A: Datasheet

Algorithm: tevian_007

Developer: Tevian

Submission Date: 2021_10_12

Template size: 1032 bytes

Template time (2.5 percentile): 775 msec

Template time (median): 778 msec

Template time (97.5 percentile): 805 msec

Investigation:

Frontal mugshot ranking 51 (out of 329) −− FNIR(1600000, 0, 1) = 0.0018 vs. lowest 0.0009 from sensetime_006

Mugshot webcam ranking 25 (out of 291) −− FNIR(1600000, 0, 1) = 0.0093 vs. lowest 0.0057 from sensetime_006

Mugshot profile ranking 24 (out of 260) −− FNIR(1600000, 0, 1) = 0.0926 vs. lowest 0.0550 from sensetime_006

Immigration visa−border ranking 19 (out of 218) −− FNIR(1600000, 0, 1) = 0.0021 vs. lowest 0.0009 from sensetime_006

Immigration visa−kiosk ranking 11 (out of 215) −− FNIR(1600000, 0, 1) = 0.0673 vs. lowest 0.0487 from cubox_000

Identification:

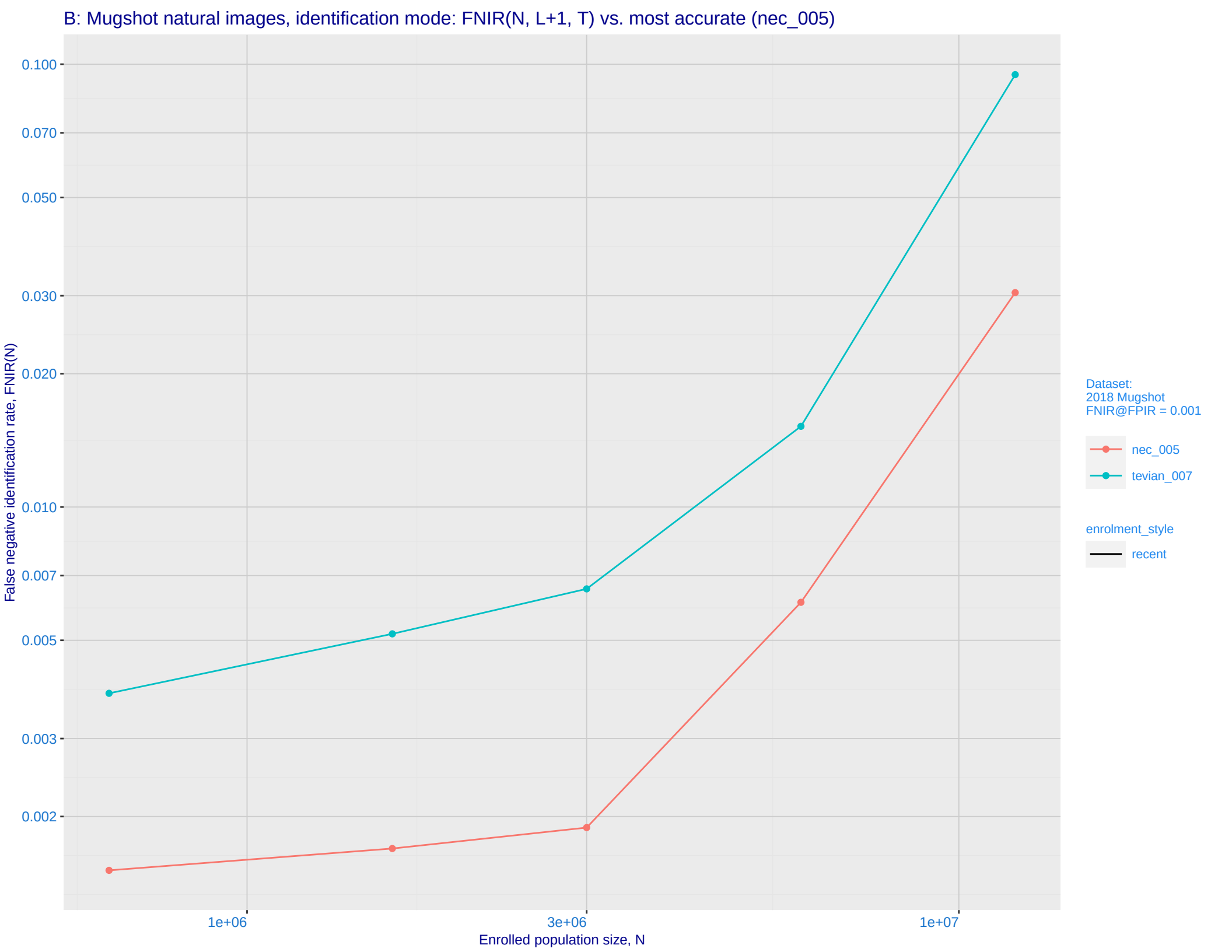
Frontal mugshot ranking 26 (out of 329) −− FNIR(1600000, T, L+1) = 0.0052, FPIR=0.001000 vs. lowest 0.0017 from nec_005

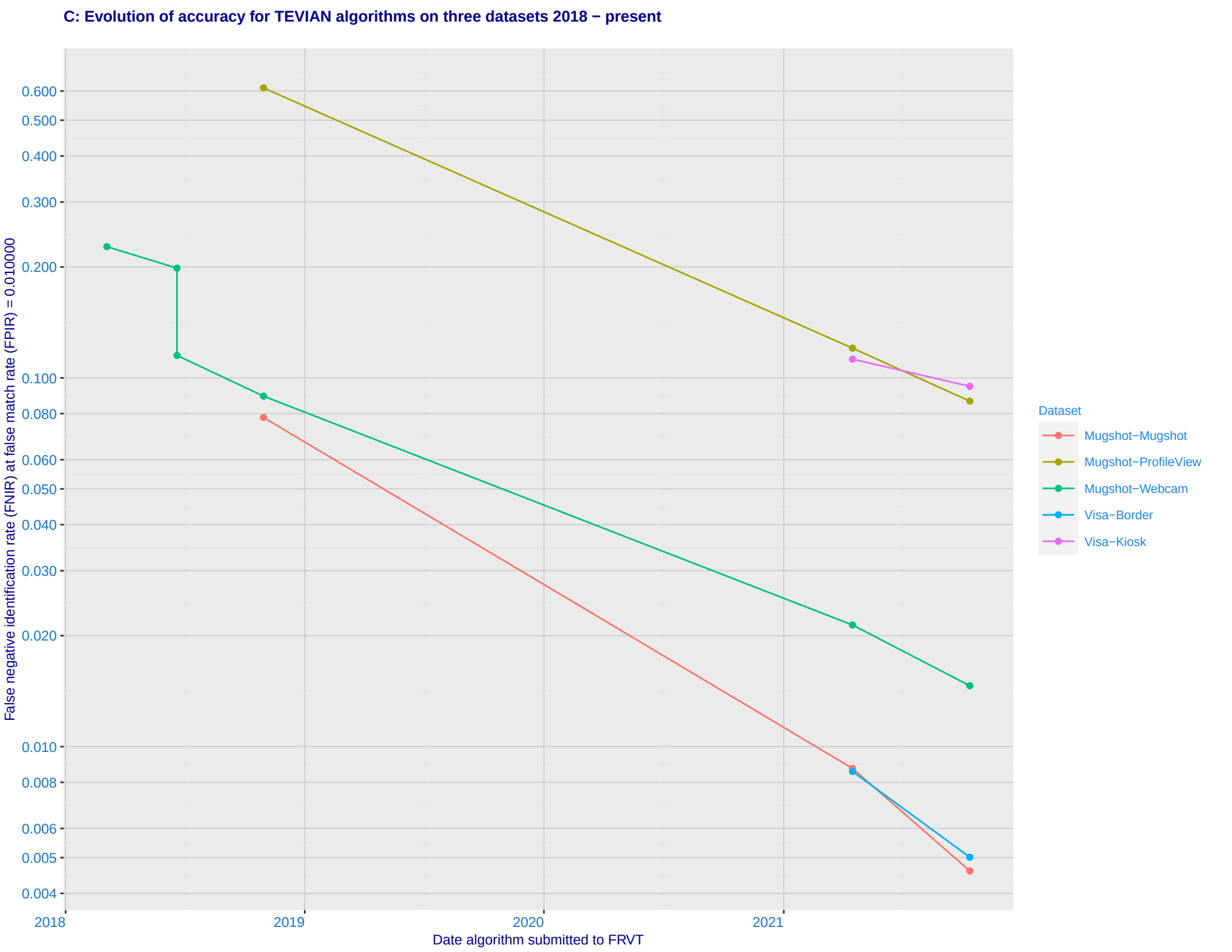
Mugshot webcam ranking 18 (out of 289) −− FNIR(1600000, T, L+1) = 0.0217, FPIR=0.001000 vs. lowest 0.0120 from nec_005

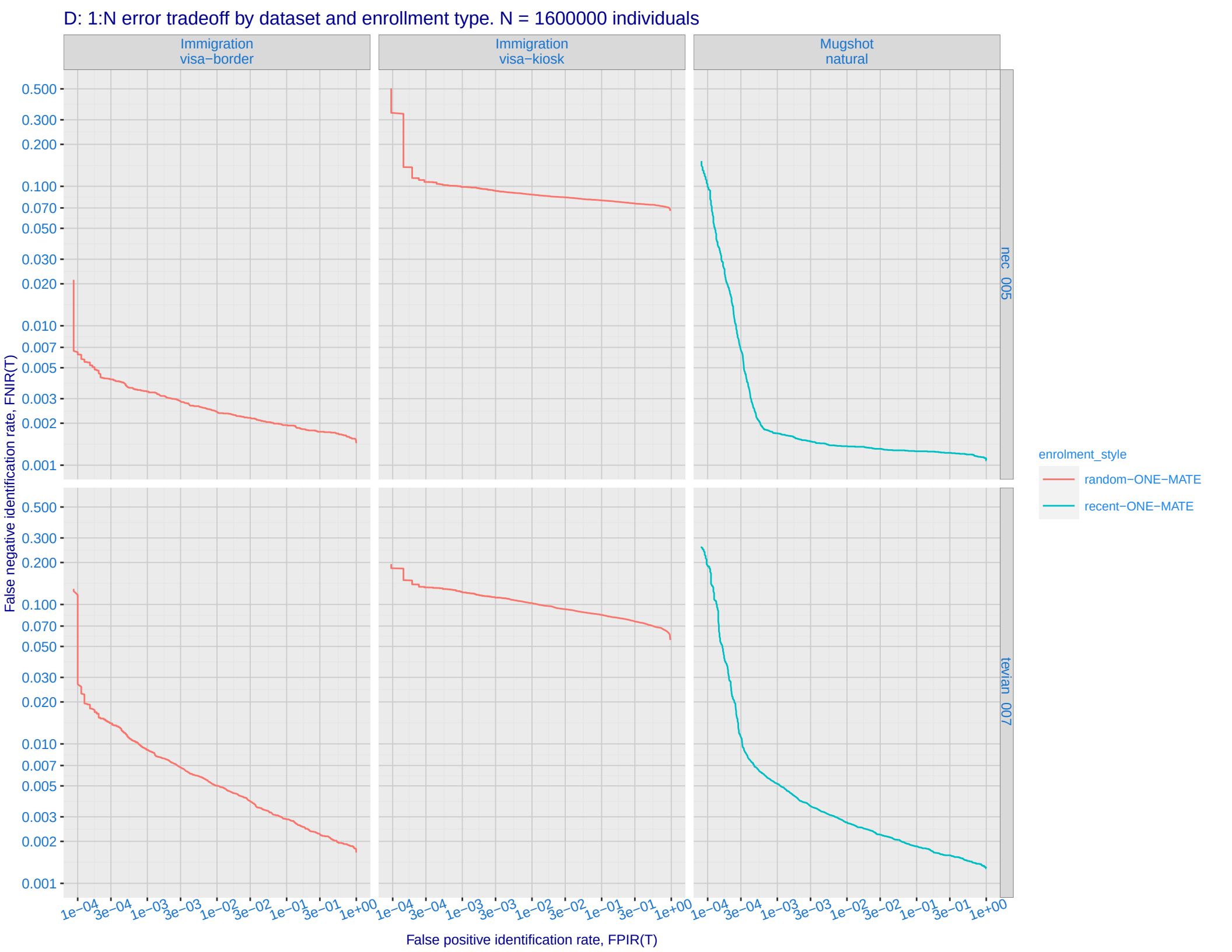
Mugshot profile ranking 10 (out of 259) −− FNIR(1600000, T, L+1) = 0.3011, FPIR=0.001000 vs. lowest 0.1331 from cloudwalk_hr_000

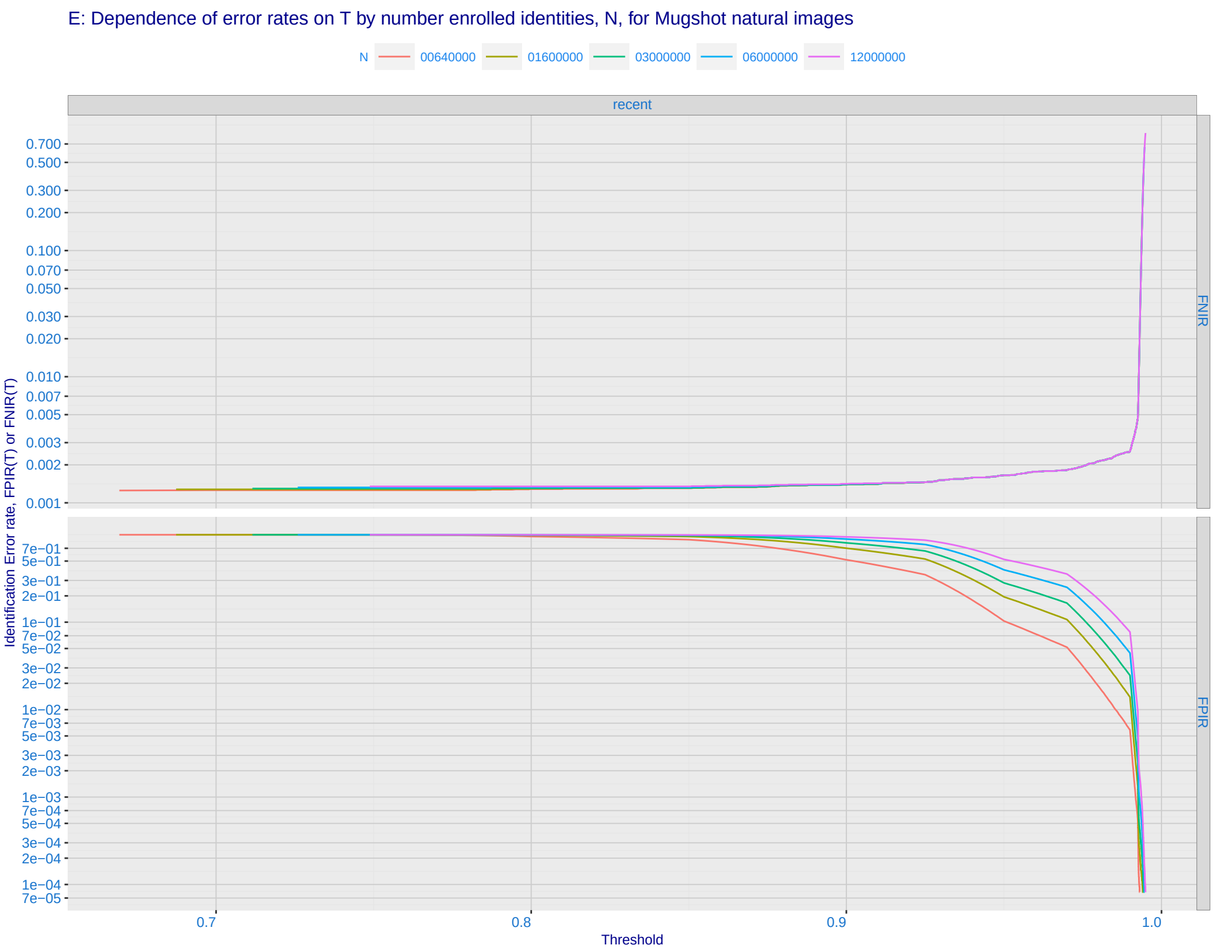
Immigration visa−border ranking 27 (out of 217) −− FNIR(1600000, T, L+1) = 0.0091, FPIR=0.001000 vs. lowest 0.0032 from paravision_009

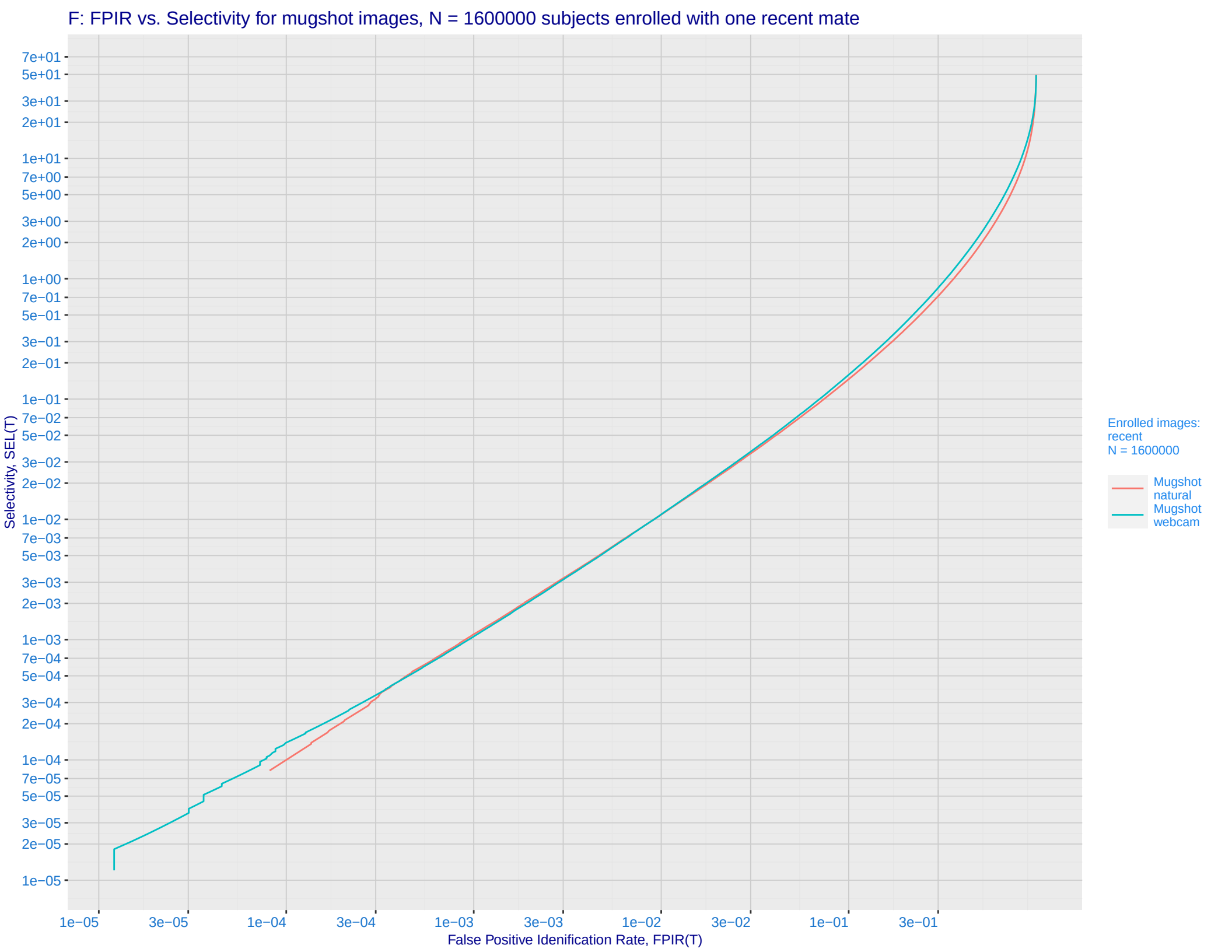
Immigration visa−kiosk ranking 18 (out of 212) −− FNIR(1600000, T, L+1) = 0.1230, FPIR=0.001000 vs. lowest 0.0728 from paravision_009

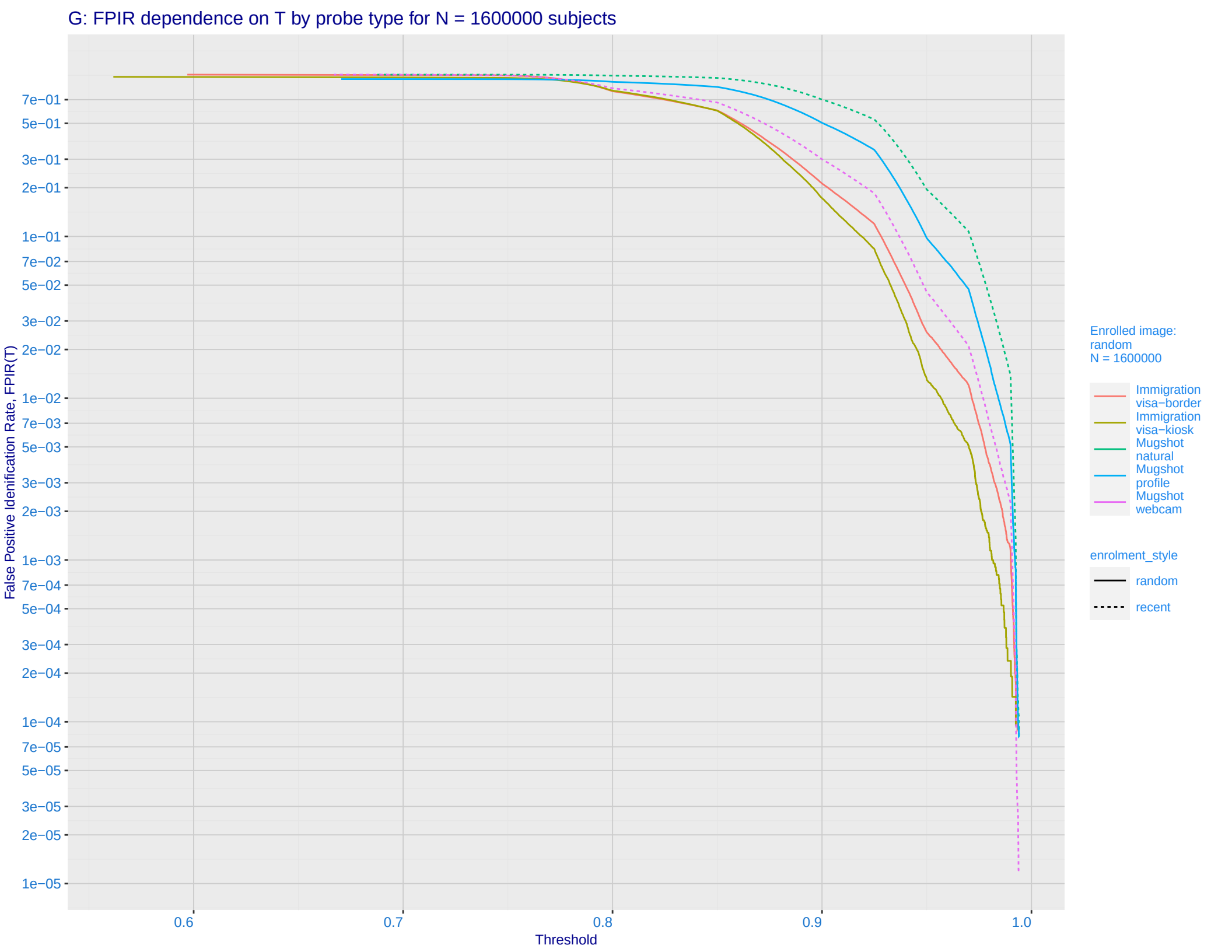

B: Mugshot natural images, identification mode: FNIR(N, L+1, T) vs. most accurate (nec_005)
False negative identification rate, FNIR(N)
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
1e+06
3e+06
1e+07
Enrolled population size, N
Dataset:
2018 Mugshot
FNIR@FPIR = 0.001
nec_005
tevian_007
enrolment_style
recent

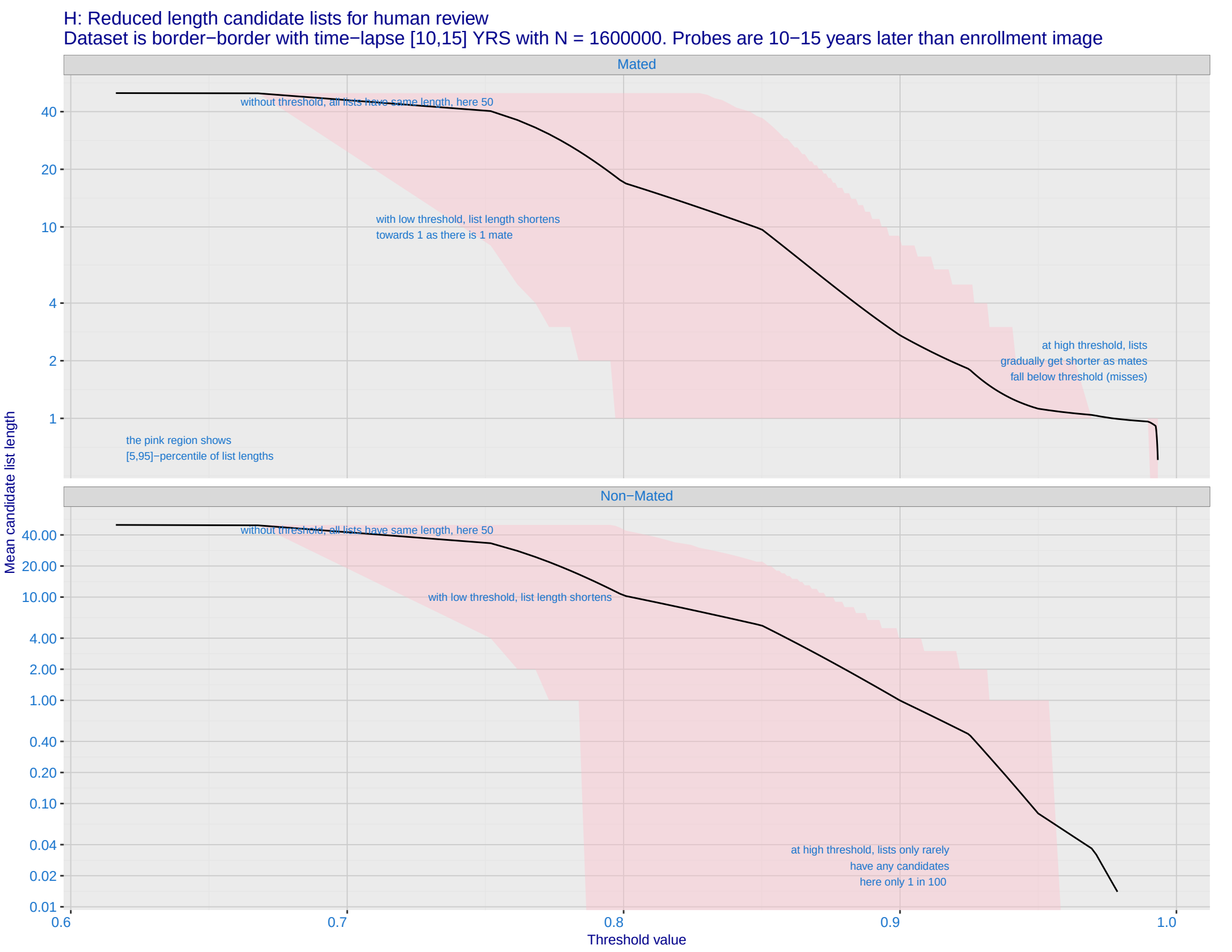

C: Evolution of accuracy for TEVIAN algorithms on three datasets 2018 − present
False negative identification rate (FNIR) at false match rate (FPIR) = 0.010000
0.600
0.500
0.400
0.300
0.200
0.100
0.080
0.060
0.050
0.040
0.030
0.020
0.010
0.008
0.006
0.005
0.004
2018
2019
2020
2021
Date algorithm submitted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

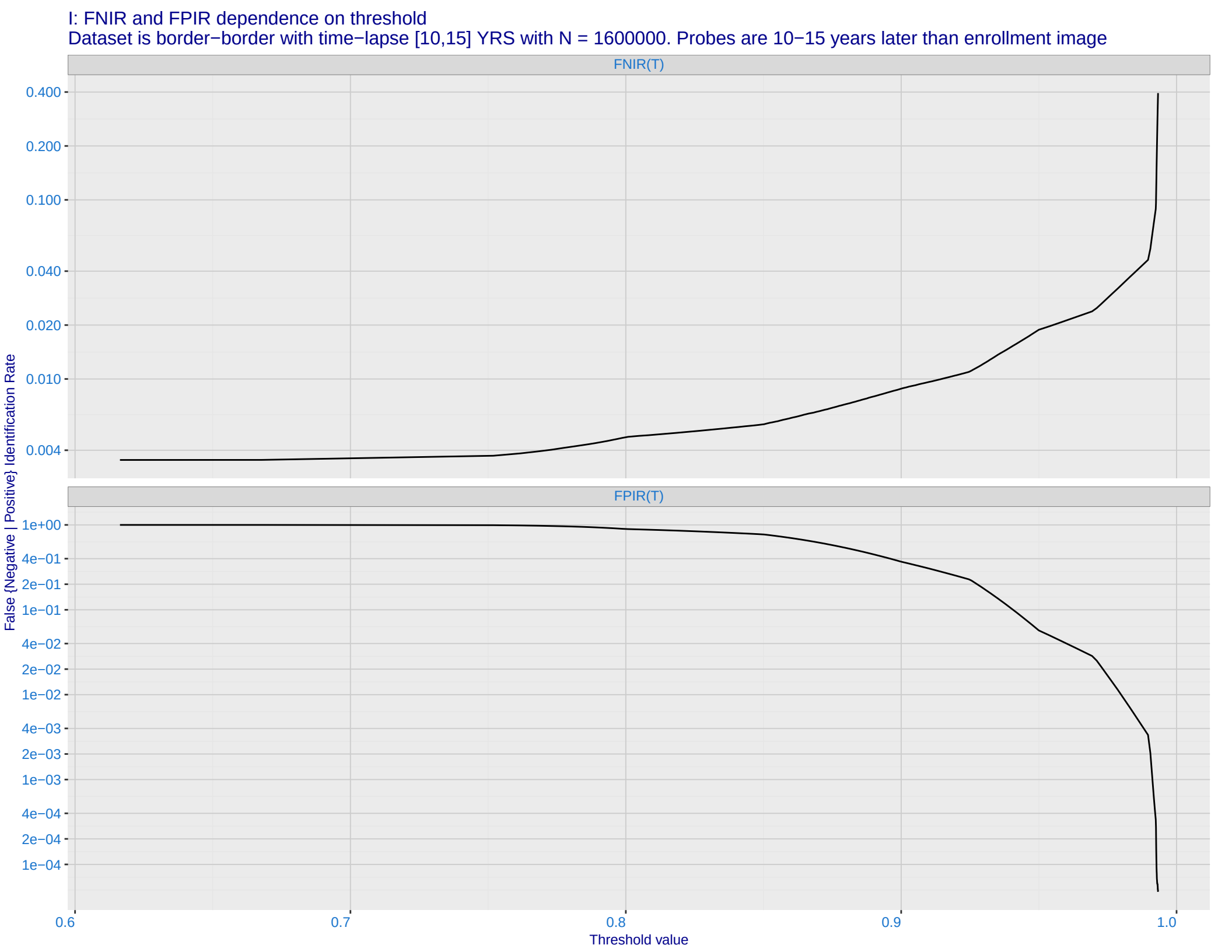

D: 1:N error tradeoff by dataset and enrollment type. N = 1600000 individuals
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
nec 005
tevian 007
False negative identification rate, FNIR(T)
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e−04
3e−04
1e−03
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

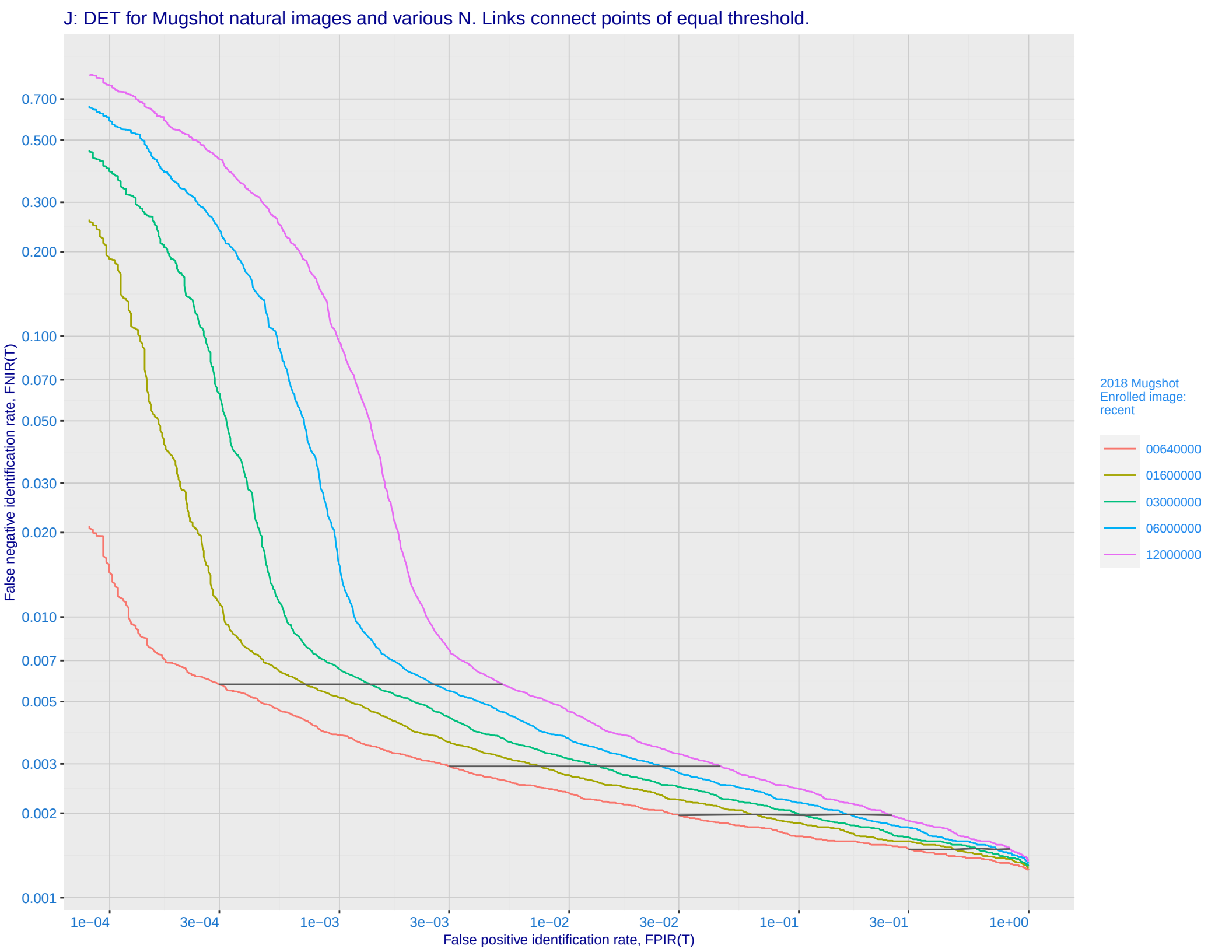

E: Dependence of error rates on T by number enrolled identities, N, for Mugshot natural images
N
00640000
01600000
03000000
06000000
12000000
recent
FNIR
FPIR
Identification Error rate, FPIR(T) or FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
7e−01
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
0.7
0.8
0.9
1.0
Threshold

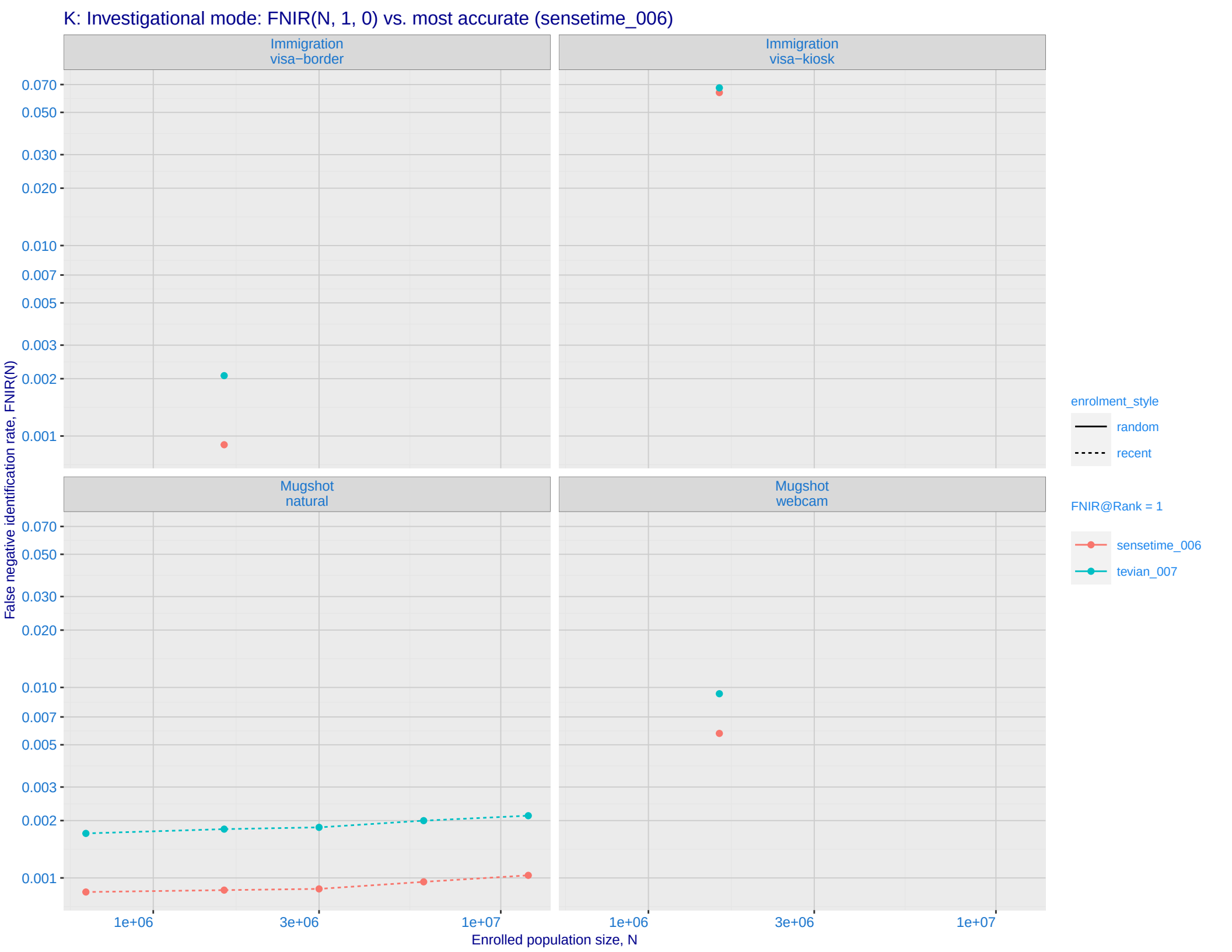

F: FPIR vs. Selectivity for mugshot images, N = 1600000 subjects enrolled with one recent mate
Selectivity, SEL(T)
7e+01
5e+01
3e+01
2e+01
1e+01
7e+00
5e+00
3e+00
2e+00
1e+00
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05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

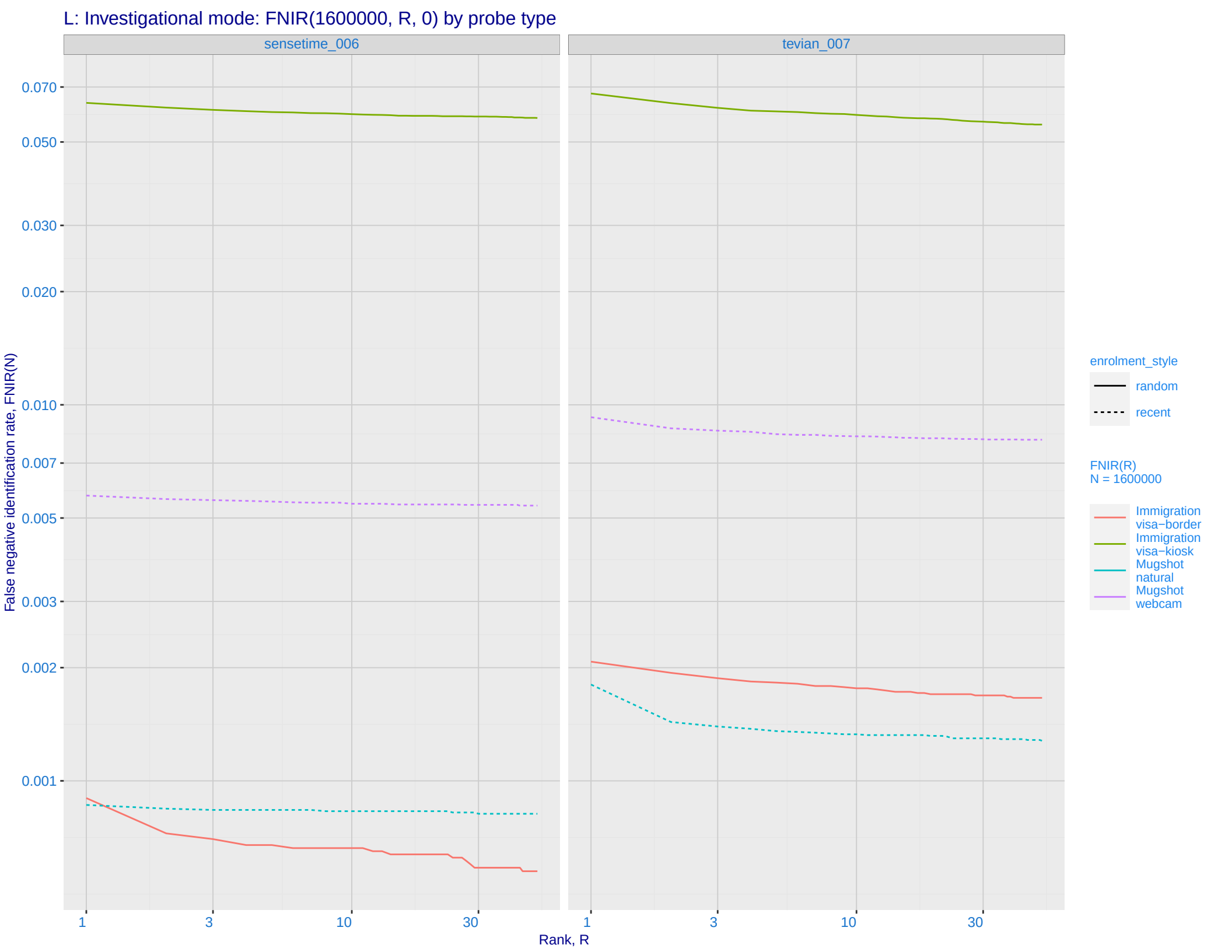

G: FPIR dependence on T by probe type for N = 1600000 subjects
False Positive Idenification Rate, FPIR(T)
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05
5e−05
3e−05
2e−05
1e−05
0.6
0.7
0.8
0.9
1.0
Threshold
Enrolled image:
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

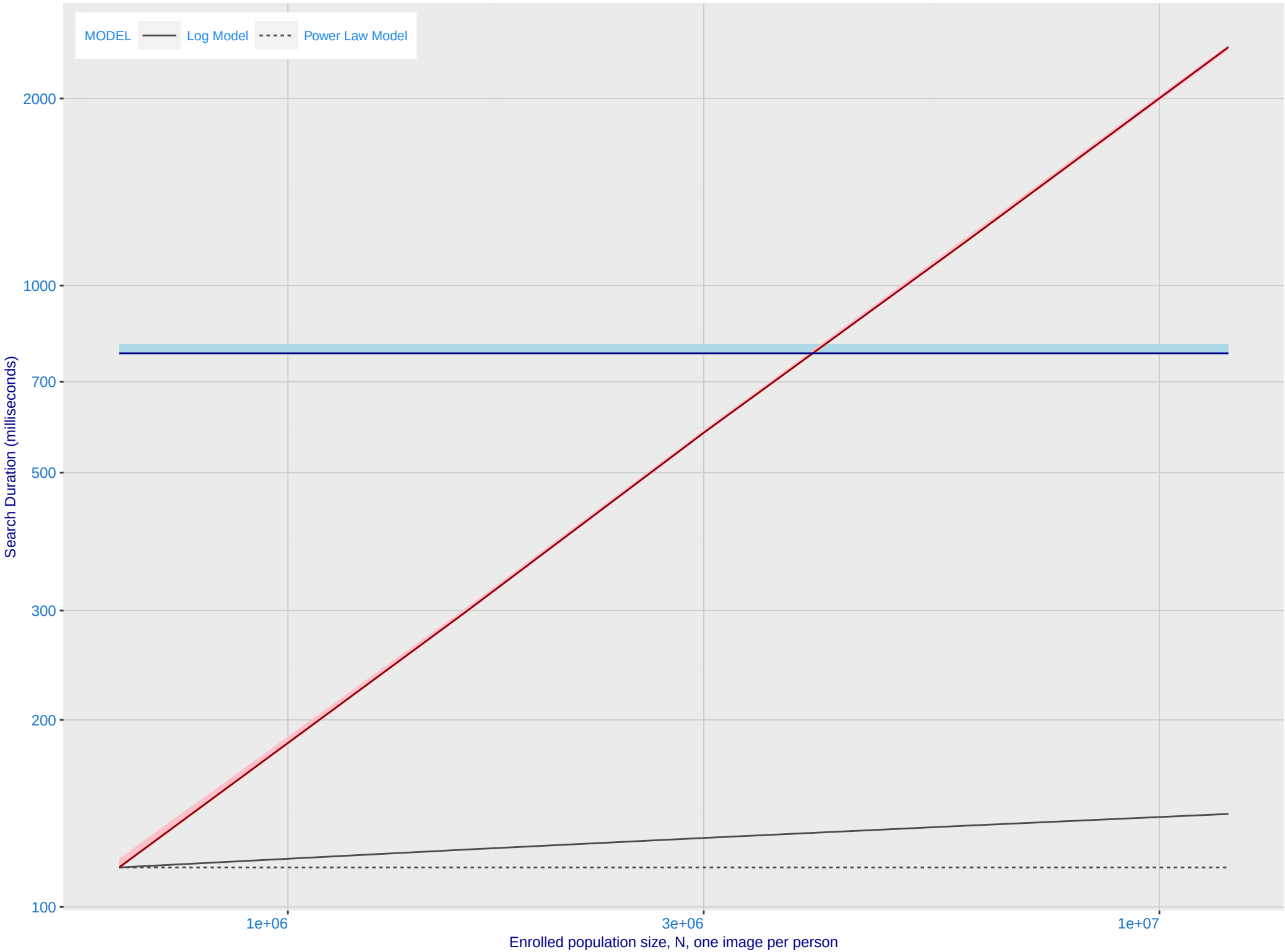

I: FNIR and FPIR dependence on threshold
Dataset is border−border with time−lapse [10,15] YRS with N = 1600000. Probes are 10−15 years later than enrollment image
FNIR(T)
0.400
0.200
0.100
0.040
0.020
0.010
0.004
FPIR(T)
1e+00
4e−01
2e−01
1e−01
4e−02
2e−02
1e−02
4e−03
2e−03
1e−03
4e−04
2e−04
1e−04
False {Negative | Positive} Identification Rate
0.6
0.7
0.8
0.9
1.0
Threshold value

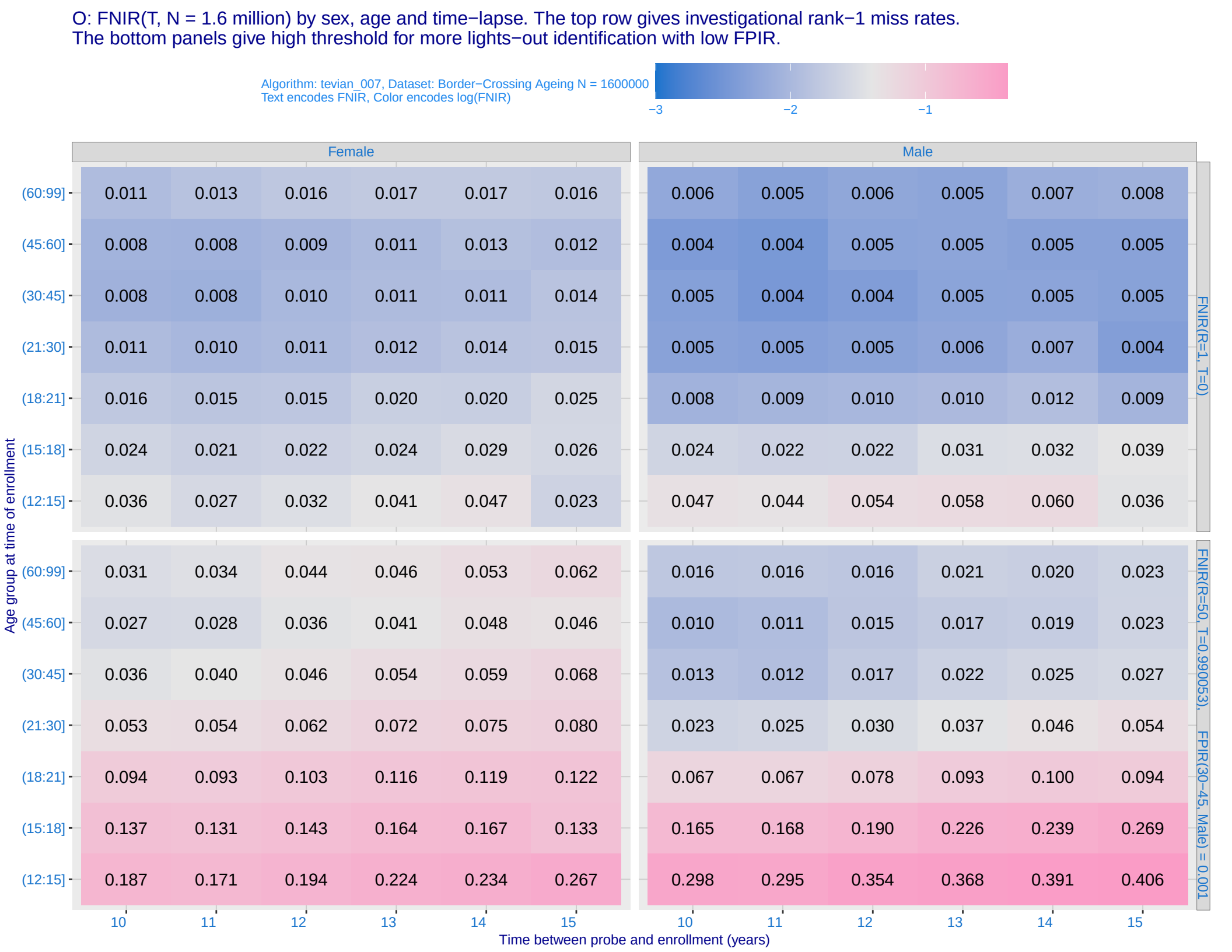

J: DET for Mugshot natural images and various N. Links connect points of equal threshold.
False negative identification rate, FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e−04
3e−04
1e−03
3e−03
1e−02
3e−02
1e−01
3e−01
1e+00
False positive identification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


K: Investigational mode: FNIR(N, 1, 0) vs. most accurate (sensetime_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
sensetime_006
tevian_007

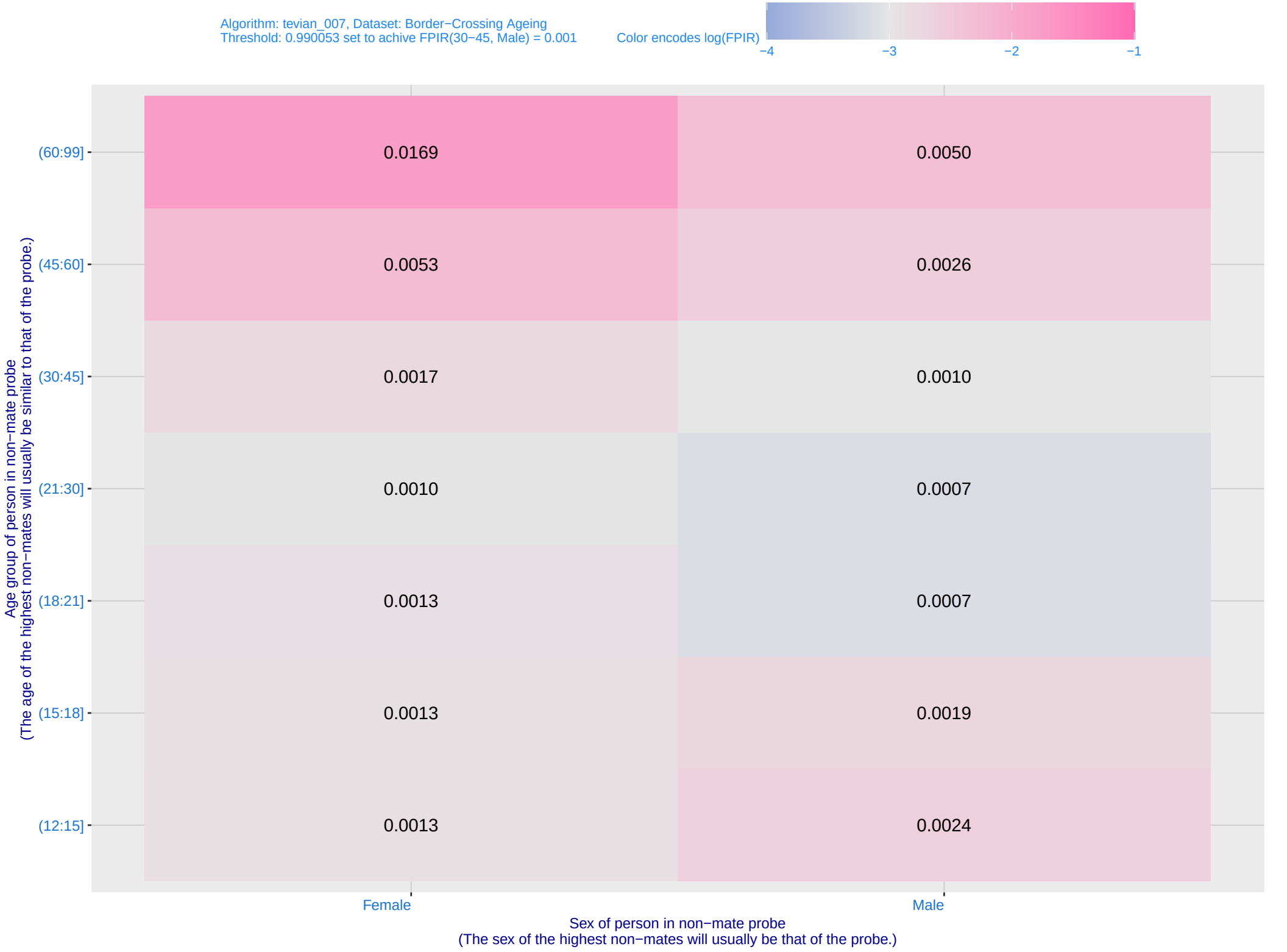

L: Investigational mode: FNIR(1600000, R, 0) by probe type
sensetime_006
tevian_007
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
False negative identification rate, FNIR(N)
1
3
10
30
Rank, R
enrolment_style
random
recent
FNIR(R)
N = 1600000
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
Mugshot webcam

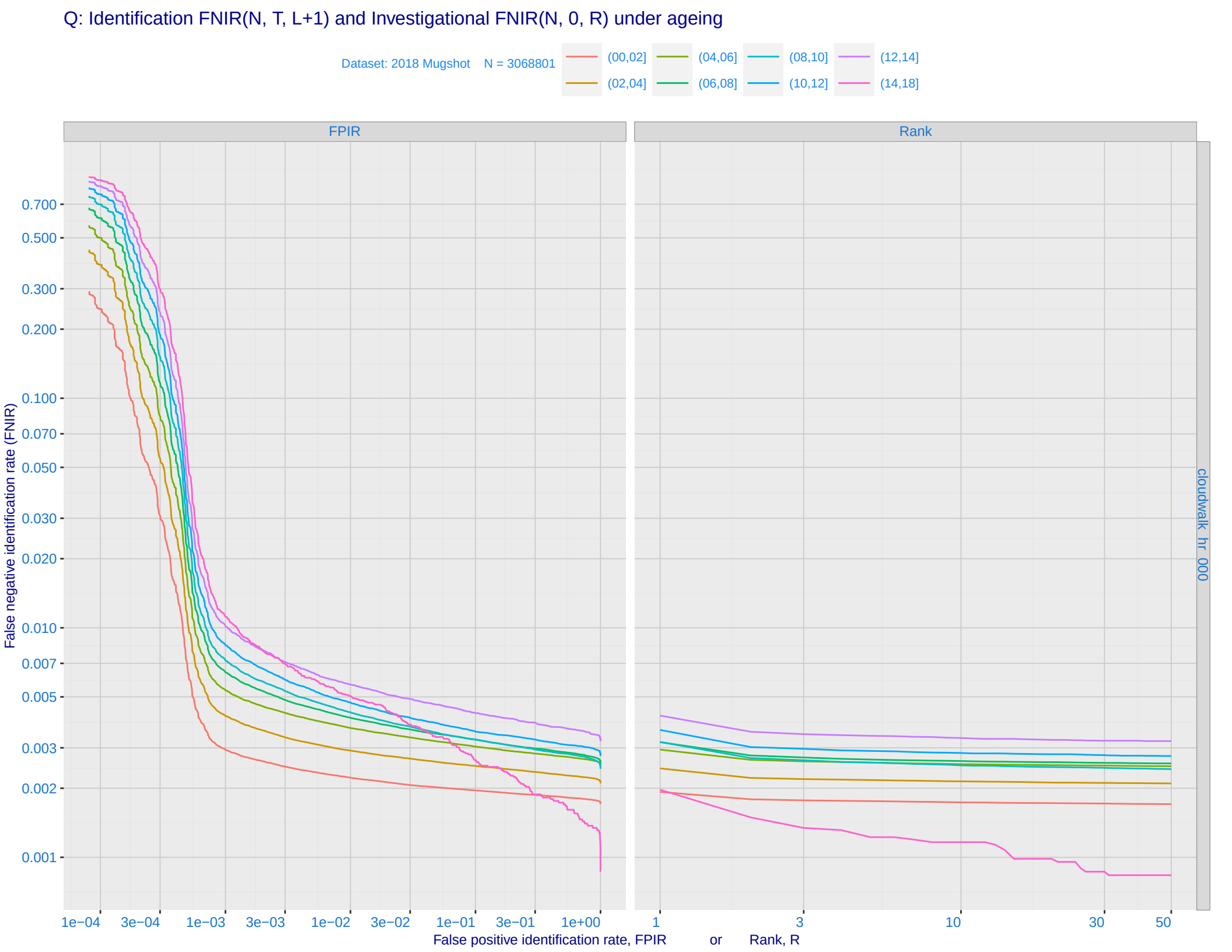
M: Template duration; search duration vs. N. The blue and pink ribbon covers 95 percent of observed measurements.
The template generation time is independent of N. The log and power−law models are fit to the first two (N,T) observations




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: tevian_007, 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]
0.011 0.013 0.016 0.017 0.017 0.016
0.008 0.008 0.009 0.011 0.013 0.012
0.008 0.008 0.010 0.011 0.011 0.014
0.011 0.010 0.011 0.012 0.014 0.015
0.016 0.015 0.015 0.020 0.020 0.025
0.024 0.021 0.022 0.024 0.029 0.026
0.036 0.027 0.032 0.041 0.047 0.023
0.006 0.005 0.006 0.005 0.007 0.008
0.004 0.004 0.005 0.005 0.005 0.005
0.005 0.004 0.004 0.005 0.005 0.005
0.005 0.005 0.005 0.006 0.007 0.004
0.008 0.009 0.010 0.010 0.012 0.009
0.024 0.022 0.022 0.031 0.032 0.039
0.047 0.044 0.054 0.058 0.060 0.036
FNIR(R=1, T=0)
0.031 0.034 0.044 0.046 0.053 0.062
0.027 0.028 0.036 0.041 0.048 0.046
0.036 0.040 0.046 0.054 0.059 0.068
0.053 0.054 0.062 0.072 0.075 0.080
0.094 0.093 0.103 0.116 0.119 0.122
0.137 0.131 0.143 0.164 0.167 0.133
0.187 0.171 0.194 0.224 0.234 0.267
0.016 0.016 0.016 0.021 0.020 0.023
0.010 0.011 0.015 0.017 0.019 0.023
0.013 0.012 0.017 0.022 0.025 0.027
0.023 0.025 0.030 0.037 0.046 0.054
0.067 0.067 0.078 0.093 0.100 0.094
0.165 0.168 0.190 0.226 0.239 0.269
0.298 0.295 0.354 0.368 0.391 0.406
FNIR(R=50, T=0.990053), 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