A: Datasheet

Algorithm: neurotechnology_010

Developer: Neurotechnology

Submission Date: 2022_01_07

Investigation:

Frontal mugshot ranking 19 (out of 329) −− FNIR(1600000, 0, 1) = 0.0012 vs. lowest 0.0009 from sensetime_006

Mugshot webcam ranking 26 (out of 291) −− FNIR(1600000, 0, 1) = 0.0094 vs. lowest 0.0057 from sensetime_006

Mugshot profile ranking 14 (out of 260) −− FNIR(1600000, 0, 1) = 0.0702 vs. lowest 0.0550 from sensetime_006

Immigration visa−border ranking 5 (out of 218) −− FNIR(1600000, 0, 1) = 0.0013 vs. lowest 0.0009 from sensetime_006

Immigration visa−kiosk ranking 12 (out of 215) −− FNIR(1600000, 0, 1) = 0.0684 vs. lowest 0.0487 from cubox_000

Identification:

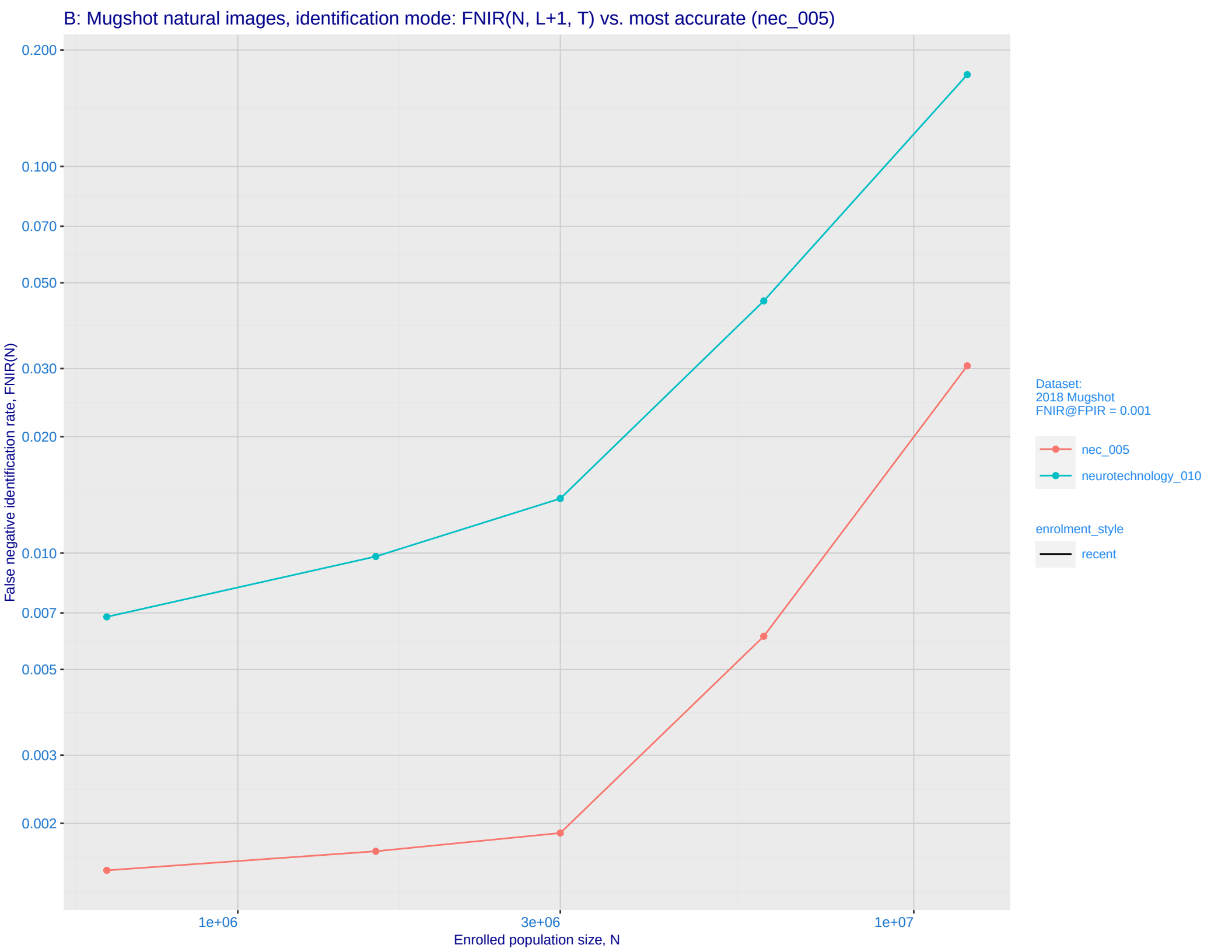
Frontal mugshot ranking 37 (out of 329) −− FNIR(1600000, T, L+1) = 0.0098, FPIR=0.001000 vs. lowest 0.0017 from nec_005

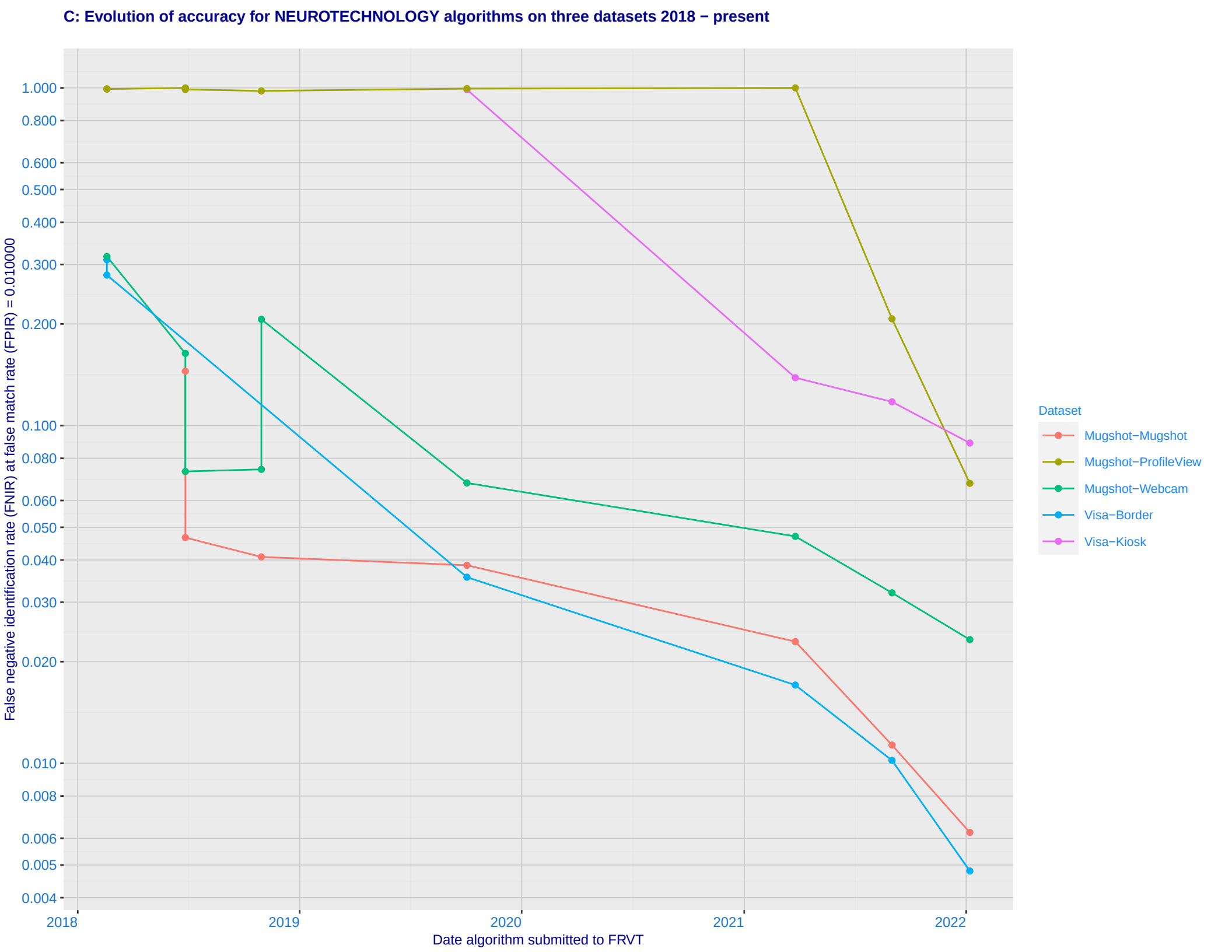
Mugshot webcam ranking 38 (out of 289) −− FNIR(1600000, T, L+1) = 0.0369, FPIR=0.001000 vs. lowest 0.0120 from nec_005

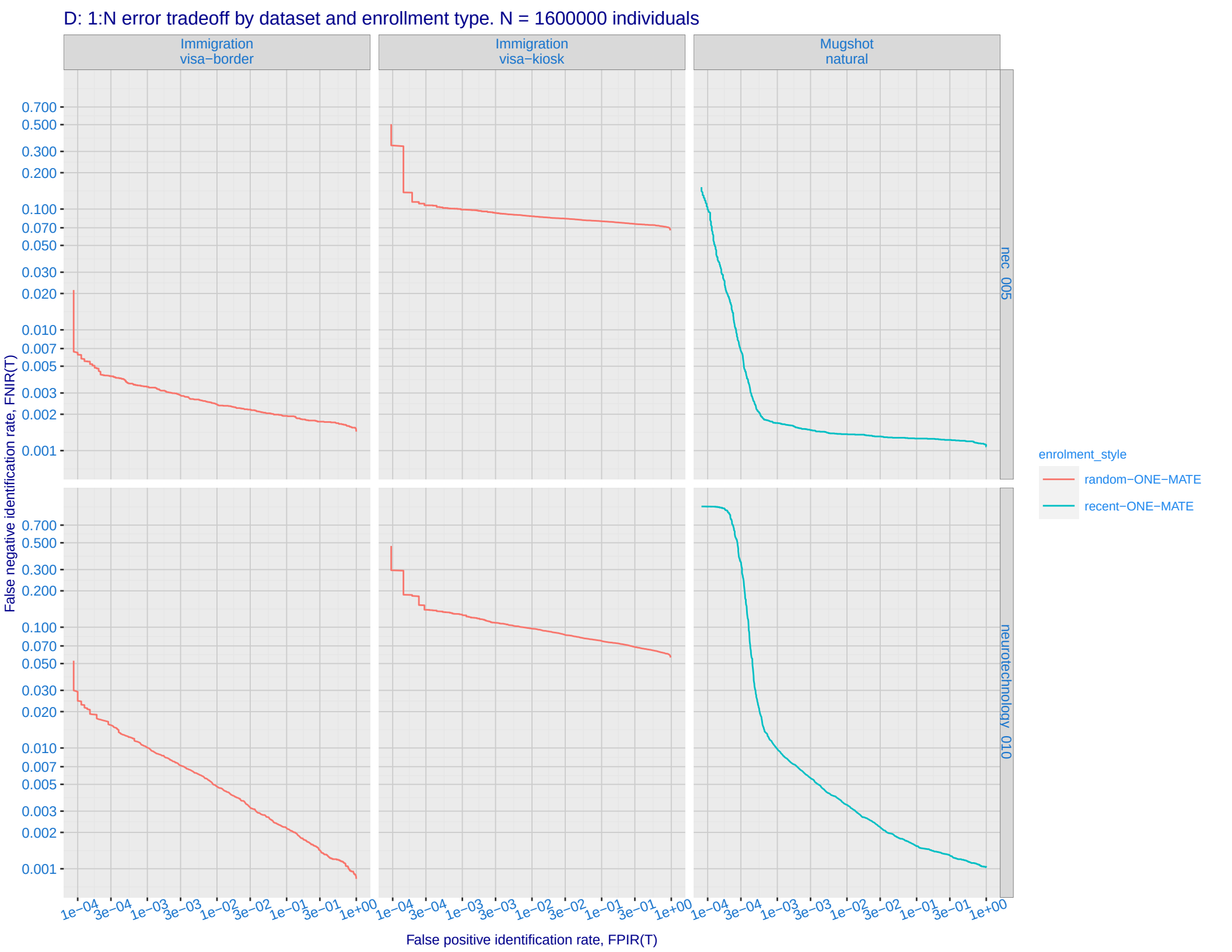
Mugshot profile ranking 9 (out of 259) −− FNIR(1600000, T, L+1) = 0.2770, FPIR=0.001000 vs. lowest 0.1331 from cloudwalk_hr_000

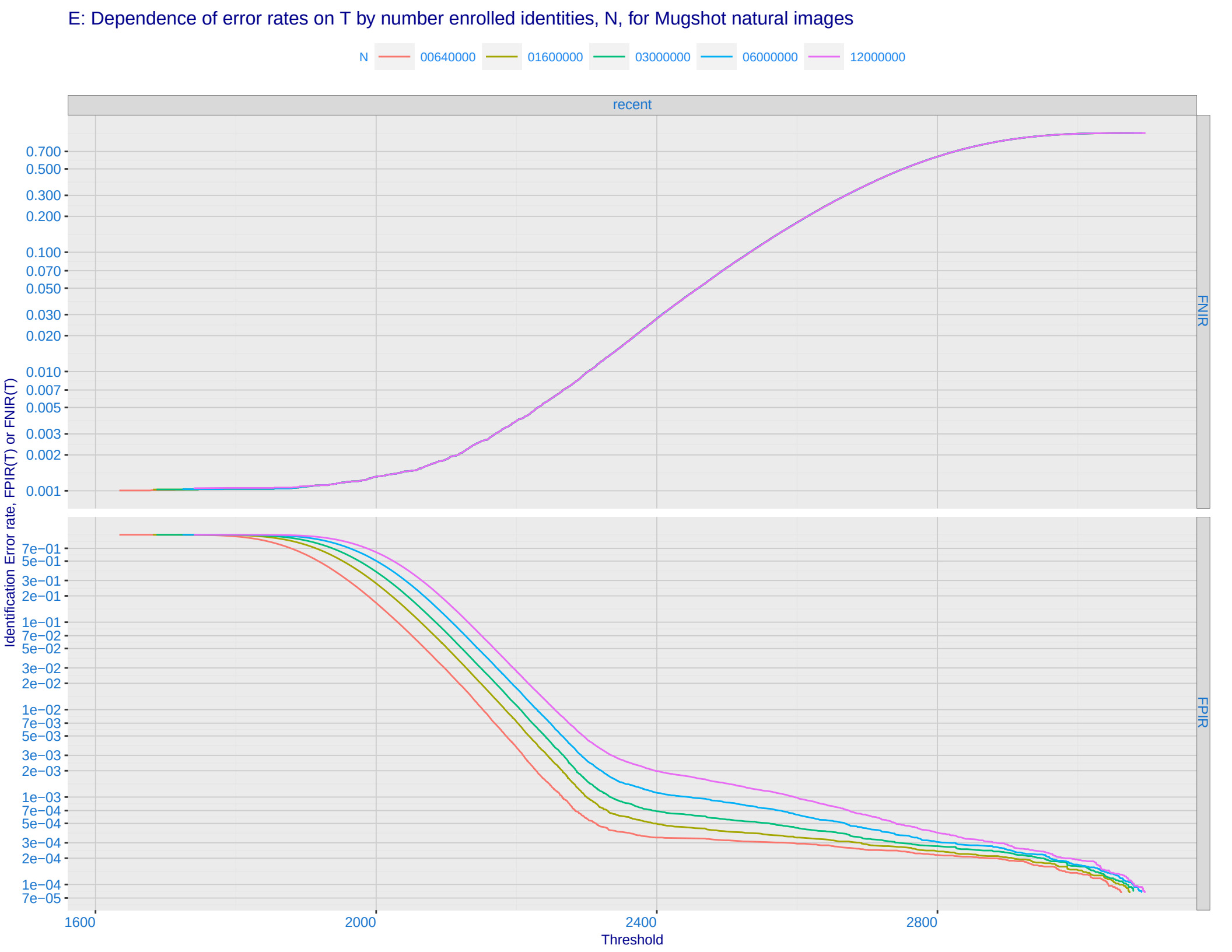
Immigration visa−border ranking 28 (out of 217) −− FNIR(1600000, T, L+1) = 0.0101, FPIR=0.001000 vs. lowest 0.0032 from paravision_009

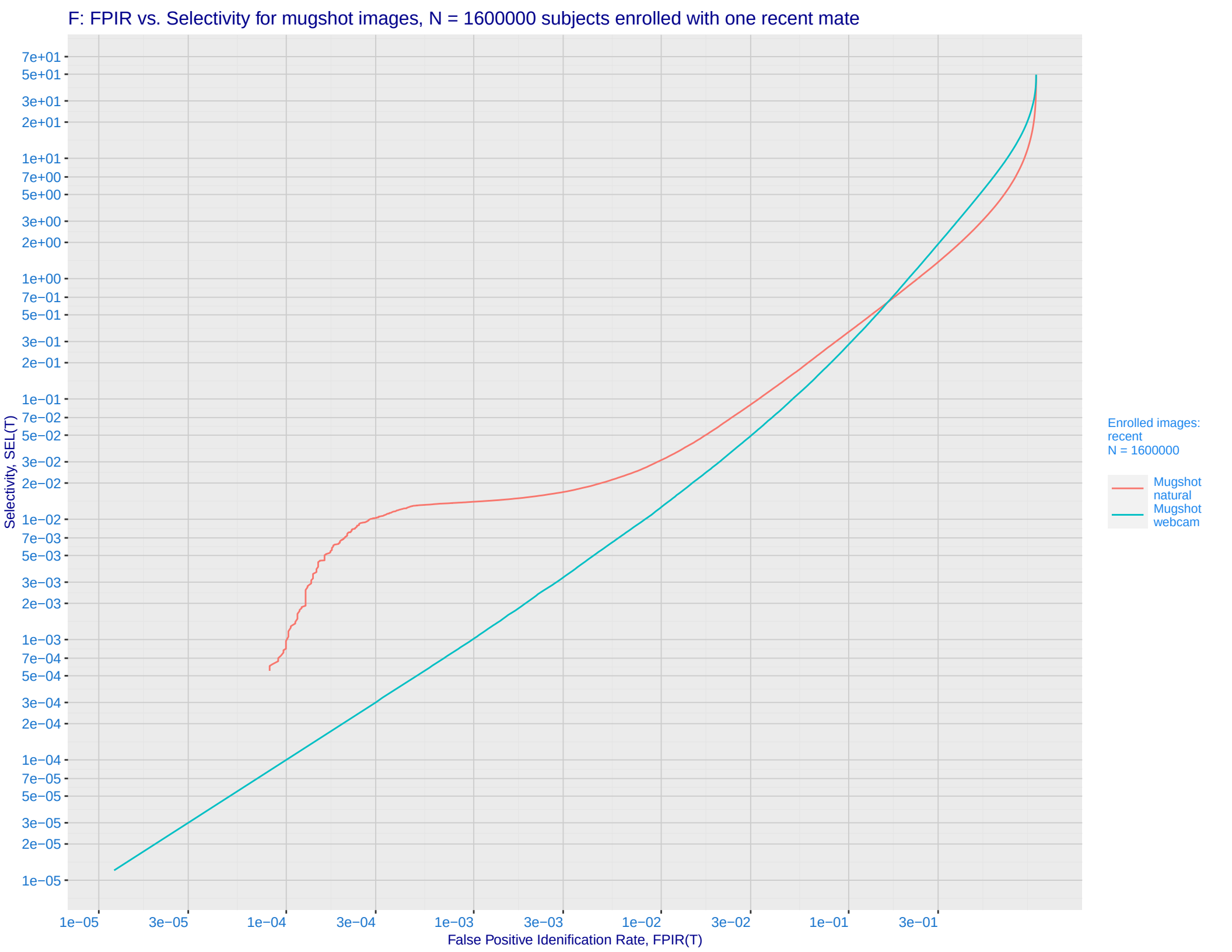
Immigration visa−kiosk ranking 20 (out of 212) −− FNIR(1600000, T, L+1) = 0.1271, FPIR=0.001000 vs. lowest 0.0728 from paravision_009

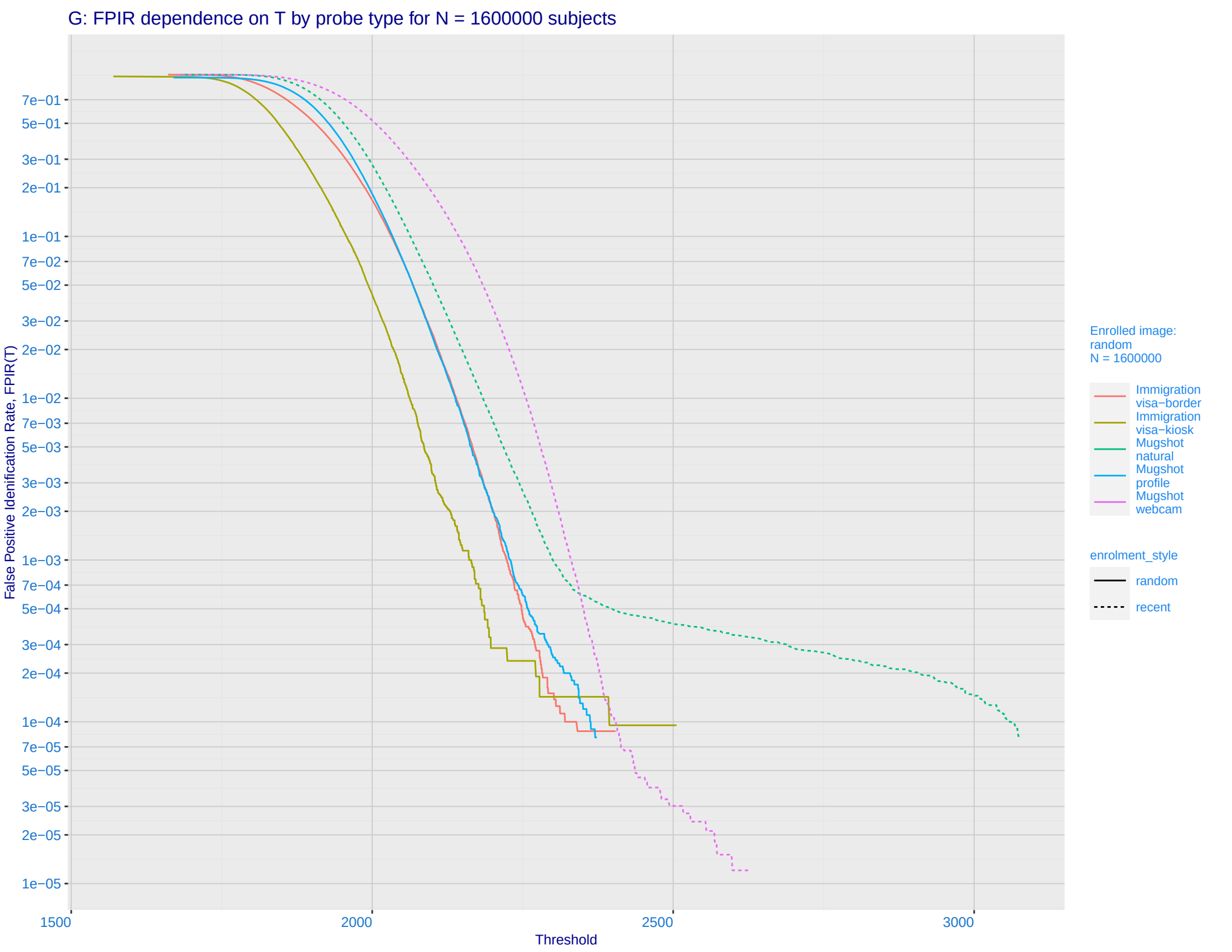

B: Mugshot natural images, identification mode: FNIR(N, L+1, T) vs. most accurate (nec_005)
False negative identification rate, FNIR(N)
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
1e+06
3e+06
1e+07
Enrolled population size, N
Dataset:
2018 Mugshot
FNIR@FPIR = 0.001
nec_005
neurotechnology_010
enrolment_style
recent

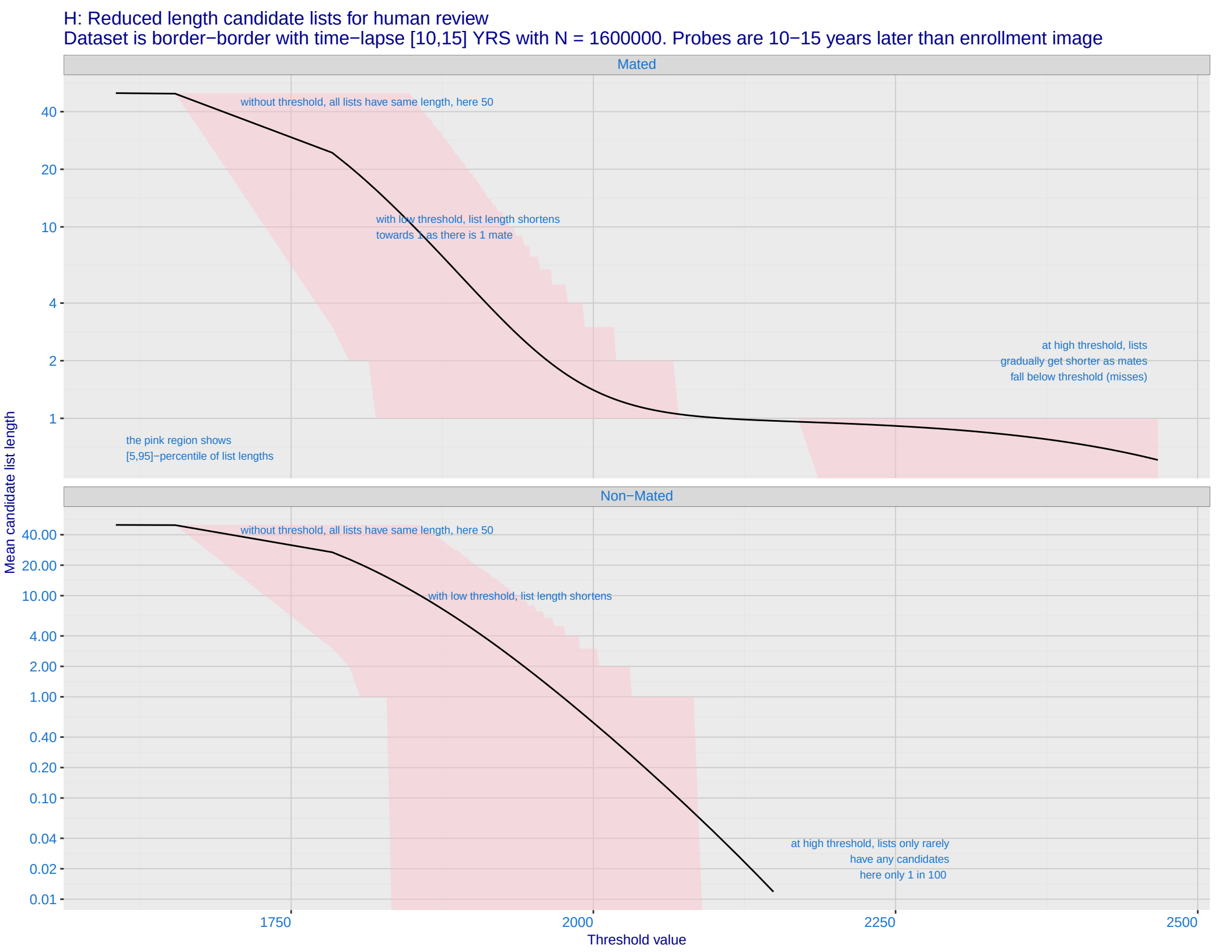

C: Evolution of accuracy for NEUROTECHNOLOGY algorithms on three datasets 2018 − present
False negative identification rate (FNIR) at false match rate (FPIR) = 0.010000
1.000
0.800
0.600
0.500
0.400
0.300
0.200
0.100
0.080
0.060
0.050
0.040
0.030
0.020
0.010
0.008
0.006
0.005
0.004
2018
2019
2020
2021
2022
Date algorithm submitted to FRVT
Dataset
Mugshot−Mugshot
Mugshot−ProfileView
Mugshot−Webcam
Visa−Border
Visa−Kiosk

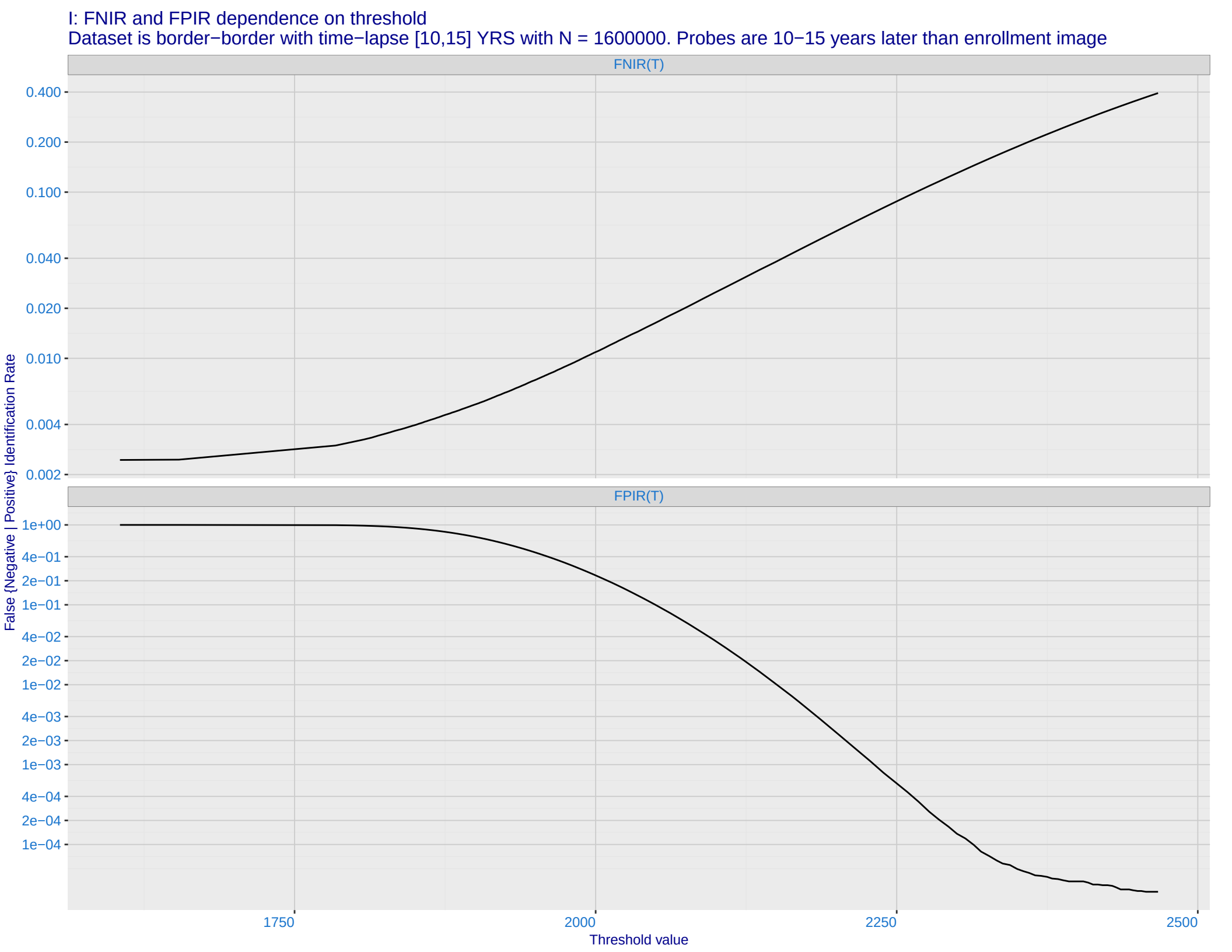

D: 1:N error tradeoff by dataset and enrollment type. N = 1600000 individuals
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
nec_005
neurotechnology_010
False negative identification rate, FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
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

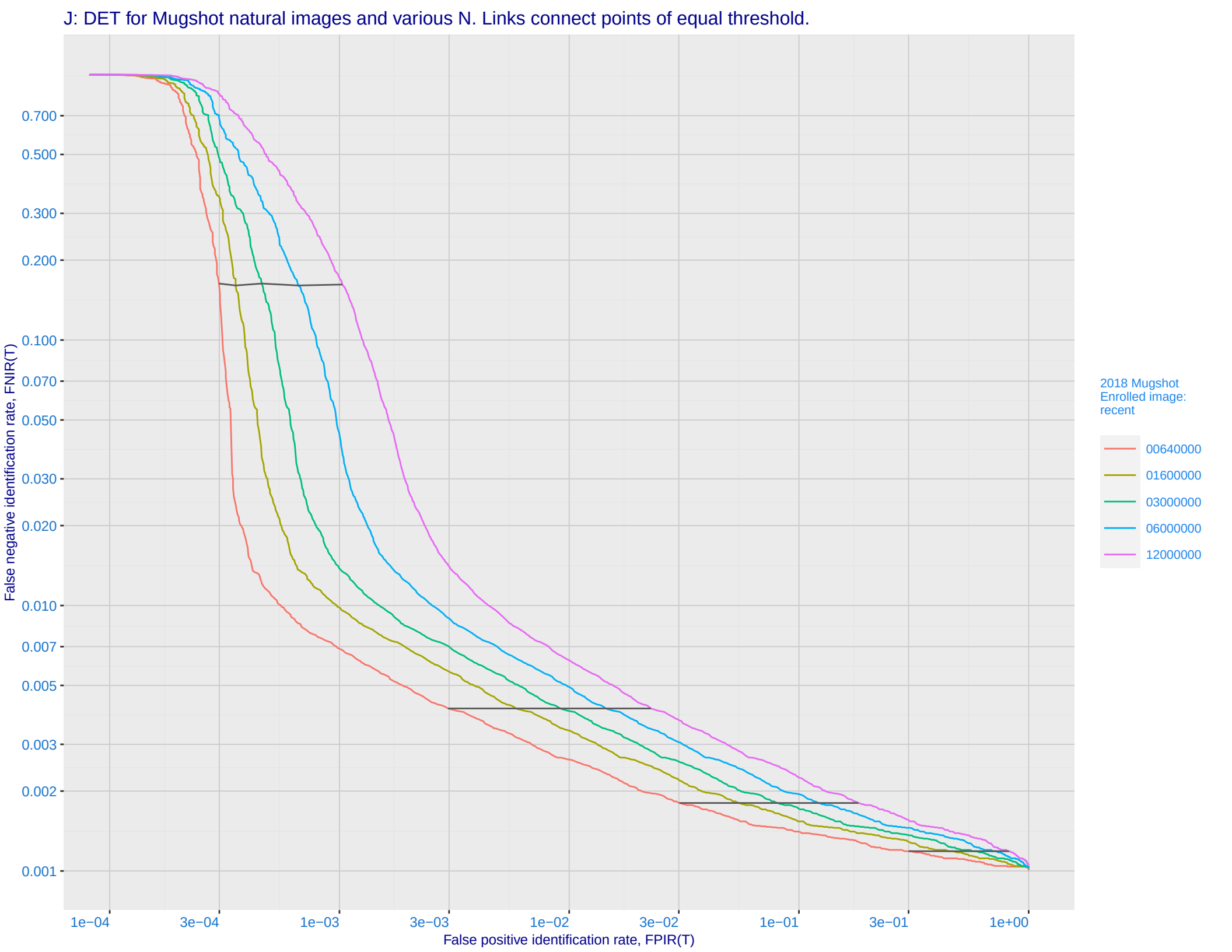

E: Dependence of error rates on T by number enrolled identities, N, for Mugshot natural images
N
00640000
01600000
03000000
06000000
12000000
recent
FNIR
FPIR
Identification Error rate, FPIR(T) or FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
7e−01
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
1600
2000
2400
2800
Threshold

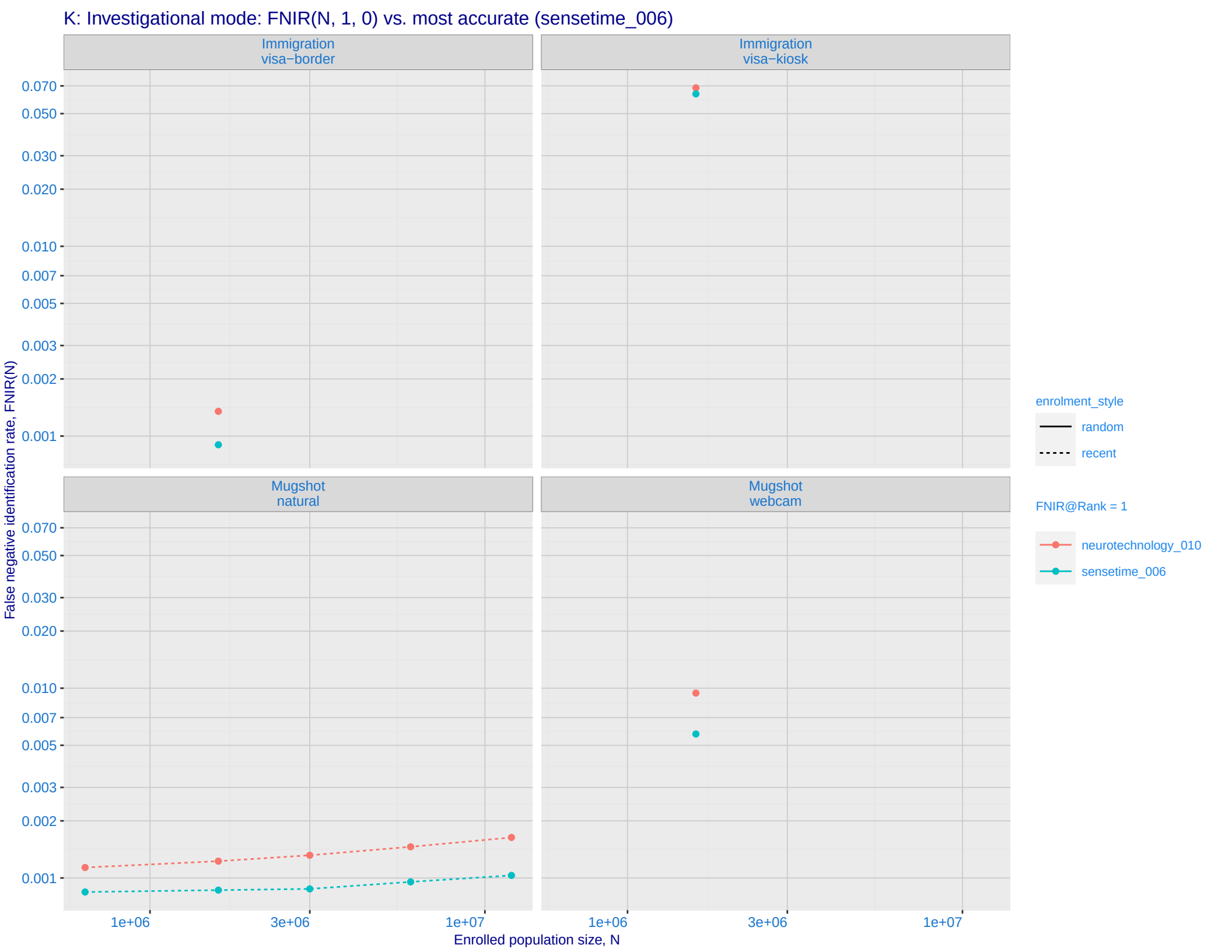

F: FPIR vs. Selectivity for mugshot images, N = 1600000 subjects enrolled with one recent mate
Selectivity, SEL(T)
7e+01
5e+01
3e+01
2e+01
1e+01
7e+00
5e+00
3e+00
2e+00
1e+00
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05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

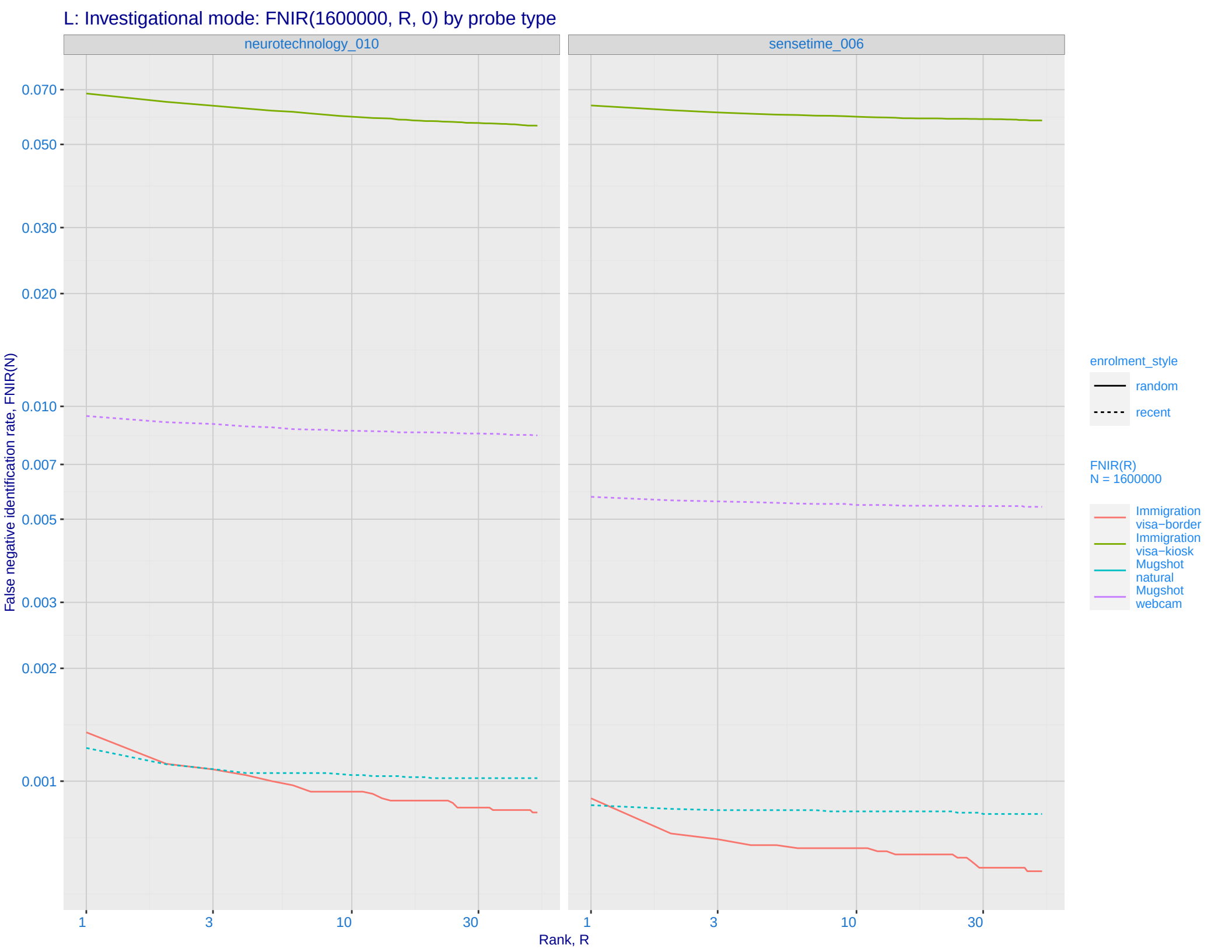

G: FPIR dependence on T by probe type for N = 1600000 subjects
False Positive Idenification Rate, FPIR(T)
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05
5e−05
3e−05
2e−05
1e−05
1500
2000
2500
3000
Threshold
Enrolled image:
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

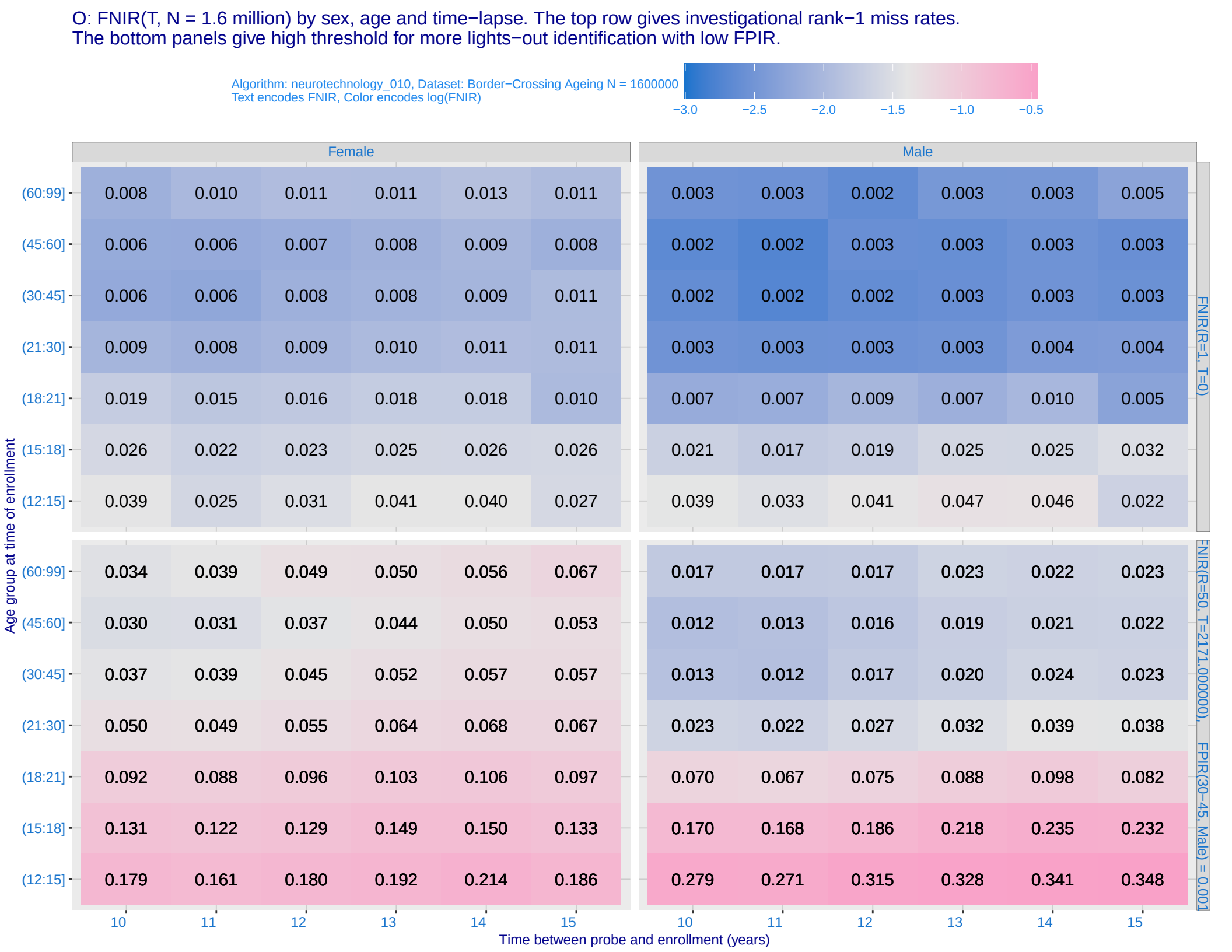

I: FNIR and FPIR dependence on threshold
Dataset is border−border with time−lapse [10,15] YRS with N = 1600000. Probes are 10−15 years later than enrollment image
FNIR(T)
0.400
0.200
0.100
0.040
0.020
0.010
0.004
0.002
FPIR(T)
1e+00
4e−01
2e−01
1e−01
4e−02
2e−02
1e−02
4e−03
2e−03
1e−03
4e−04
2e−04
1e−04
False {Negative | Positive} Identification Rate
1750
2000
2250
2500
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

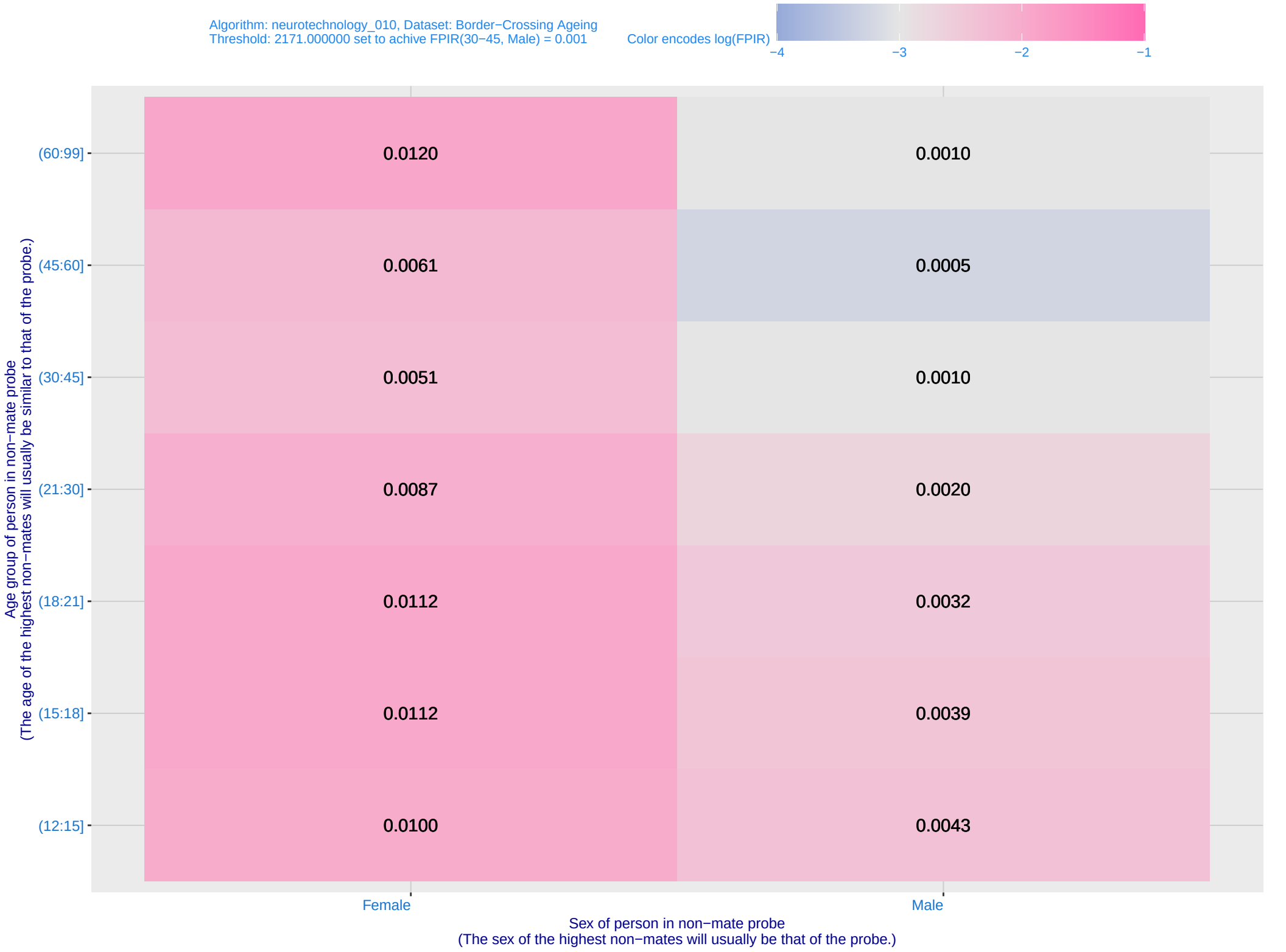

K: Investigational mode: FNIR(N, 1, 0) vs. most accurate (sensetime_006)
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
Mugshot webcam
False negative identification rate, FNIR(N)
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e+06
3e+06
1e+07
Enrolled population size, N
enrolment_style
random
recent
FNIR@Rank = 1
neurotechnology_010
sensetime_006


L: Investigational mode: FNIR(1600000, R, 0) by probe type
neurotechnology_010
sensetime_006
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

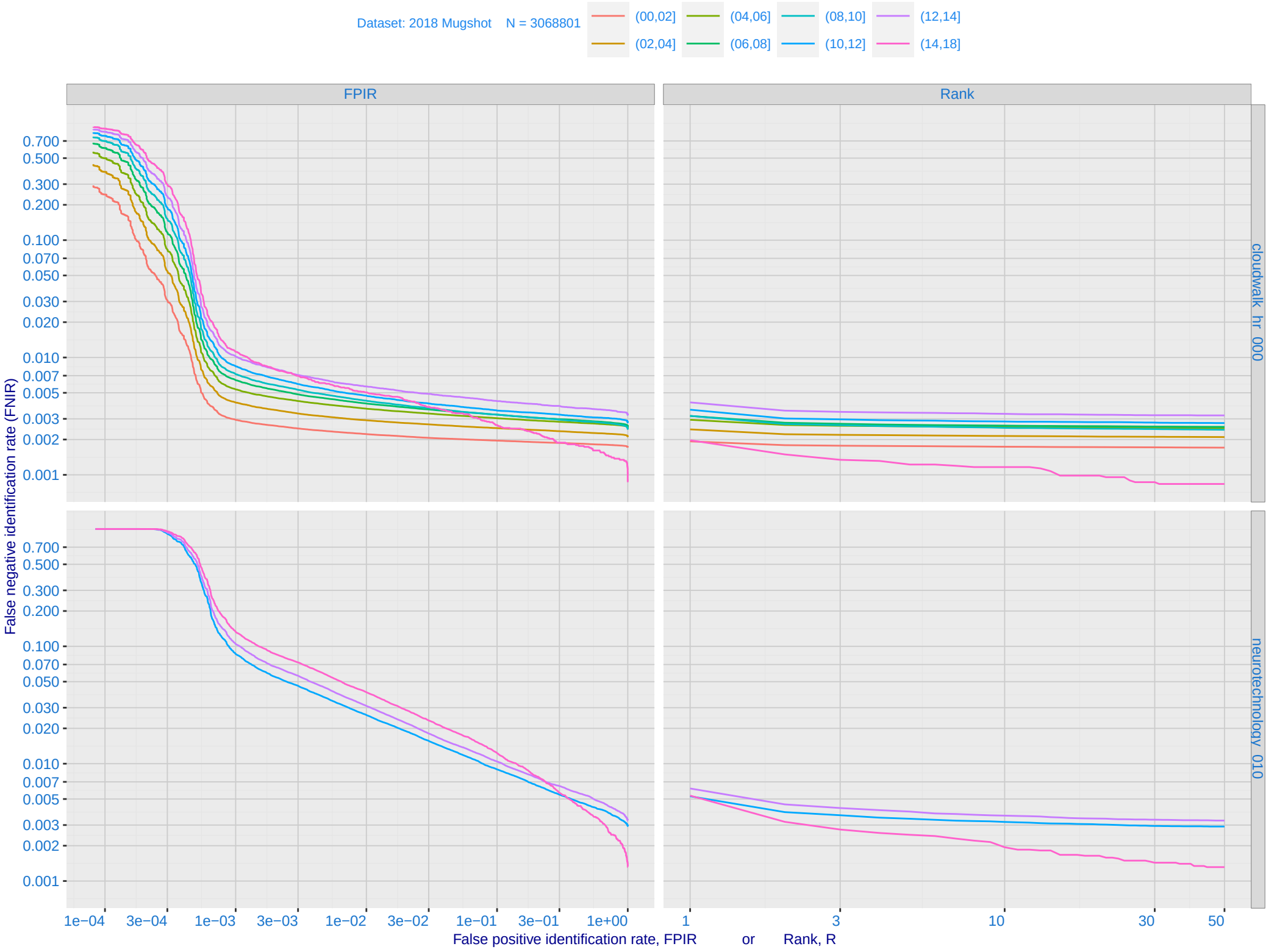
M: Template duration; search duration vs. N. The blue and pink ribbon covers 95 percent of observed measurements.
The template generation time is independent of N. The log and power−law models are fit to the first two (N,T) observations

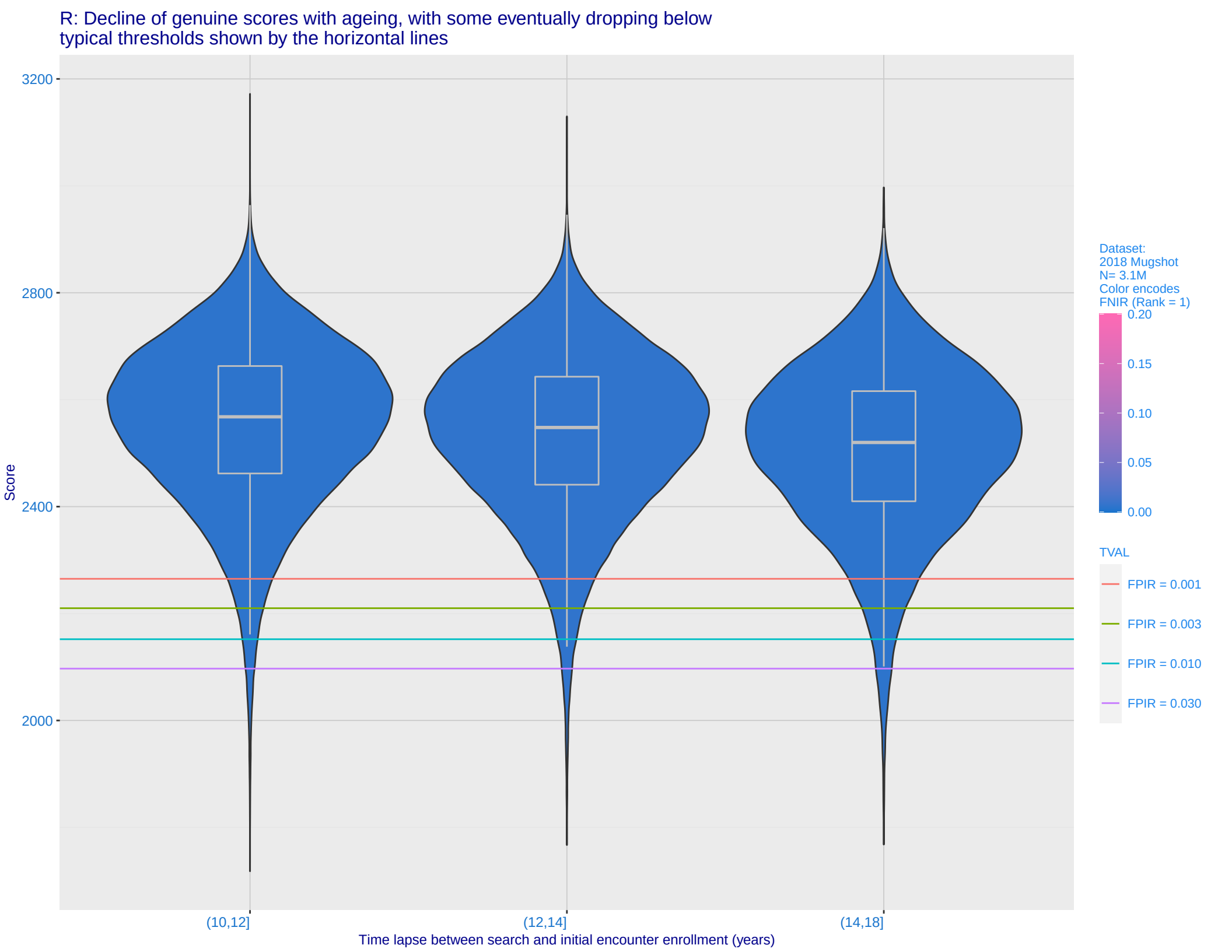

O: FNIR(T, N = 1.6 million) by sex, age and time−lapse. The top row gives investigational rank−1 miss rates.
The bottom panels give high threshold for more lights−out identification with low FPIR.
Algorithm: neurotechnology_010, Dataset: Border−Crossing Ageing N = 1600000
Text encodes FNIR, Color encodes log(FNIR)
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
Female
Male
FNIR(R=1, T=0)
FNIR(R=50, T=2171.000000), FPIR(30−45, Male) = 0.001
Age group at time of enrollment
(60:99]
(45:60]
(30:45]
(21:30]
(18:21]
(15:18]
(12:15]
0.008 0.010 0.011 0.011 0.013 0.011
0.006 0.006 0.007 0.008 0.009 0.008
0.006 0.006 0.008 0.008 0.009 0.011
0.009 0.008 0.009 0.010 0.011 0.011
0.019 0.015 0.016 0.018 0.018 0.010
0.026 0.022 0.023 0.025 0.026 0.026
0.039 0.025 0.031 0.041 0.040 0.027
0.003 0.003 0.002 0.003 0.003 0.005
0.002 0.002 0.003 0.003 0.003 0.003
0.002 0.002 0.002 0.003 0.003 0.003
0.003 0.003 0.003 0.003 0.004 0.004
0.007 0.007 0.009 0.007 0.010 0.005
0.021 0.017 0.019 0.025 0.025 0.032
0.039 0.033 0.041 0.047 0.046 0.022
0.034 0.039 0.049 0.050 0.056 0.067
0.030 0.031 0.037 0.044 0.050 0.053
0.037 0.039 0.045 0.052 0.057 0.057
0.050 0.049 0.055 0.064 0.068 0.067
0.092 0.088 0.096 0.103 0.106 0.097
0.131 0.122 0.129 0.149 0.150 0.133
0.179 0.161 0.180 0.192 0.214 0.186
0.017 0.017 0.017 0.023 0.022 0.023
0.012 0.013 0.016 0.019 0.021 0.022
0.013 0.012 0.017 0.020 0.024 0.023
0.023 0.022 0.027 0.032 0.039 0.038
0.070 0.067 0.075 0.088 0.098 0.082
0.170 0.168 0.186 0.218 0.235 0.232
0.279 0.271 0.315 0.328 0.341 0.348
10 11 12 13 14 15
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
3200
2800
2400
2000
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