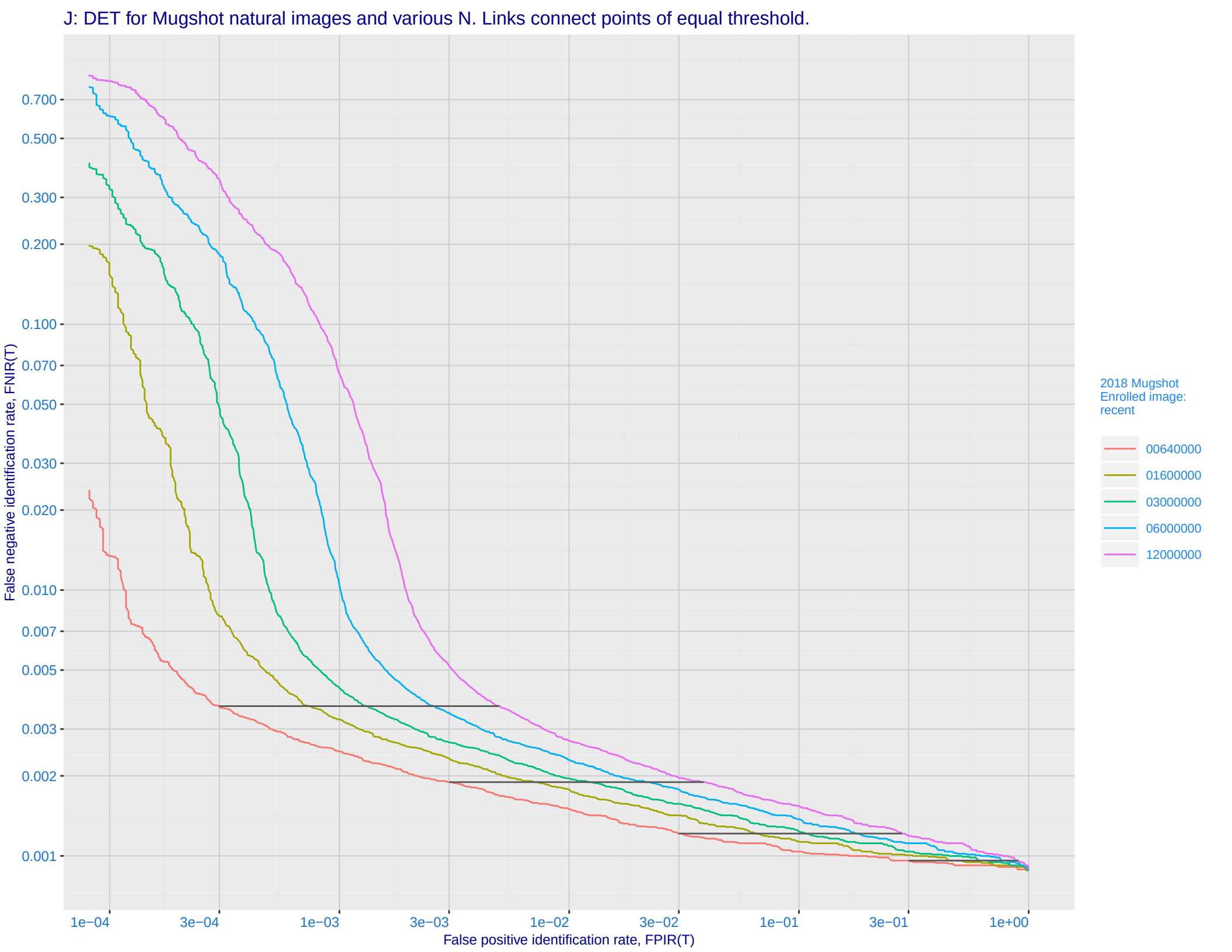

E: Dependence of error rates on T by number enrolled identities, N, for Mugshot natural images
N
00640000
01600000
03000000
06000000
12000000
recent
FNIR
FPIR
Identification Error rate, FPIR(T) or FNIR(T)
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05
0.4
0.6
0.8
1.0
Threshold

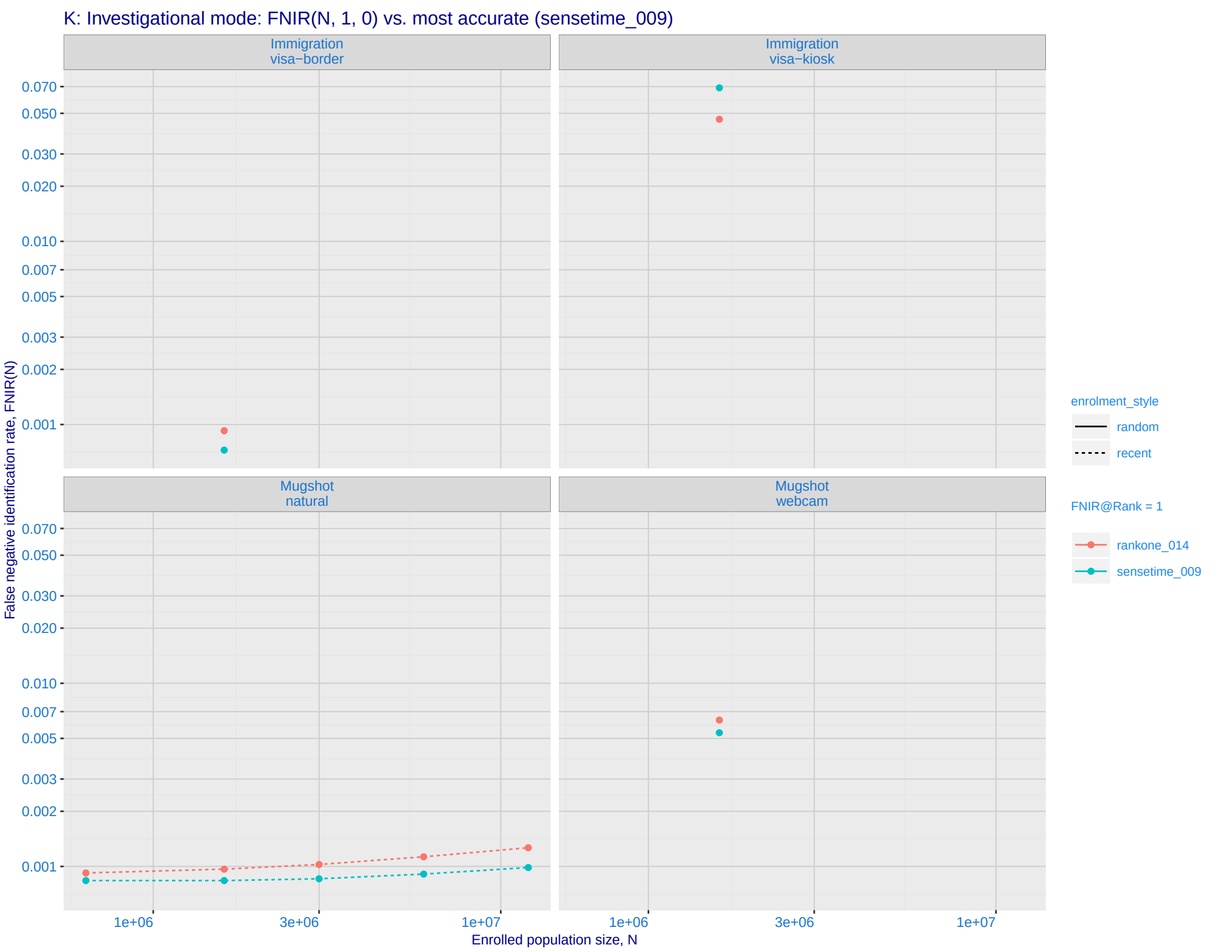

F: FPIR vs. Selectivity for mugshot images, N = 1600000 subjects enrolled with one recent mate
Selectivity, SEL(T)
7e+01
5e+01
3e+01
2e+01
1e+01
7e+00
5e+00
3e+00
2e+00
1e+00
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−05
3e−05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

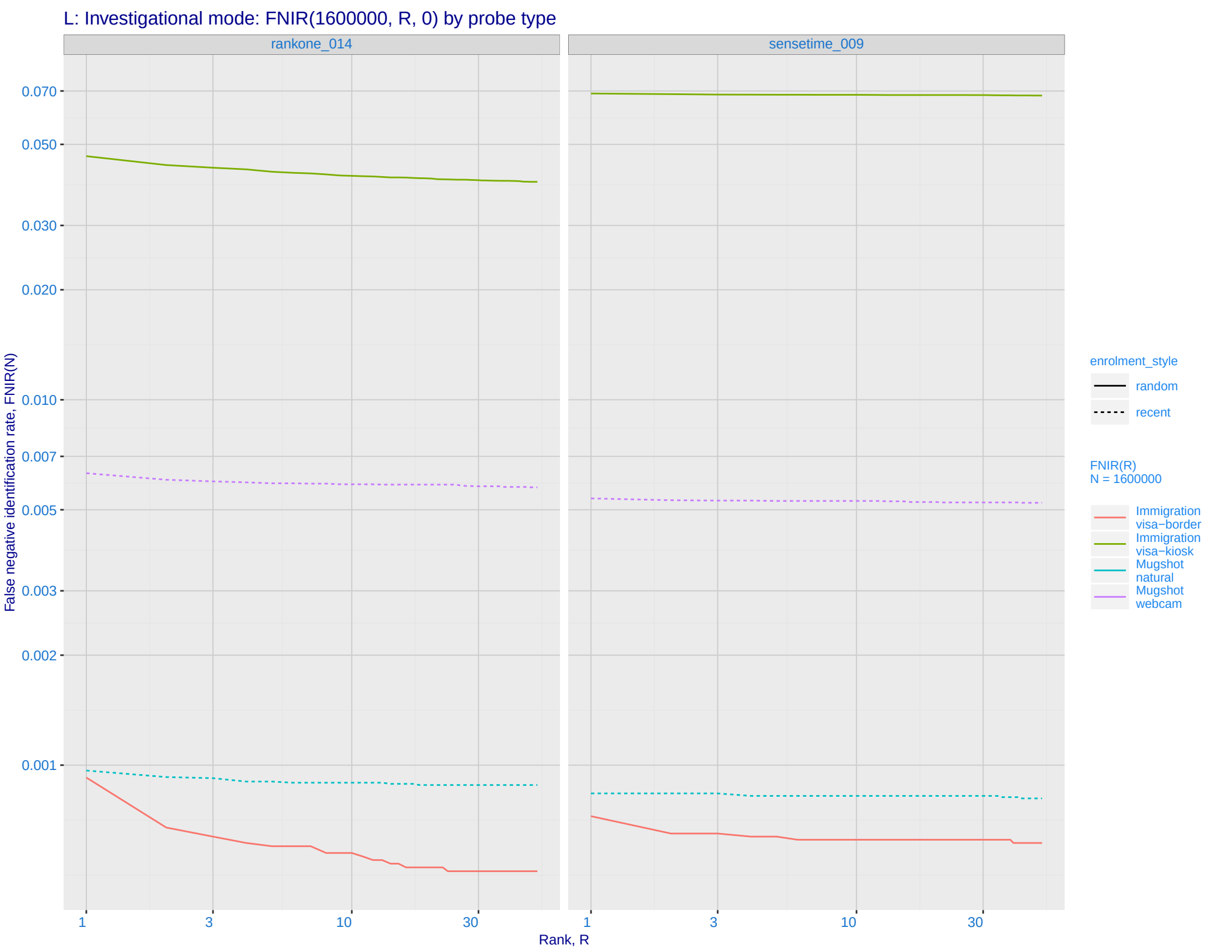

G: FPIR dependence on T by probe type for N = 1600000 subjects
False Positive Identification Rate, FPIR(T)
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05
5e−05
3e−05
2e−05
1e−05
0.4
0.6
0.8
1.0
Threshold
Enrolled image:
random
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

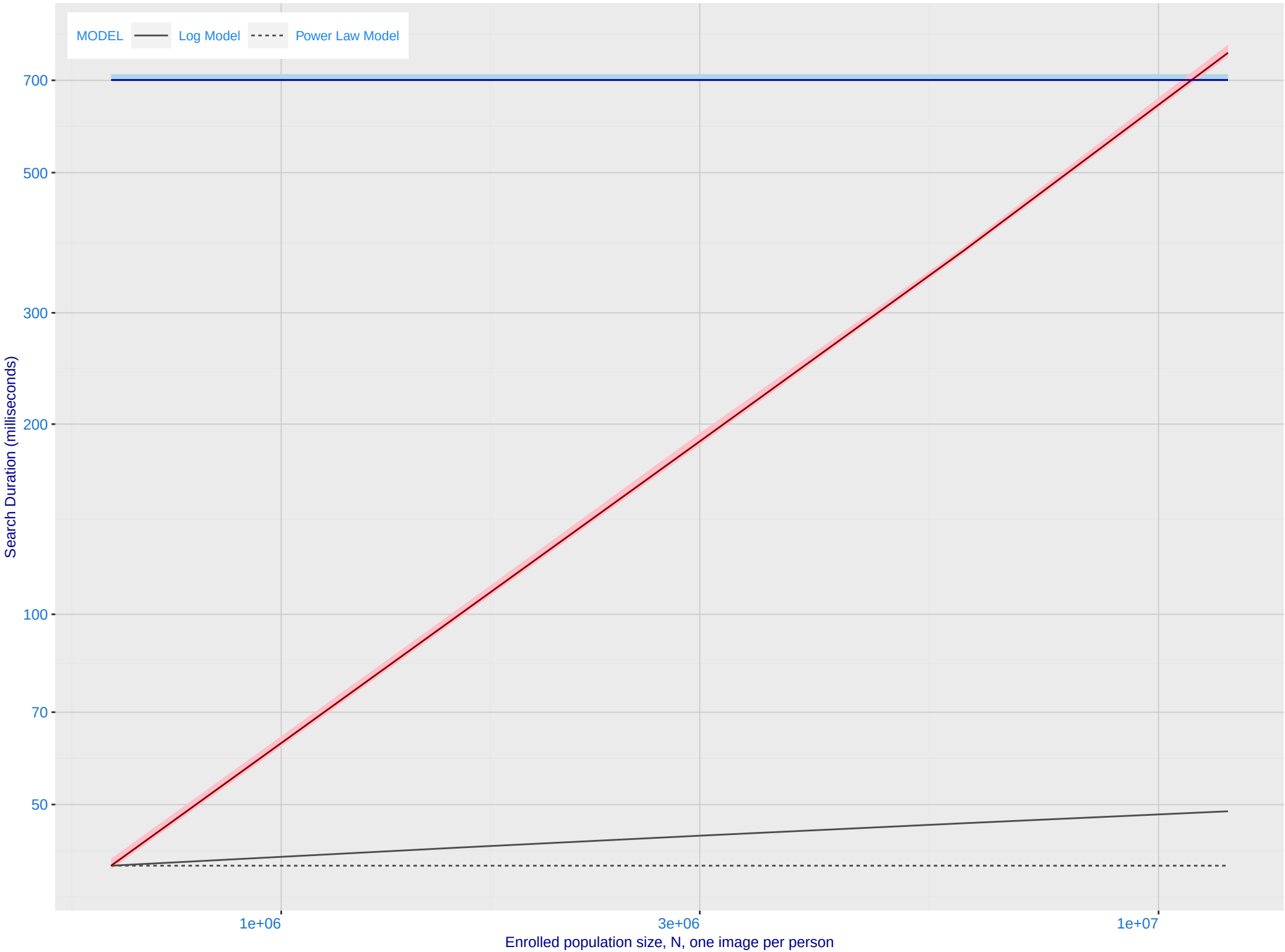

I: FNIR and FPIR dependence on threshold
Dataset is border−border with time−lapse [10,15] YRS with N = 1600000. Probes are 10−15 years later than enrollment image
FNIR(T)
0.400
0.200
0.100
0.040
0.020
0.010
0.004
0.002
FPIR(T)
1e+00
4e−01
2e−01
1e−01
4e−02
2e−02
1e−02
4e−03
2e−03
1e−03
4e−04
2e−04
False {Negative | Positive} Identification Rate
0.2
0.4
0.6
0.8
1.0
Threshold value

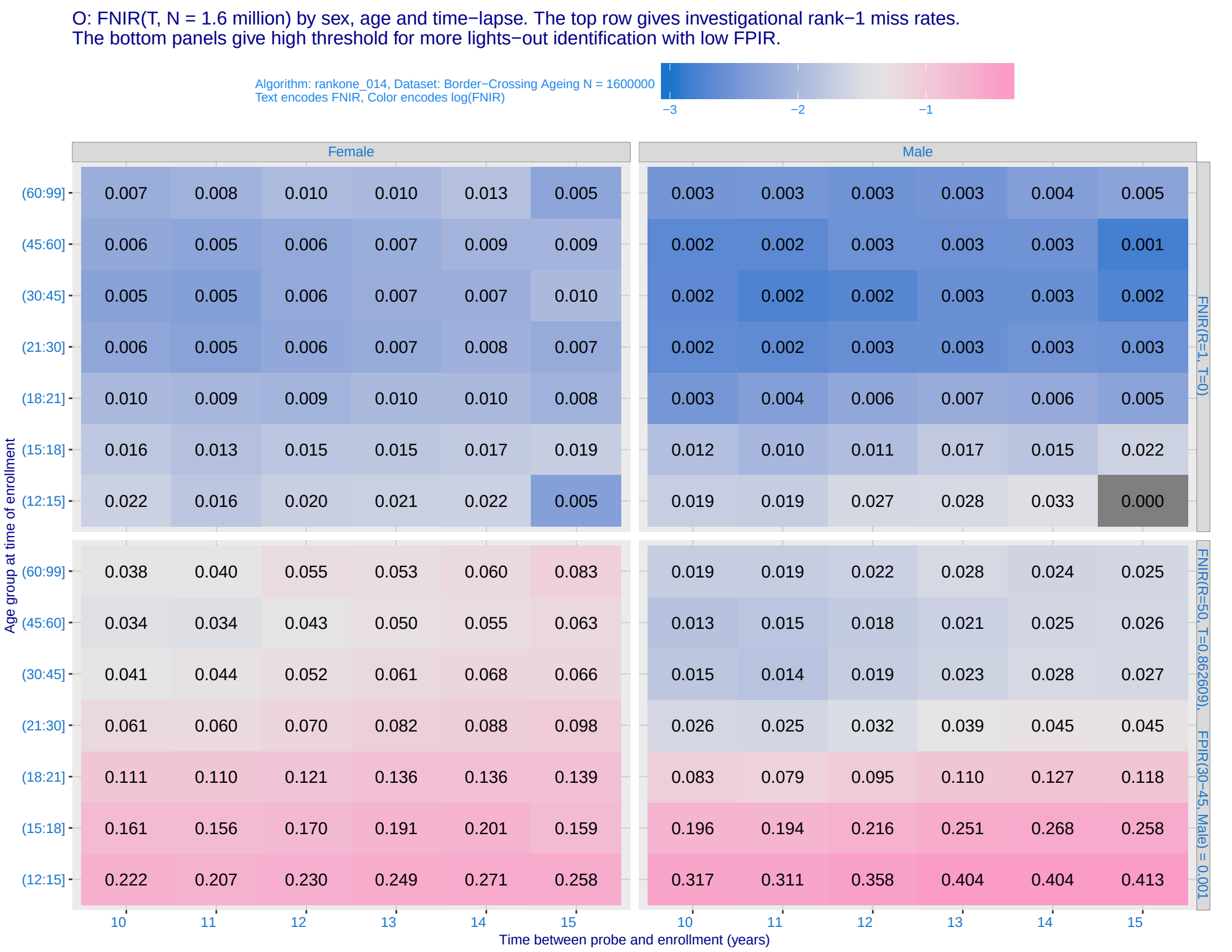

J: DET for Mugshot natural images and various N. Links connect points of equal threshold.
False negative identification rate, FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e−04
3e−04
1e−03
3e−03
1e−02
3e−02
1e−01
3e−01
1e+00
False positive identification rate, FPIR(T)
2018 Mugshot
Enrolled image:
recent
00640000
01600000
03000000
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
enrolment_style
random
recent
FNIR@Rank = 1
rankone_014
sensetime_009

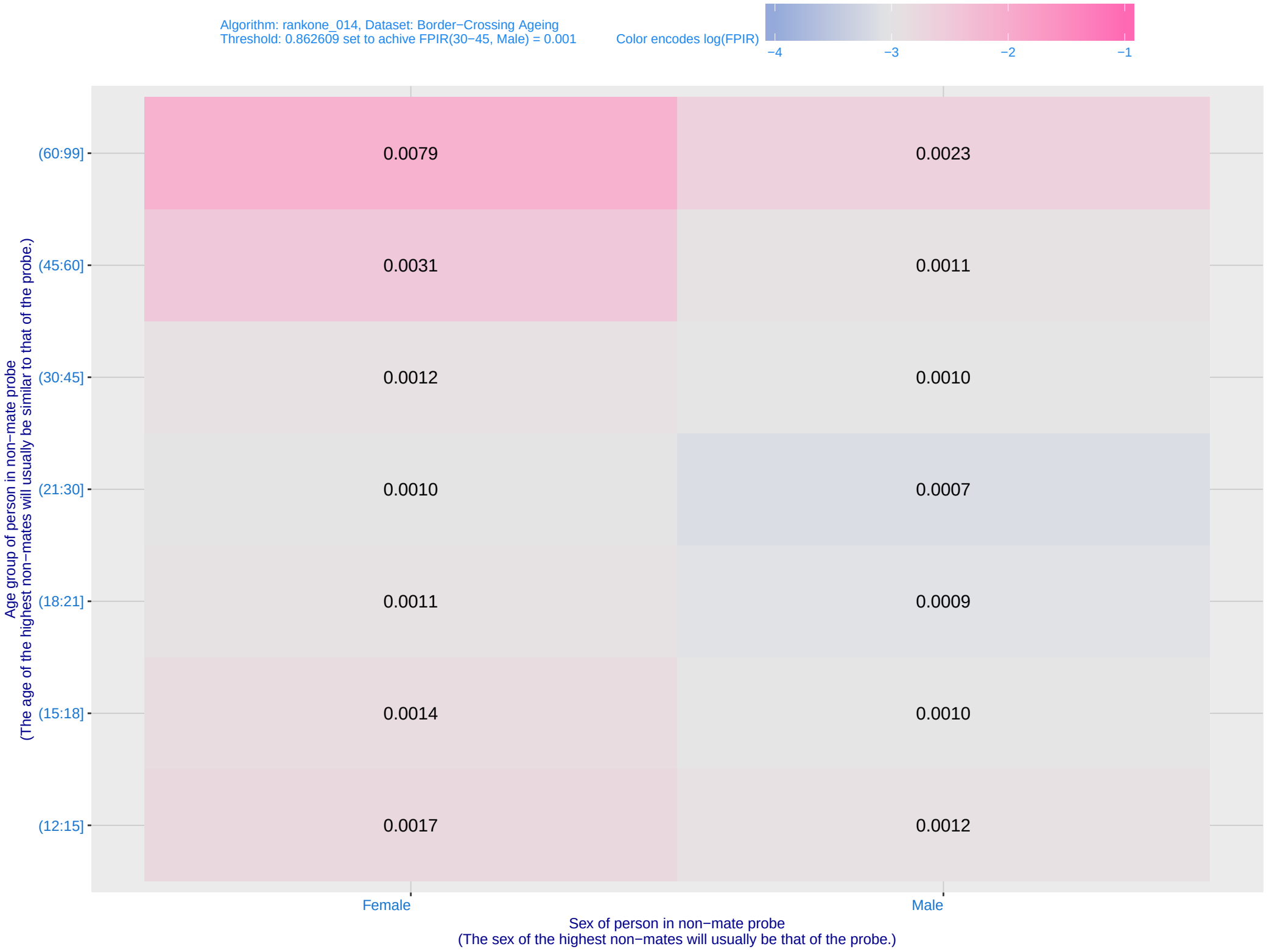

L: Investigational mode: FNIR(1600000, R, 0) by probe type
rankone_014
sensetime_009
False negative identification rate, FNIR(N)
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1
3
10
30
Rank, R
enrolment_style
random
recent
FNIR(R)
N = 1600000
Immigration visa−border
Immigration visa−kiosk
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

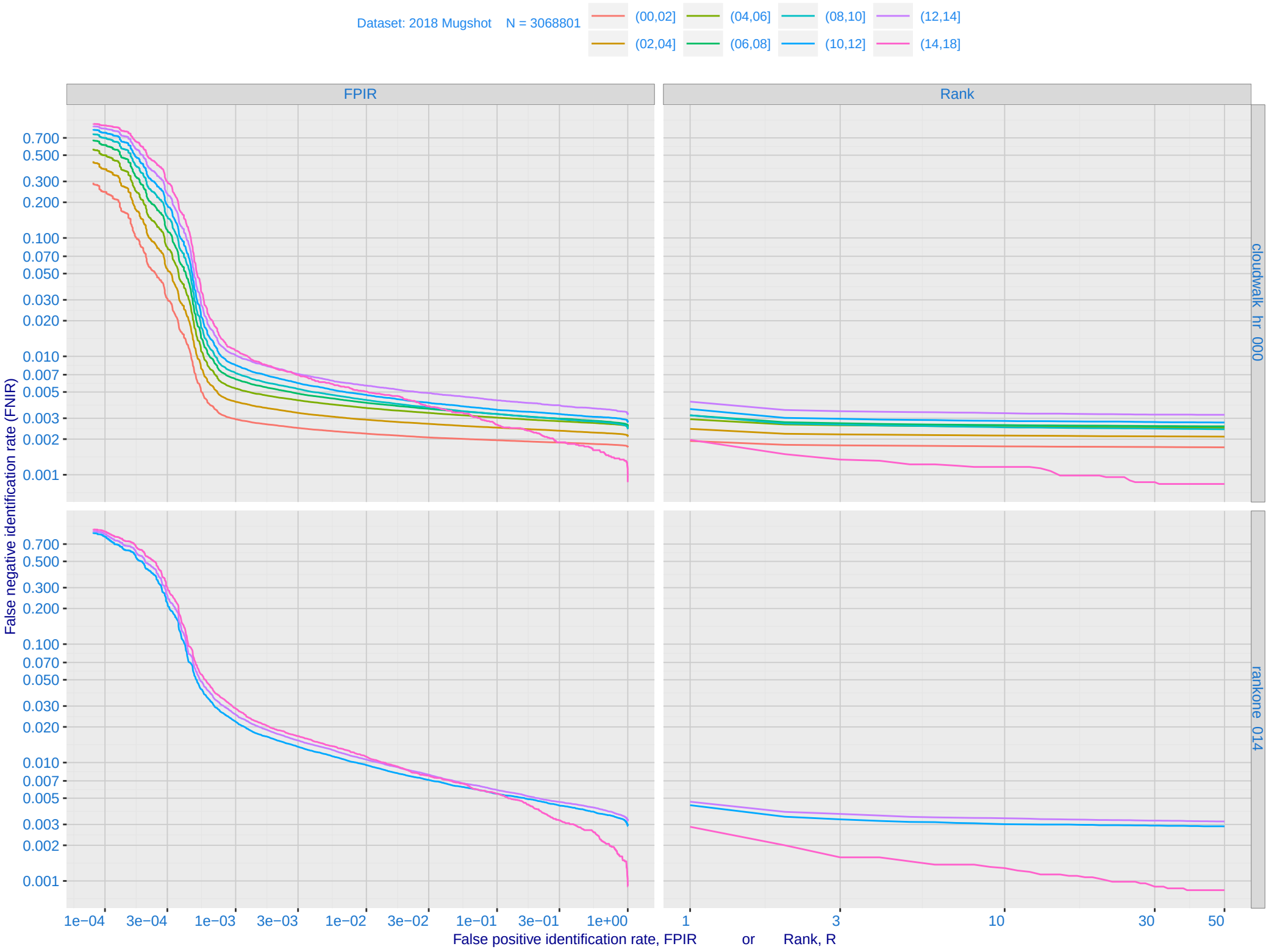


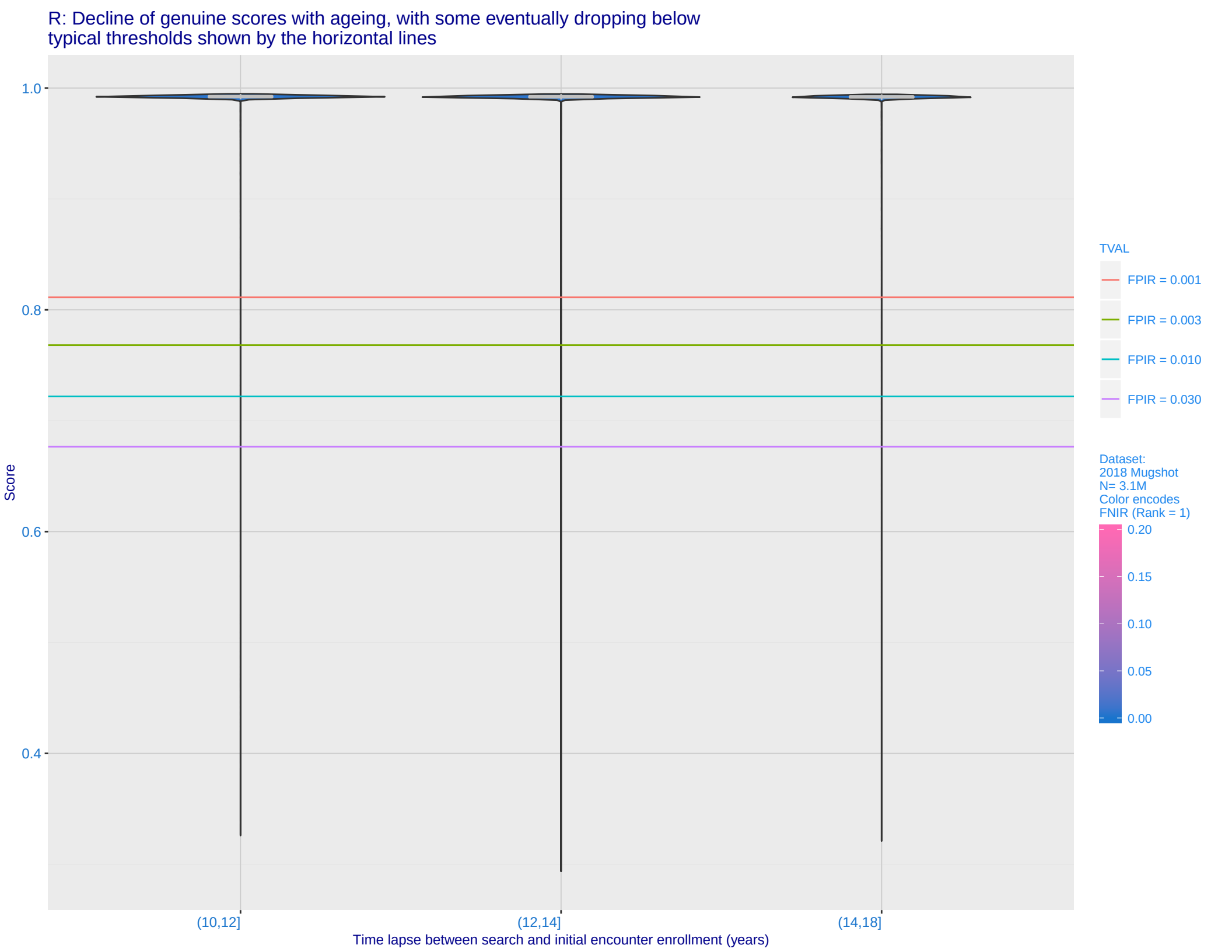

O: FNIR(T, N = 1.6 million) by sex, age and time−lapse. The top row gives investigational rank−1 miss rates.
The bottom panels give high threshold for more lights−out identification with low FPIR.
Algorithm: rankone_014, Dataset: Border−Crossing Ageing N = 1600000
Text encodes FNIR, Color encodes log(FNIR)
−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 0.013 0.005
0.006 0.005 0.006 0.007 0.009 0.009
0.005 0.005 0.006 0.007 0.007 0.010
0.006 0.005 0.006 0.007 0.008 0.007
0.010 0.009 0.009 0.010 0.010 0.008
0.016 0.013 0.015 0.015 0.017 0.019
0.022 0.016 0.020 0.021 0.022 0.005
0.003 0.003 0.003 0.003 0.004 0.005
0.002 0.002 0.003 0.003 0.003 0.001
0.002 0.002 0.002 0.003 0.003 0.002
0.002 0.002 0.003 0.003 0.003 0.003
0.003 0.004 0.006 0.007 0.006 0.005
0.012 0.010 0.011 0.017 0.015 0.022
0.019 0.019 0.027 0.028 0.033 0.000
FNIR(R=1, T=0)
0.038 0.040 0.055 0.053 0.060 0.083
0.034 0.034 0.043 0.050 0.055 0.063
0.041 0.044 0.052 0.061 0.068 0.066
0.061 0.060 0.070 0.082 0.088 0.098
0.111 0.110 0.121 0.136 0.136 0.139
0.161 0.156 0.170 0.191 0.201 0.159
0.222 0.207 0.230 0.249 0.271 0.258
0.019 0.019 0.022 0.028 0.024 0.025
0.013 0.015 0.018 0.021 0.025 0.026
0.015 0.014 0.019 0.023 0.028 0.027
0.026 0.025 0.032 0.039 0.045 0.045
0.083 0.079 0.095 0.110 0.127 0.118
0.196 0.194 0.216 0.251 0.268 0.258
0.317 0.311 0.358 0.404 0.404 0.413
FNIR(R=50, T=0.862609), 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




R: Decline of genuine scores with ageing, with some eventually dropping below typical thresholds shown by the horizontal lines
1.0
0.8
0.6
0.4
Score
(10,12]
(12,14]
(14,18]
Time lapse between search and initial encounter enrollment (years)
TVAL
FPIR = 0.001
FPIR = 0.003
FPIR = 0.010
FPIR = 0.030
Dataset:
2018 Mugshot
N= 3.1M
Color encodes
FNIR (Rank = 1)
0.20
0.15
0.10
0.05
0.00