A: Datasheet

Algorithm: neurotechnology_013

Developer: Neurotechnology

Submission Date: 2023_02_03

Template size: 256 bytes

Template time (2.5 percentile): 970 msec

Template time (median): 971 msec

Template time (97.5 percentile): 1031 msec

Investigation:

Frontal mugshot ranking 16 (out of 397) −− FNIR(1600000, 0, 1) = 0.0010 vs. lowest 0.0008 from intema_001

Mugshot webcam ranking 31 (out of 359) −− FNIR(1600000, 0, 1) = 0.0077 vs. lowest 0.0054 from sensetime_009

Mugshot profile ranking 11 (out of 328) −− FNIR(1600000, 0, 1) = 0.0581 vs. lowest 0.0517 from sensetime_009

Immigration visa−border ranking 8 (out of 286) −− FNIR(1600000, 0, 1) = 0.0009 vs. lowest 0.0006 from cloudwalk_mt_002

Immigration visa−kiosk ranking 19 (out of 231) −− FNIR(1600000, 0, 1) = 0.0510 vs. lowest 0.0387 from cloudwalk_mt_002

Identification:

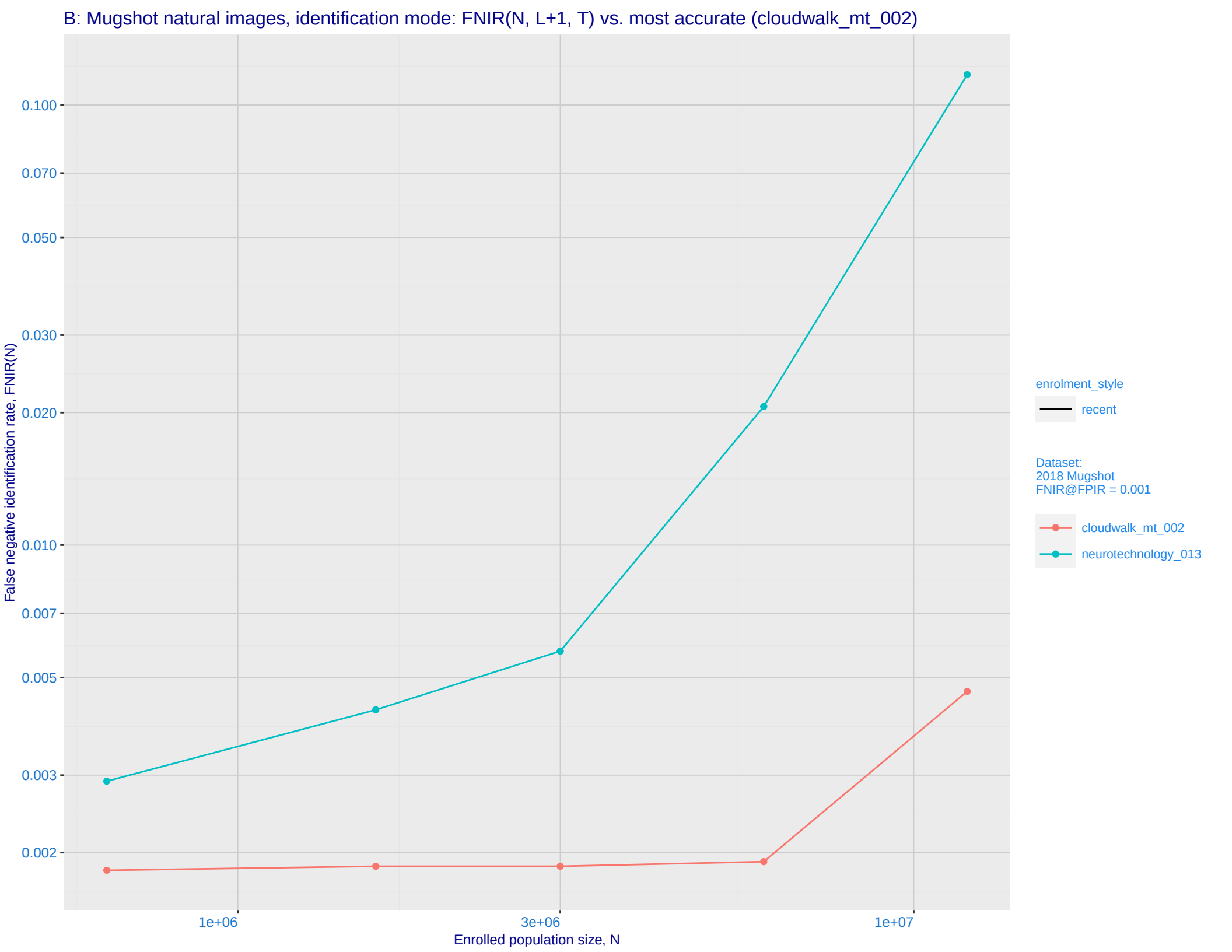
Frontal mugshot ranking 41 (out of 397) −− FNIR(1600000, T, L+1) = 0.0042, FPIR=0.001000 vs. lowest 0.0011 from idemia_010

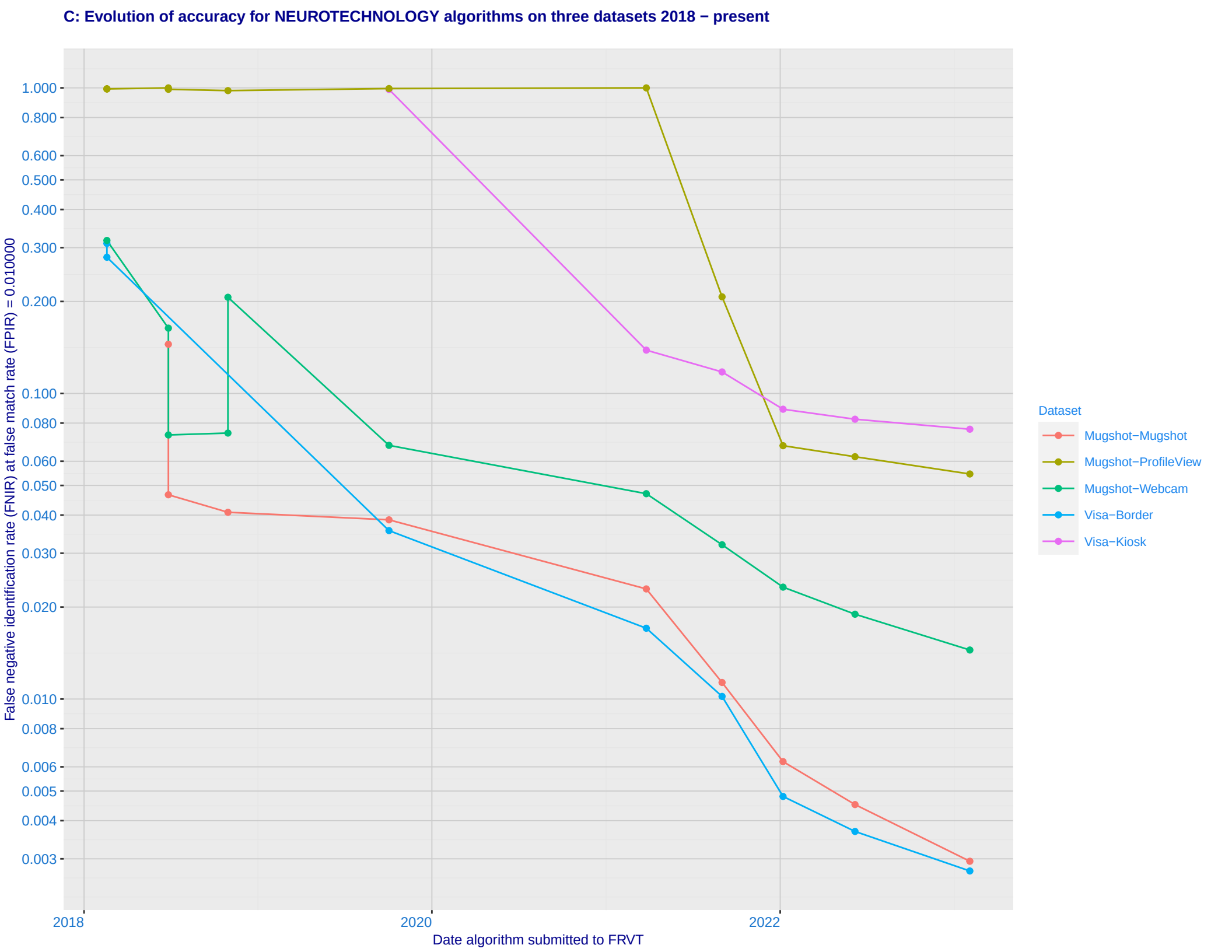
Mugshot webcam ranking 36 (out of 357) −− FNIR(1600000, T, L+1) = 0.0227, FPIR=0.001000 vs. lowest 0.0072 from sensetime_009

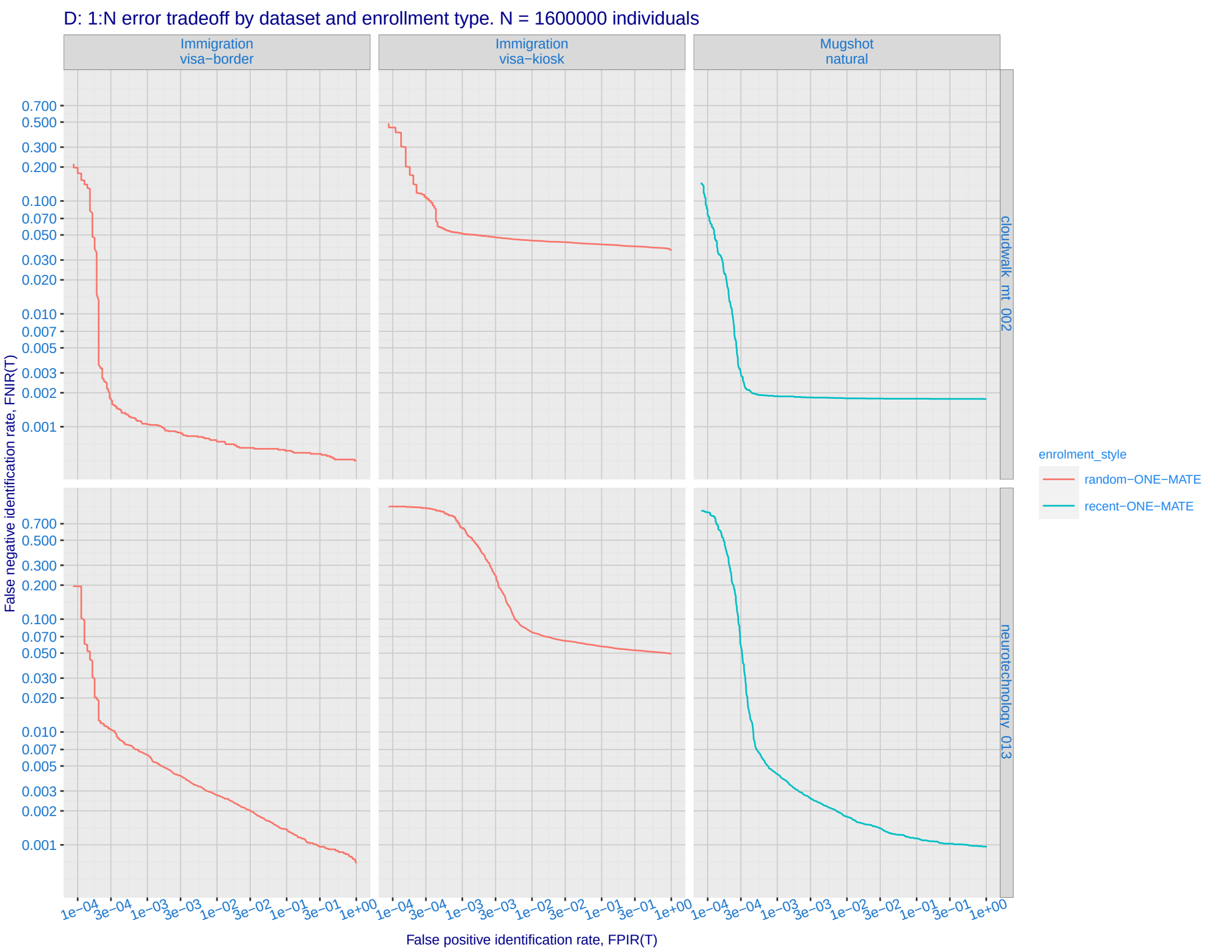
Mugshot profile ranking 27 (out of 327) −− FNIR(1600000, T, L+1) = 0.3242, FPIR=0.001000 vs. lowest 0.0634 from cloudwalk_mt_002

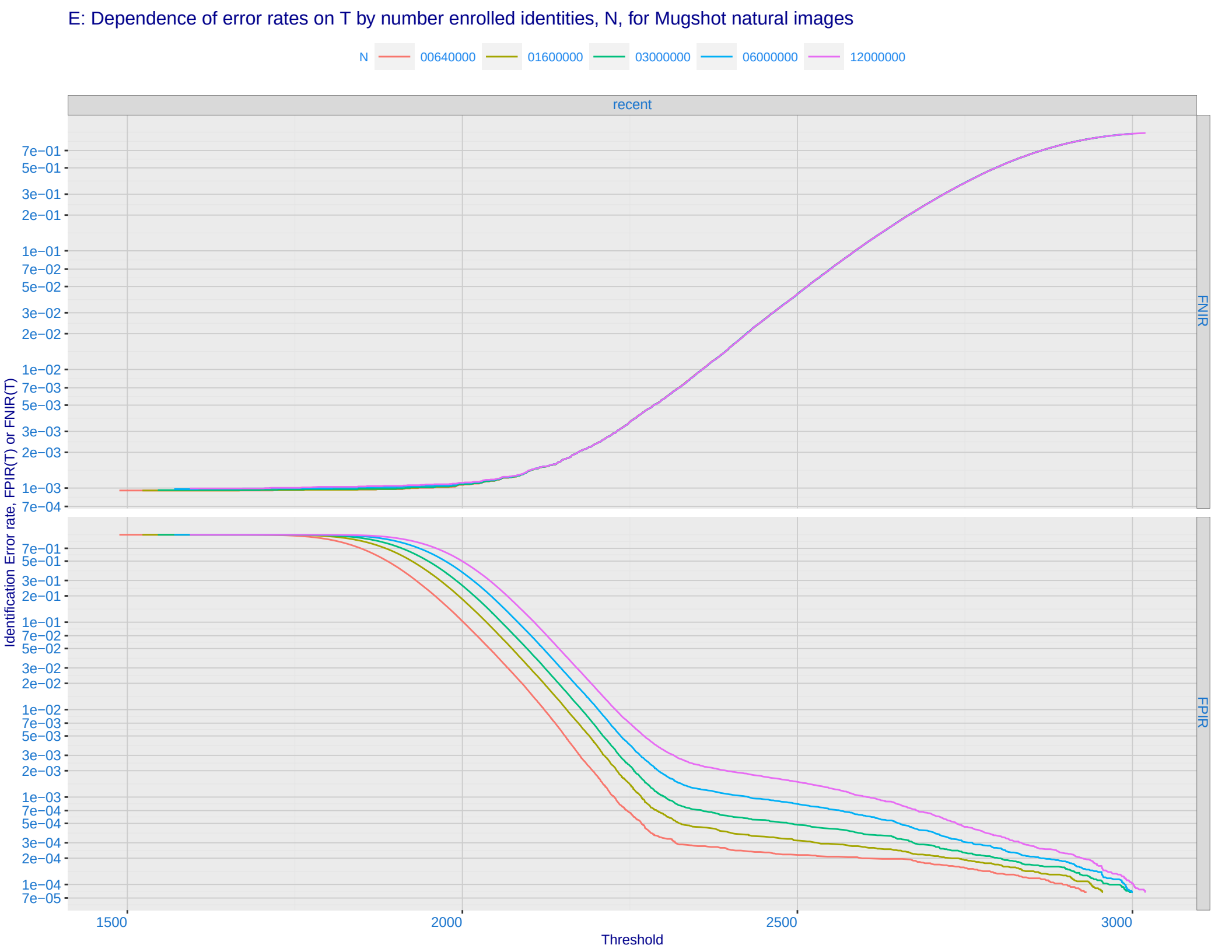
Immigration visa−border ranking 30 (out of 285) −− FNIR(1600000, T, L+1) = 0.0063, FPIR=0.001000 vs. lowest 0.0010 from cloudwalk_mt_002

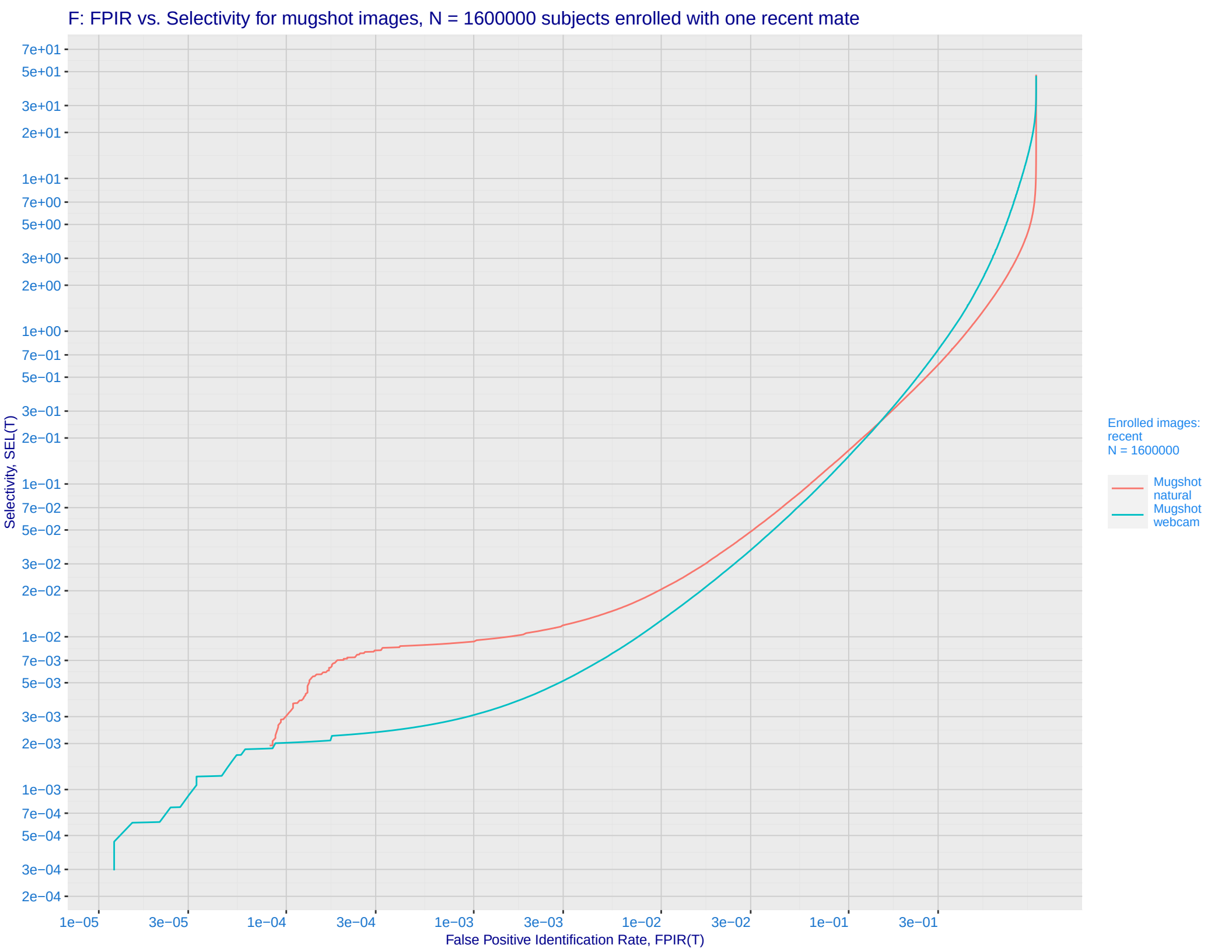
Immigration visa−kiosk ranking 166 (out of 231) −− FNIR(1600000, T, L+1) = 0.6413, FPIR=0.001000 vs. lowest 0.0517 from cloudwalk_mt_002

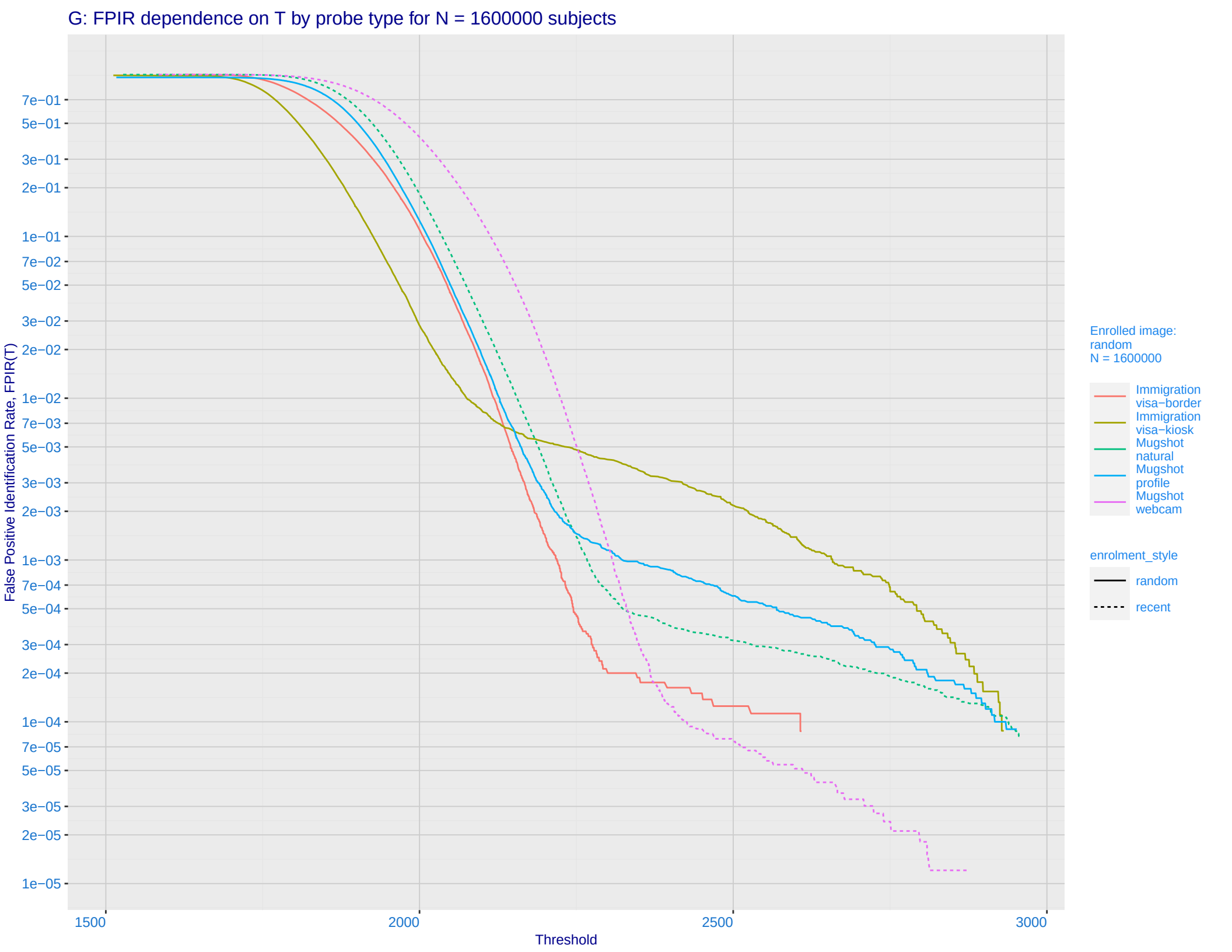

B: Mugshot natural images, identification mode: FNIR(N, L+1, T) vs. most accurate (cloudwalk_mt_002)
False negative identification rate, FNIR(N)
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
1e+06
3e+06
1e+07
Enrolled population size, N
enrolment_style
recent
Dataset:
2018 Mugshot
FNIR@FPIR = 0.001
cloudwalk_mt_002
neurotechnology_013

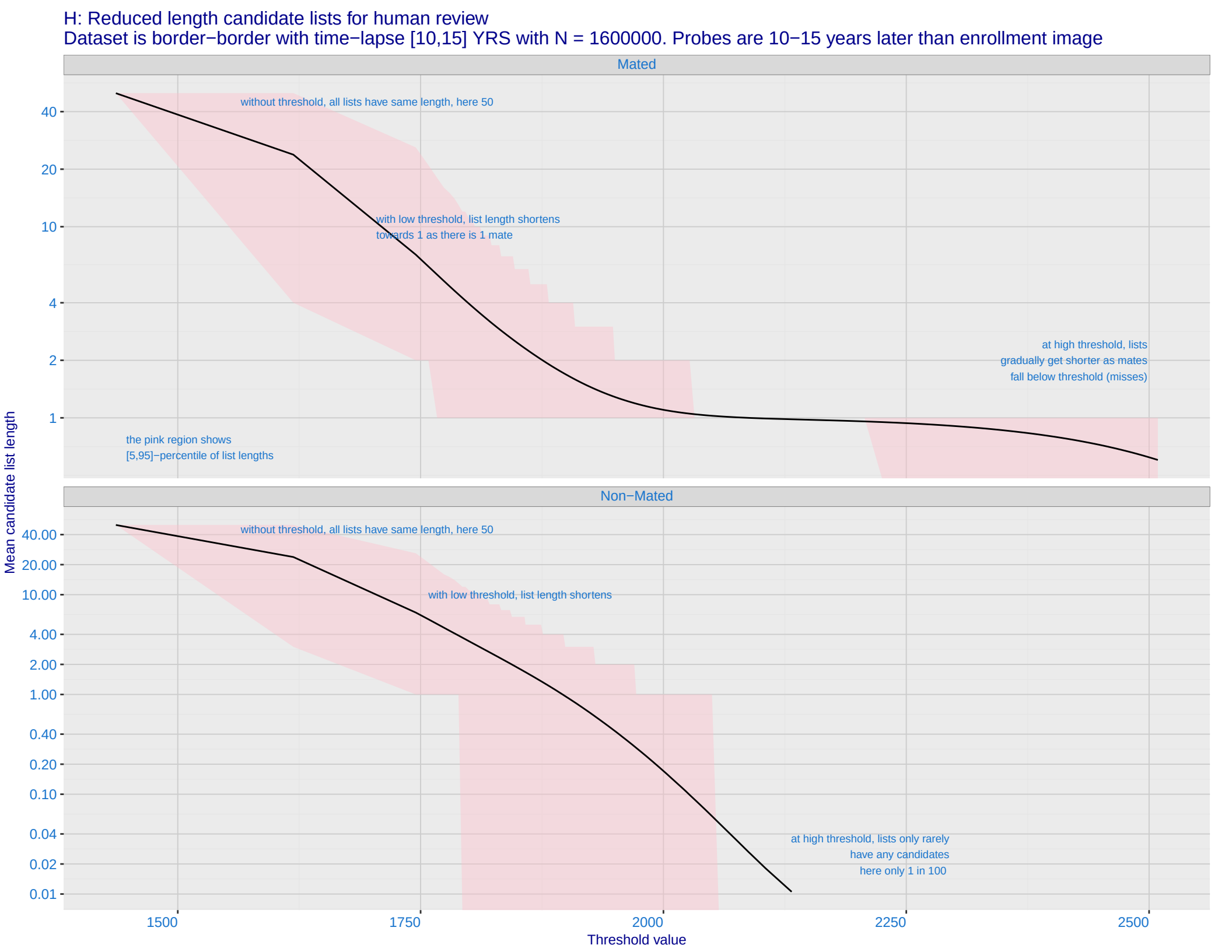

C: Evolution of accuracy for NEUROTECHNOLOGY algorithms on three datasets 2018 − present
False negative identification rate (FNIR) at false match rate (FPIR) = 0.010000
1.000
0.800
0.600
0.500
0.400
0.300
0.200
0.100
0.080
0.060
0.050
0.040
0.030
0.020
0.010
0.008
0.006
0.005
0.004
0.003
2018
2020
2022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

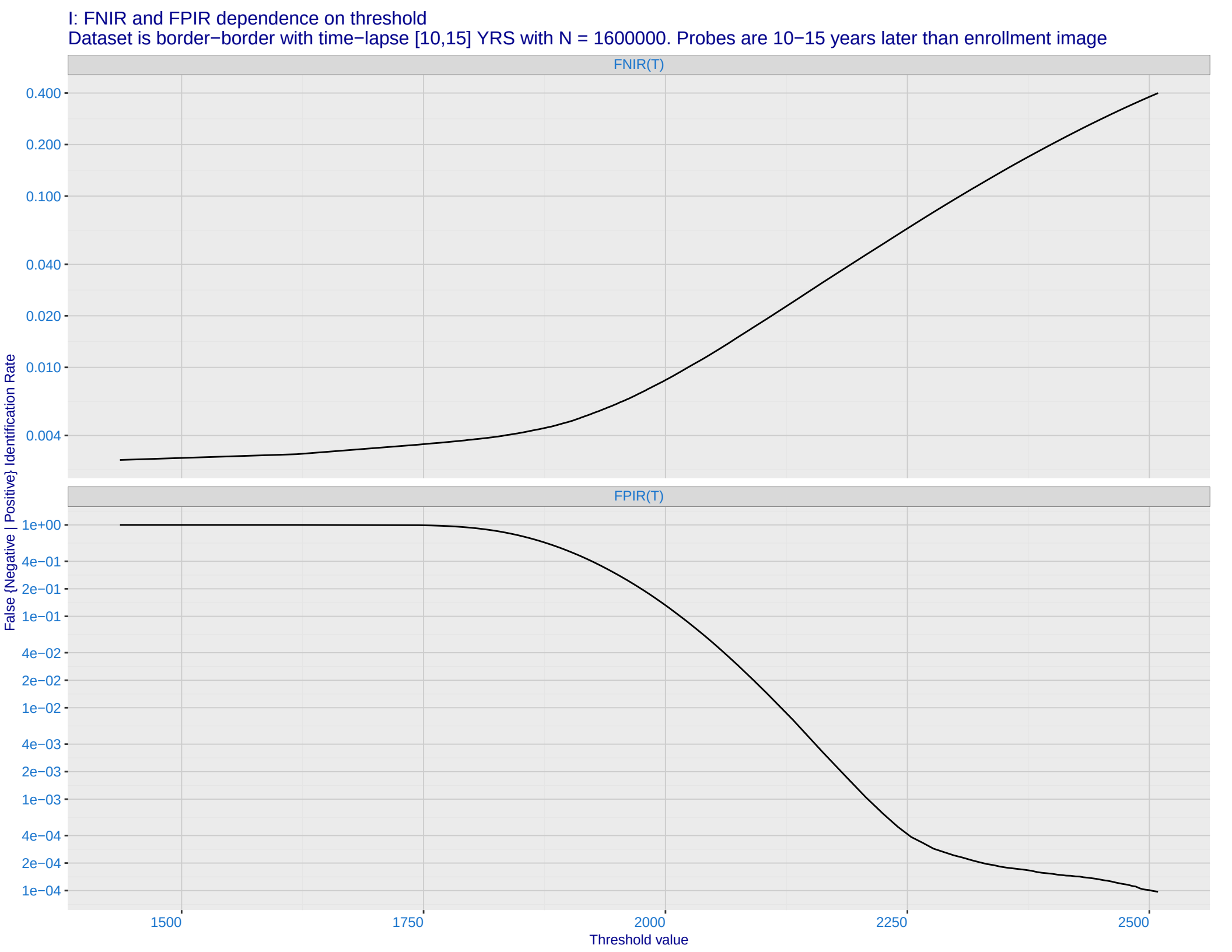

D: 1:N error tradeoff by dataset and enrollment type. N = 1600000 individuals
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
cloudwalk_mt_002
neurotechnology_013
False negative identification rate, FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
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

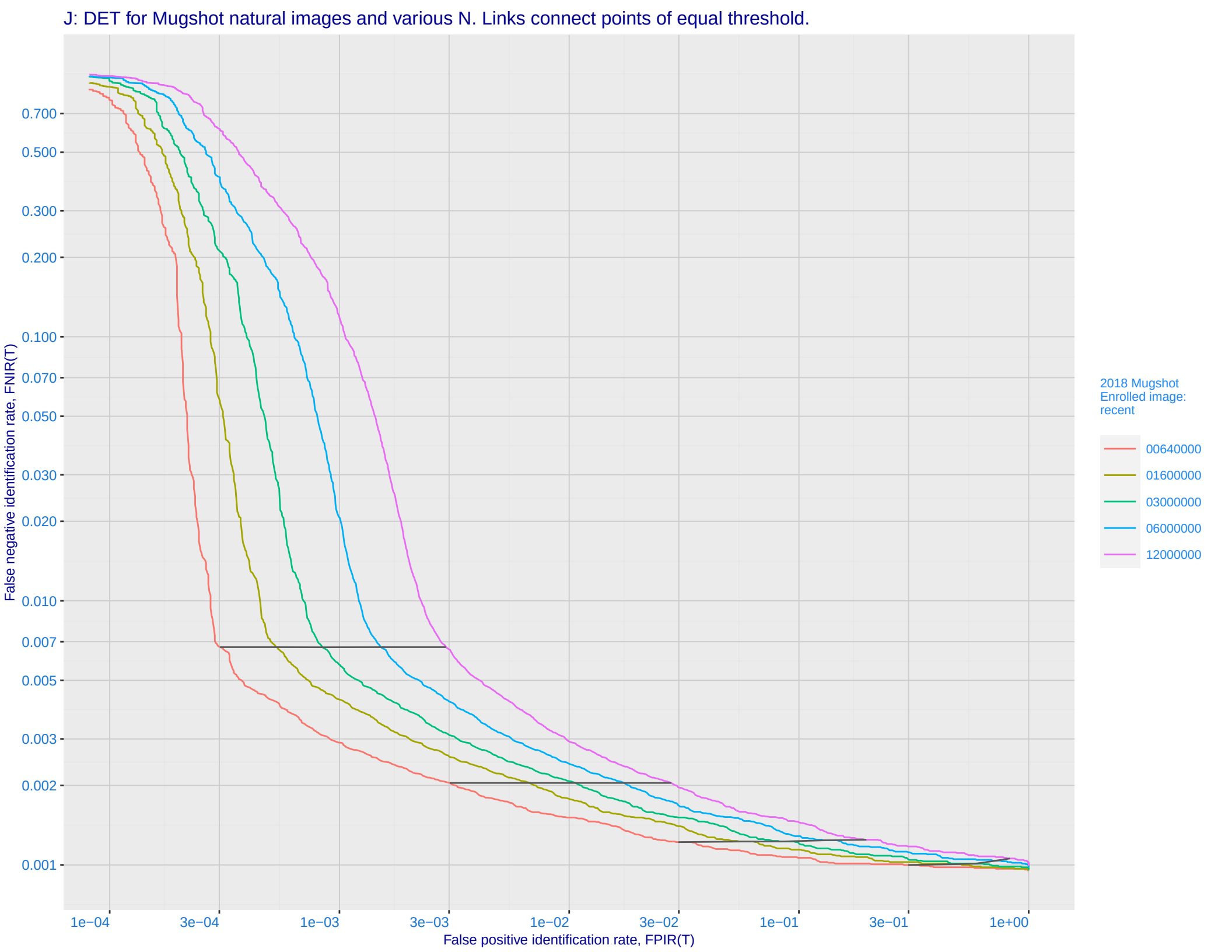

E: Dependence of error rates on T by number enrolled identities, N, for Mugshot natural images
N
00640000
01600000
03000000
06000000
12000000
recent
FNIR
FPIR
Identification Error rate, FPIR(T) or FNIR(T)
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05
1500
2000
2500
3000
Threshold

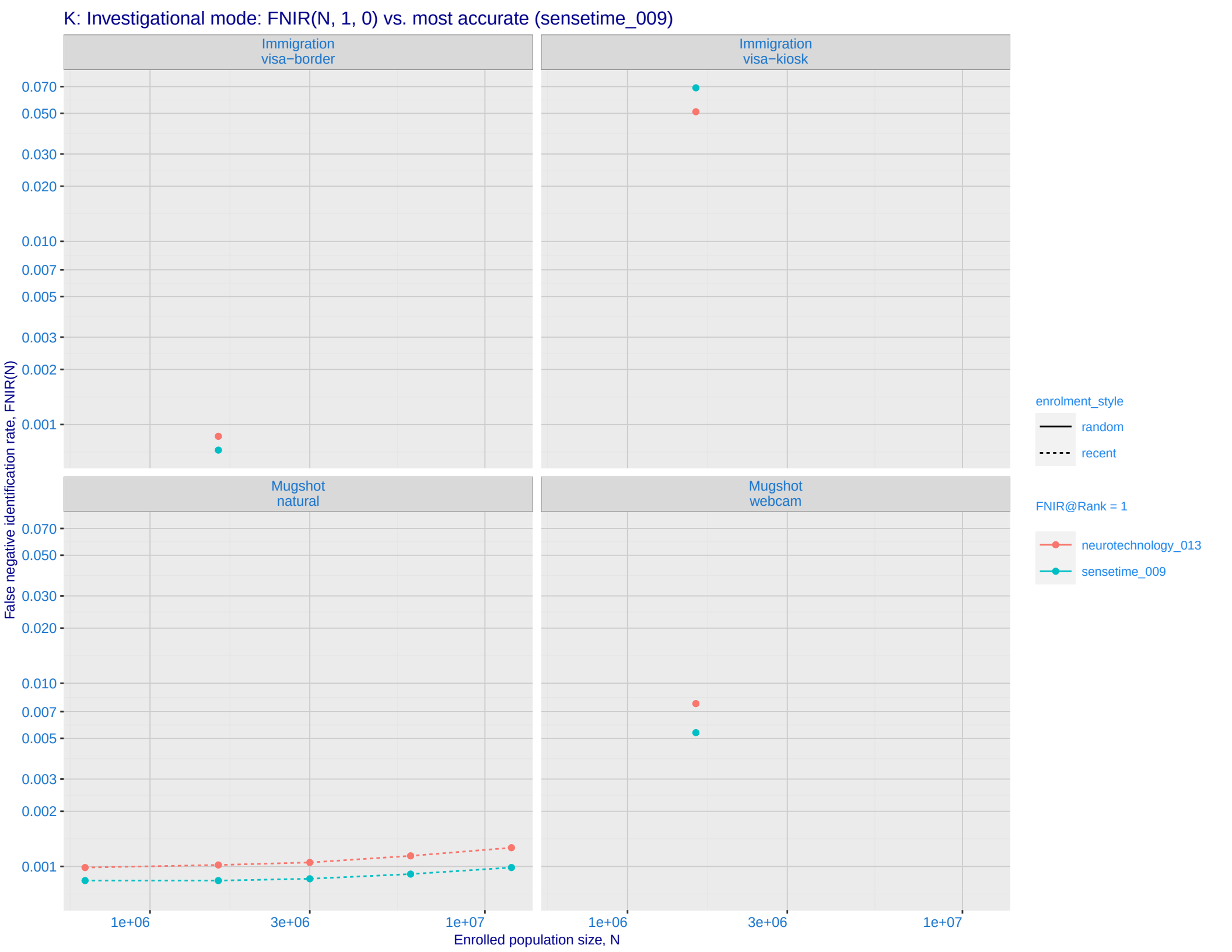

F: FPIR vs. Selectivity for mugshot images, N = 1600000 subjects enrolled with one recent mate
Selectivity, SEL(T)
7e+01
5e+01
3e+01
2e+01
1e+01
7e+00
5e+00
3e+00
2e+00
1e+00
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−05
3e−05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

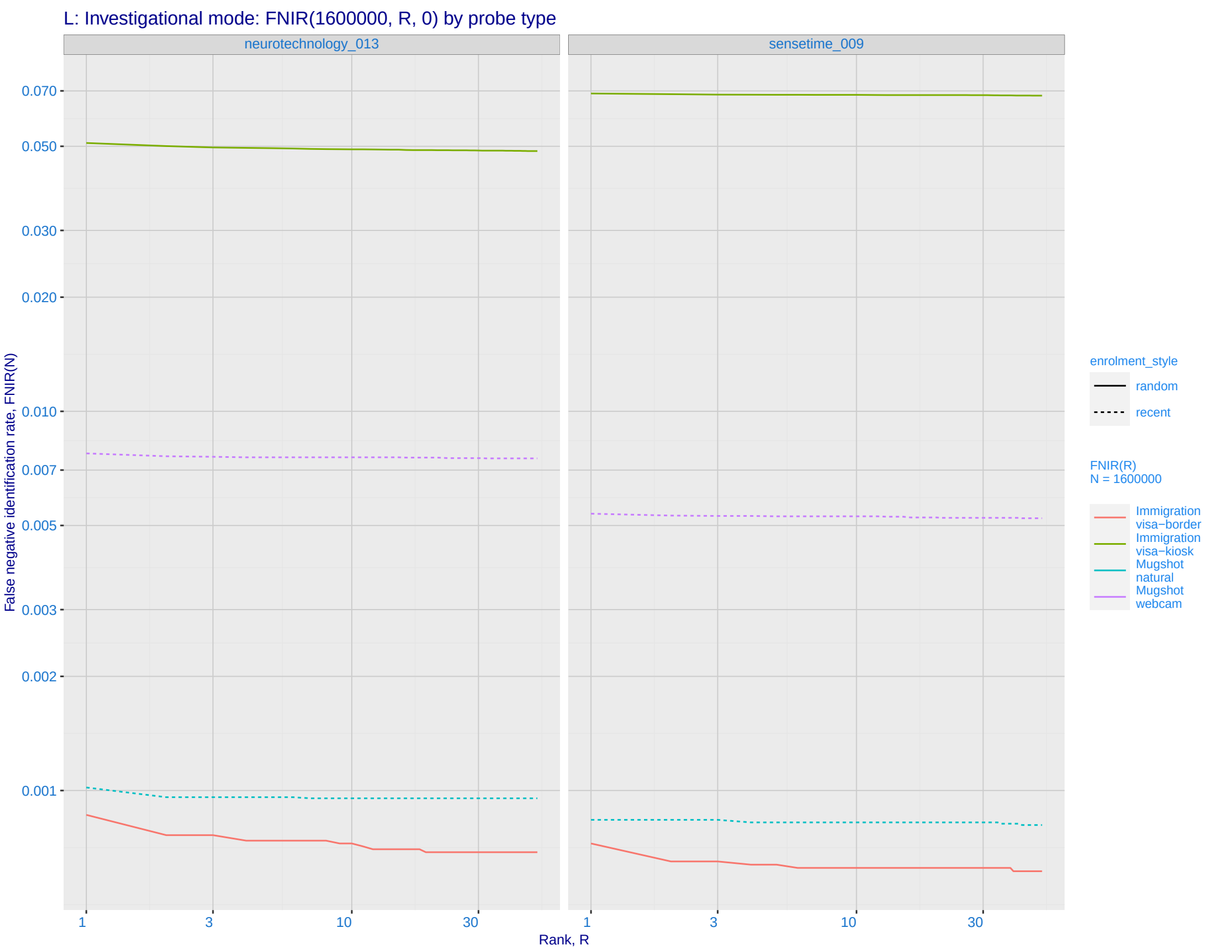

G: FPIR dependence on T by probe type for N = 1600000 subjects
False Positive Identification Rate, FPIR(T)
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05
5e−05
3e−05
2e−05
1e−05
1500
2000
2500
3000
Threshold
Enrolled image:
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
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
1500
1750
2000
2250
2500
Threshold value

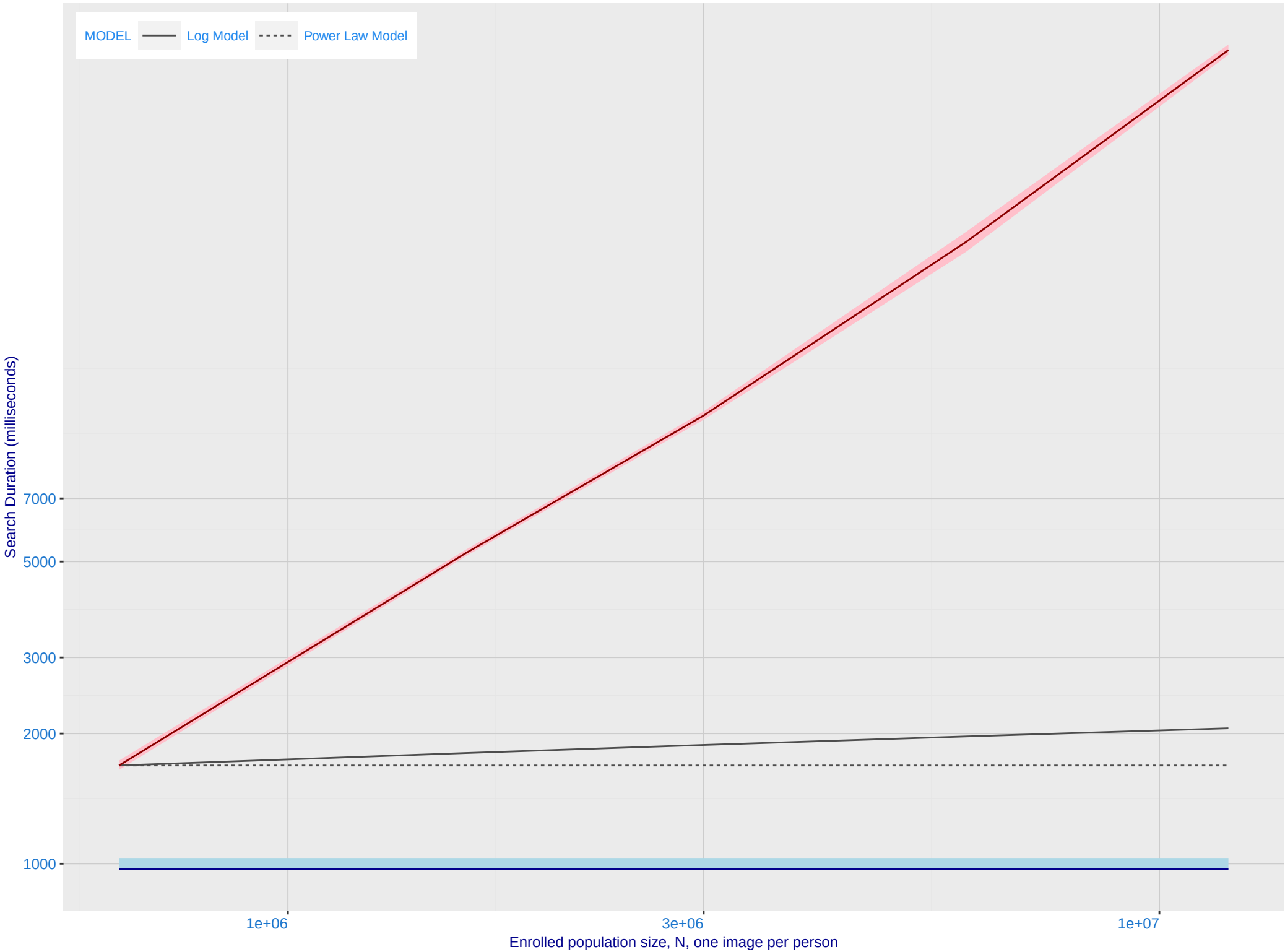

I: FNIR and FPIR dependence on threshold
Dataset is border−border with time−lapse [10,15] YRS with N = 1600000. Probes are 10−15 years later than enrollment image
FNIR(T)
0.400
0.200
0.100
0.040
0.020
0.010
0.004
FPIR(T)
1e+00
4e−01
2e−01
1e−01
4e−02
2e−02
1e−02
4e−03
2e−03
1e−03
4e−04
2e−04
1e−04
False {Negative | Positive} Identification Rate
1500
1750
2000
2250
2500
Threshold value

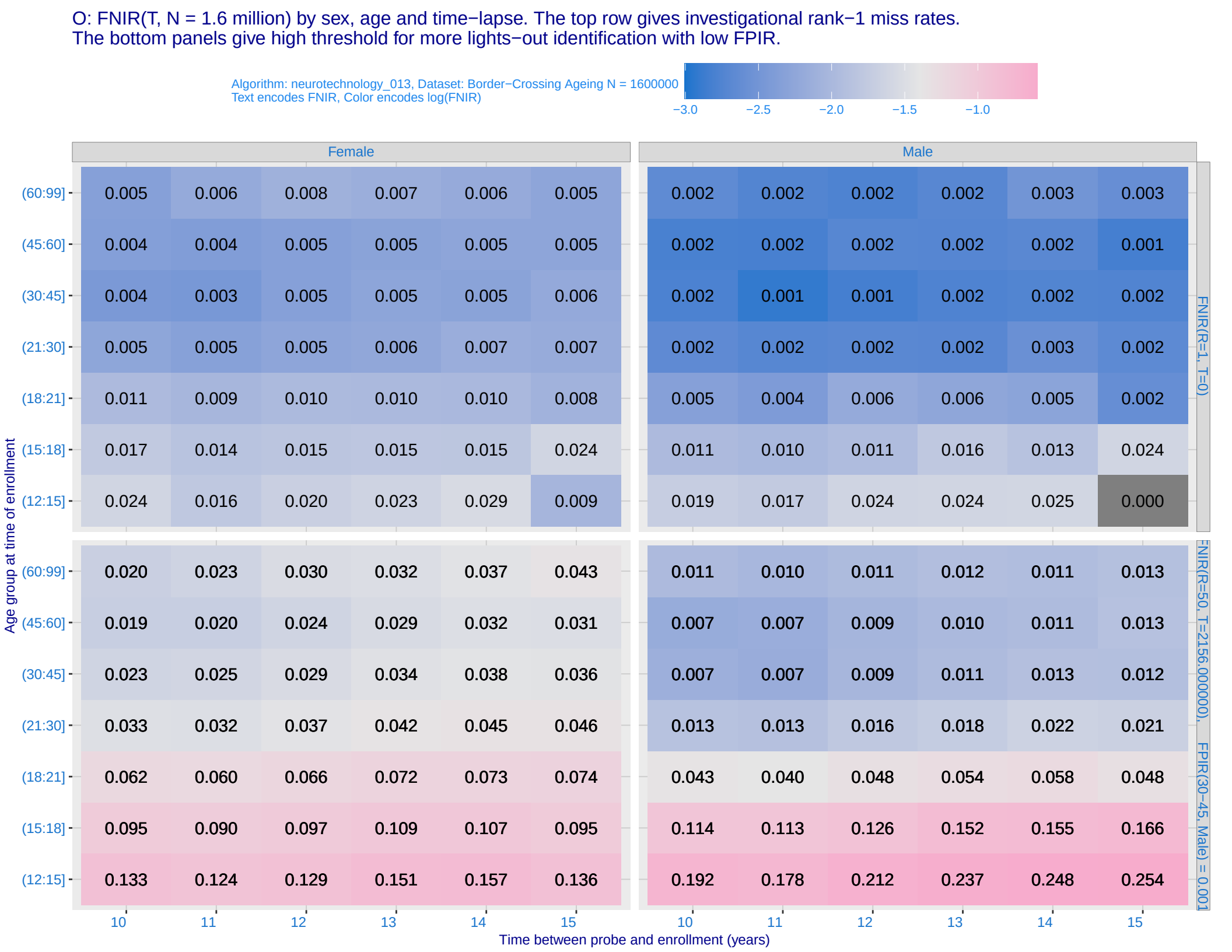

J: DET for Mugshot natural images and various N. Links connect points of equal threshold.
False negative identification rate, FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e−04
3e−04
1e−03
3e−03
1e−02
3e−02
1e−01
3e−01
1e+00
False positive identification rate, FPIR(T)
2018 Mugshot
Enrolled image:
recent
00640000
01600000
03000000
06000000
12000000

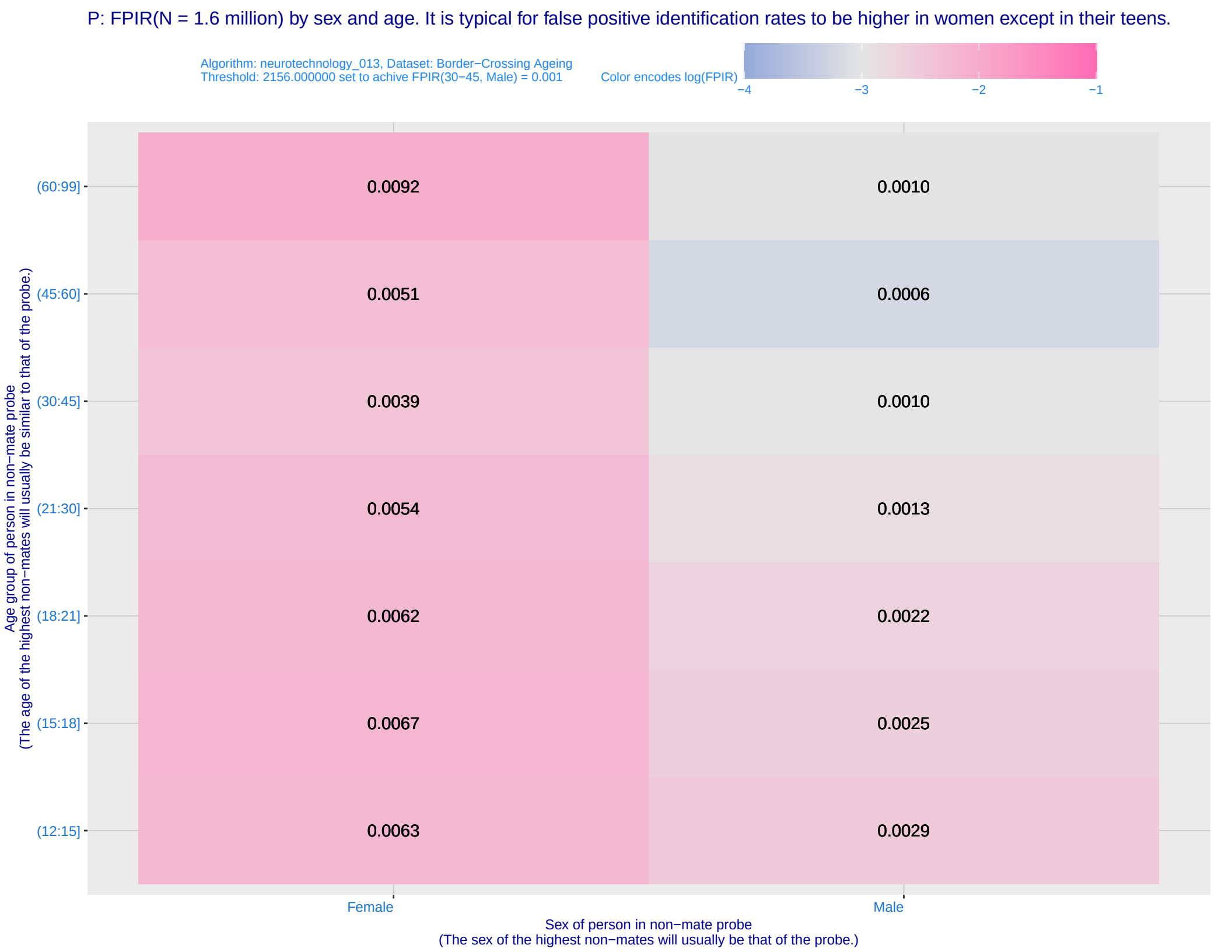

K: Investigational mode: FNIR(N, 1, 0) vs. most accurate (sensetime_009)
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
Mugshot webcam
False negative identification rate, FNIR(N)
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e+06
3e+06
1e+07
Enrolled population size, N
enrolment_style
random
recent
FNIR@Rank = 1
neurotechnology_013
sensetime_009

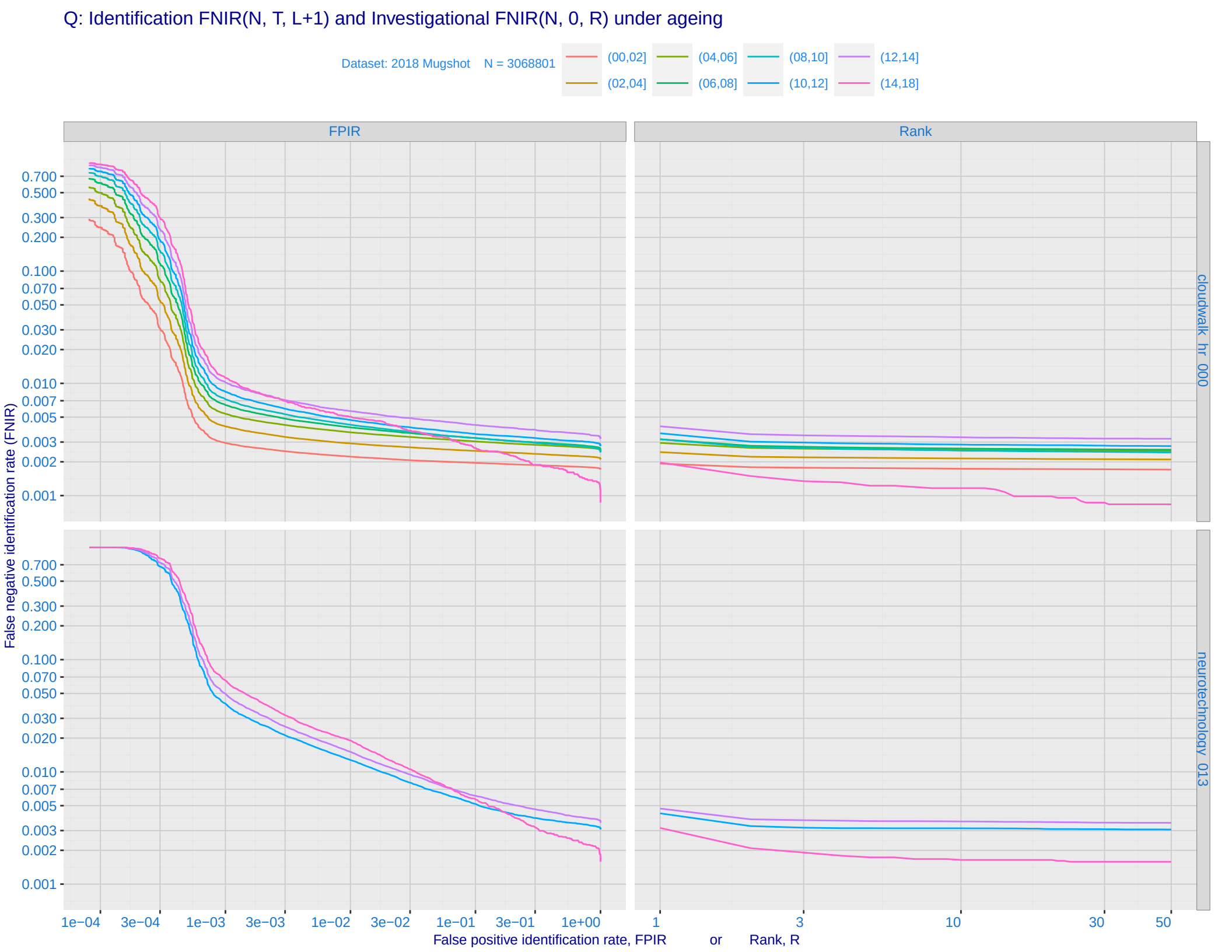

L: Investigational mode: FNIR(1600000, R, 0) by probe type
neurotechnology_013
sensetime_009
False negative identification rate, FNIR(N)
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1
3
10
30
Rank, R
enrolment_style
random
recent
FNIR(R)
N = 1600000
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
Mugshot webcam

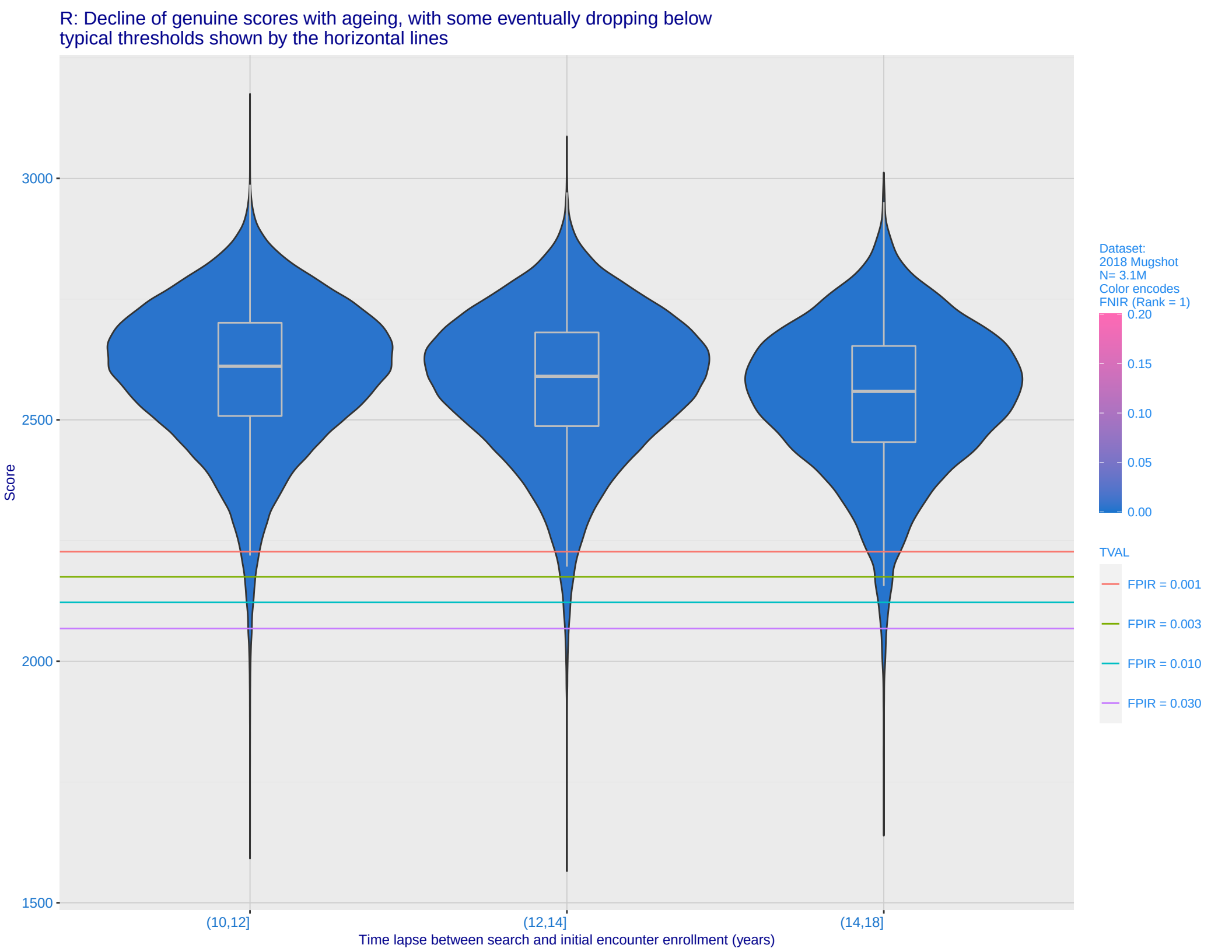
M: Template duration; search duration vs. N. The blue and pink ribbon covers 95 percent of observed measurements.
The template generation time is independent of N. The log and power−law models are fit to the first two (N,T) observations




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: neurotechnology_013, Dataset: Border−Crossing Ageing N = 1600000
Text encodes FNIR, Color encodes log(FNIR)
−3.0
−2.5
−2.0
−1.5
−1.0
Female
Male
FNIR(R=1, T=0)
FNIR(R=50, T=2156.000000), 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]
0.005 0.006 0.008 0.007 0.006 0.005
0.004 0.004 0.005 0.005 0.005 0.005
0.004 0.003 0.005 0.005 0.005 0.006
0.005 0.005 0.005 0.006 0.007 0.007
0.011 0.009 0.010 0.010 0.010 0.008
0.017 0.014 0.015 0.015 0.015 0.024
0.024 0.016 0.020 0.023 0.029 0.009
0.002 0.002 0.002 0.002 0.003 0.003
0.002 0.002 0.002 0.002 0.002 0.001
0.002 0.001 0.001 0.002 0.002 0.002
0.002 0.002 0.002 0.002 0.003 0.002
0.005 0.004 0.006 0.006 0.005 0.002
0.011 0.010 0.011 0.016 0.013 0.024
0.019 0.017 0.024 0.024 0.025 0.000
0.020 0.023 0.030 0.032 0.037 0.043
0.019 0.020 0.024 0.029 0.032 0.031
0.023 0.025 0.029 0.034 0.038 0.036
0.033 0.032 0.037 0.042 0.045 0.046
0.062 0.060 0.066 0.072 0.073 0.074
0.095 0.090 0.097 0.109 0.107 0.095
0.133 0.124 0.129 0.151 0.157 0.136
0.011 0.010 0.011 0.012 0.011 0.013
0.007 0.007 0.009 0.010 0.011 0.013
0.007 0.007 0.009 0.011 0.013 0.012
0.013 0.013 0.016 0.018 0.022 0.021
0.043 0.040 0.048 0.054 0.058 0.048
0.114 0.113 0.126 0.152 0.155 0.166
0.192 0.178 0.212 0.237 0.248 0.254
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: neurotechnology_013, Dataset: Border−Crossing Ageing
Threshold: 2156.000000 set to achive FPIR(30−45, Male) = 0.001
Color encodes log(FPIR)
−4
−3
−2
−1
0.0092
0.0010
0.0051
0.0006
0.0039
0.0010
0.0054
0.0013
0.0062
0.0022
0.0067
0.0025
0.0063
0.0029
(60:99]
(45:60]
(30:45]
(21:30]
(18:21]
(15:18]
(12:15]
Age group of person in non−mate probe
(The age of the highest non−mates will usually be similar to that of the probe.)
Female
Male
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
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
neurotechnology 013
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
Score
3000
2500
2000
1500
(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