A: Datasheet

Algorithm: sensetime_009

Developer: Sensetime Group

Submission Date: 2023_01_04

Template size: 1032 bytes

Template time (2.5 percentile): 991 msec

Template time (median): 995 msec

Template time (97.5 percentile): 1071 msec

Investigation:

Frontal mugshot ranking 2 (out of 397) −− FNIR(1600000, 0, 1) = 0.0008 vs. lowest 0.0008 from intema_001

Mugshot webcam ranking 1 (out of 359) −− FNIR(1600000, 0, 1) = 0.0054

Mugshot profile ranking 1 (out of 328) −− FNIR(1600000, 0, 1) = 0.0517

Immigration visa−border ranking 4 (out of 286) −− FNIR(1600000, 0, 1) = 0.0007 vs. lowest 0.0006 from cloudwalk_mt_002

Immigration visa−kiosk ranking 58 (out of 231) −− FNIR(1600000, 0, 1) = 0.0689 vs. lowest 0.0387 from cloudwalk_mt_002

Identification:

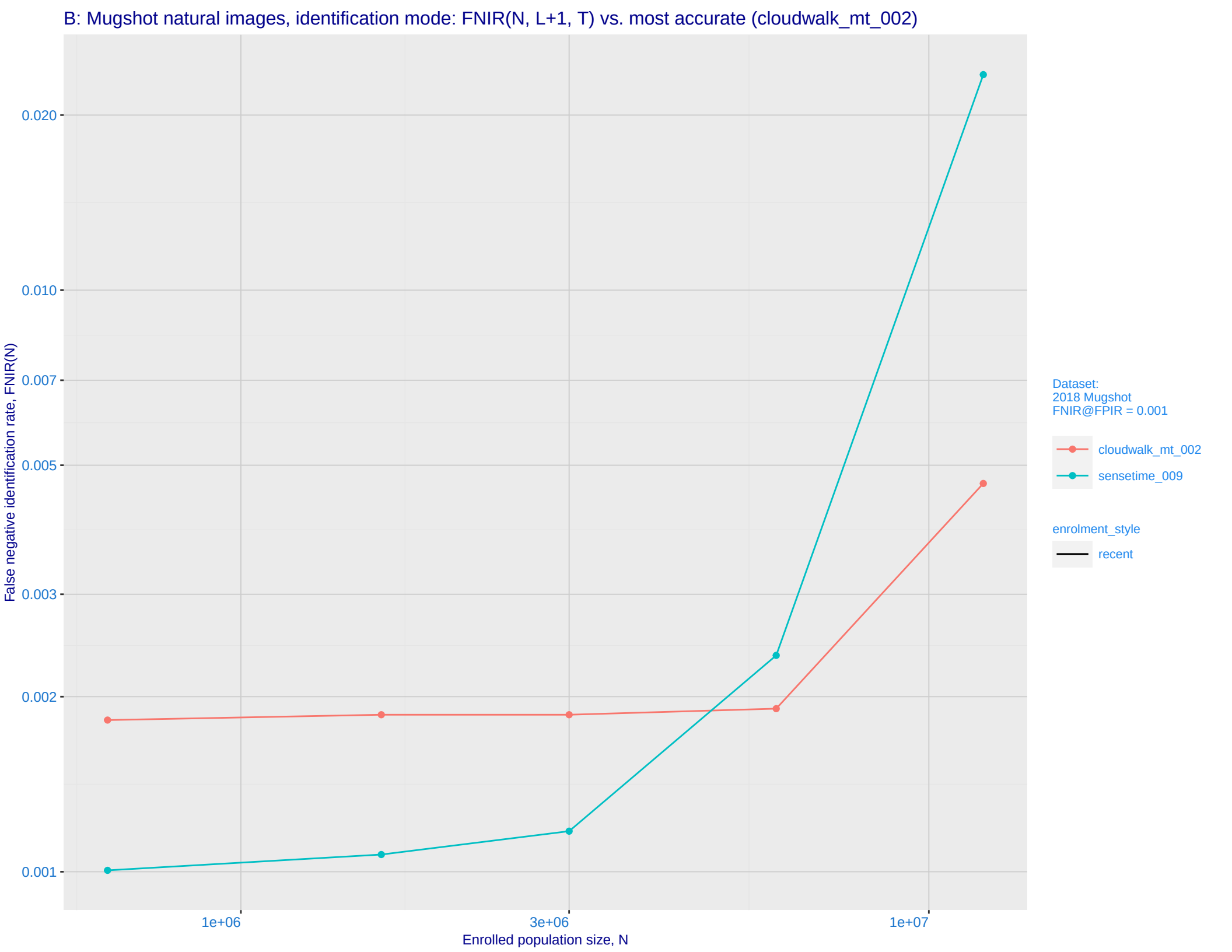
Frontal mugshot ranking 2 (out of 397) −− FNIR(1600000, T, L+1) = 0.0011, FPIR=0.001000 vs. lowest 0.0011 from idemia_010

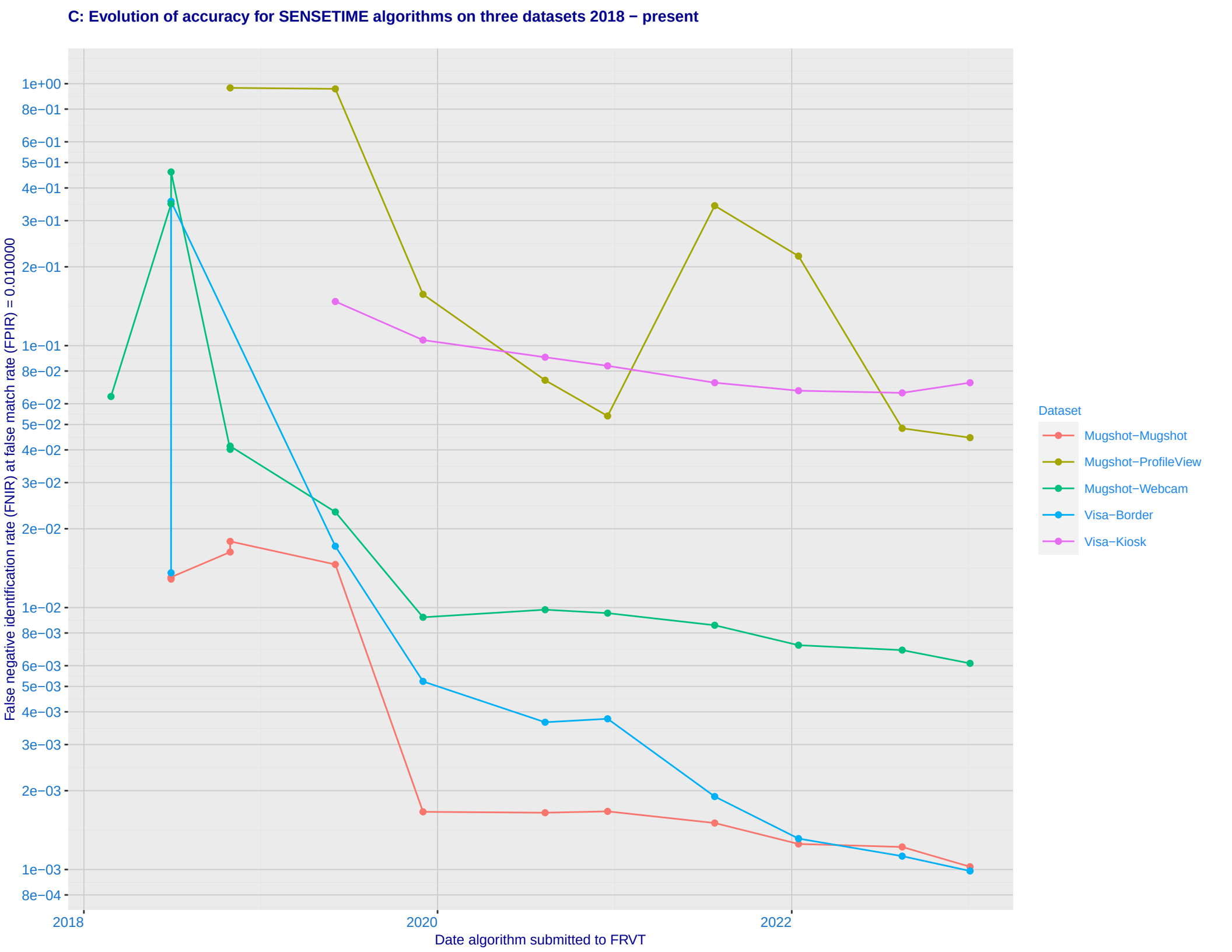
Mugshot webcam ranking 1 (out of 357) −− FNIR(1600000, T, L+1) = 0.0072, FPIR=0.001000

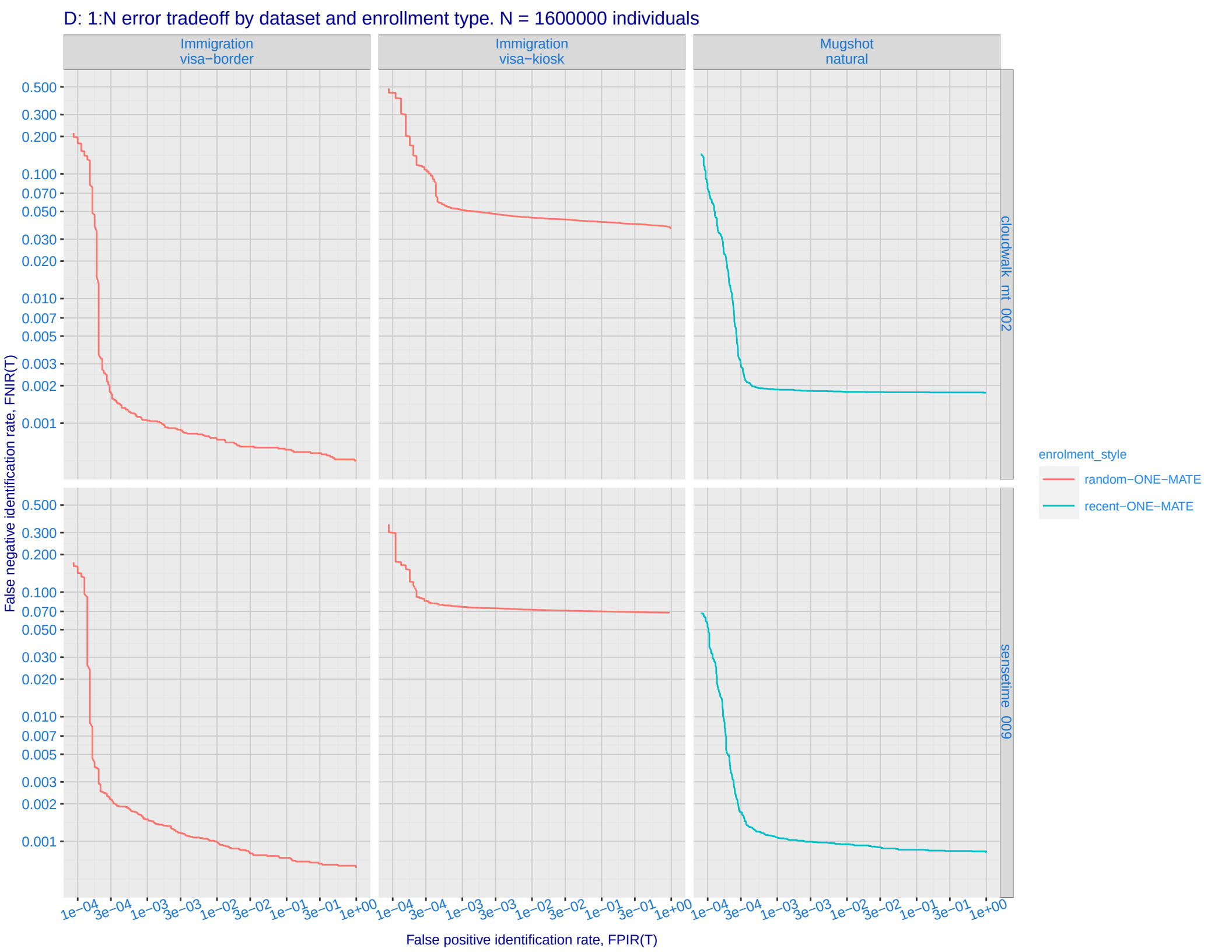
Mugshot profile ranking 88 (out of 327) −− FNIR(1600000, T, L+1) = 0.8900, FPIR=0.001000 vs. lowest 0.0634 from cloudwalk_mt_002

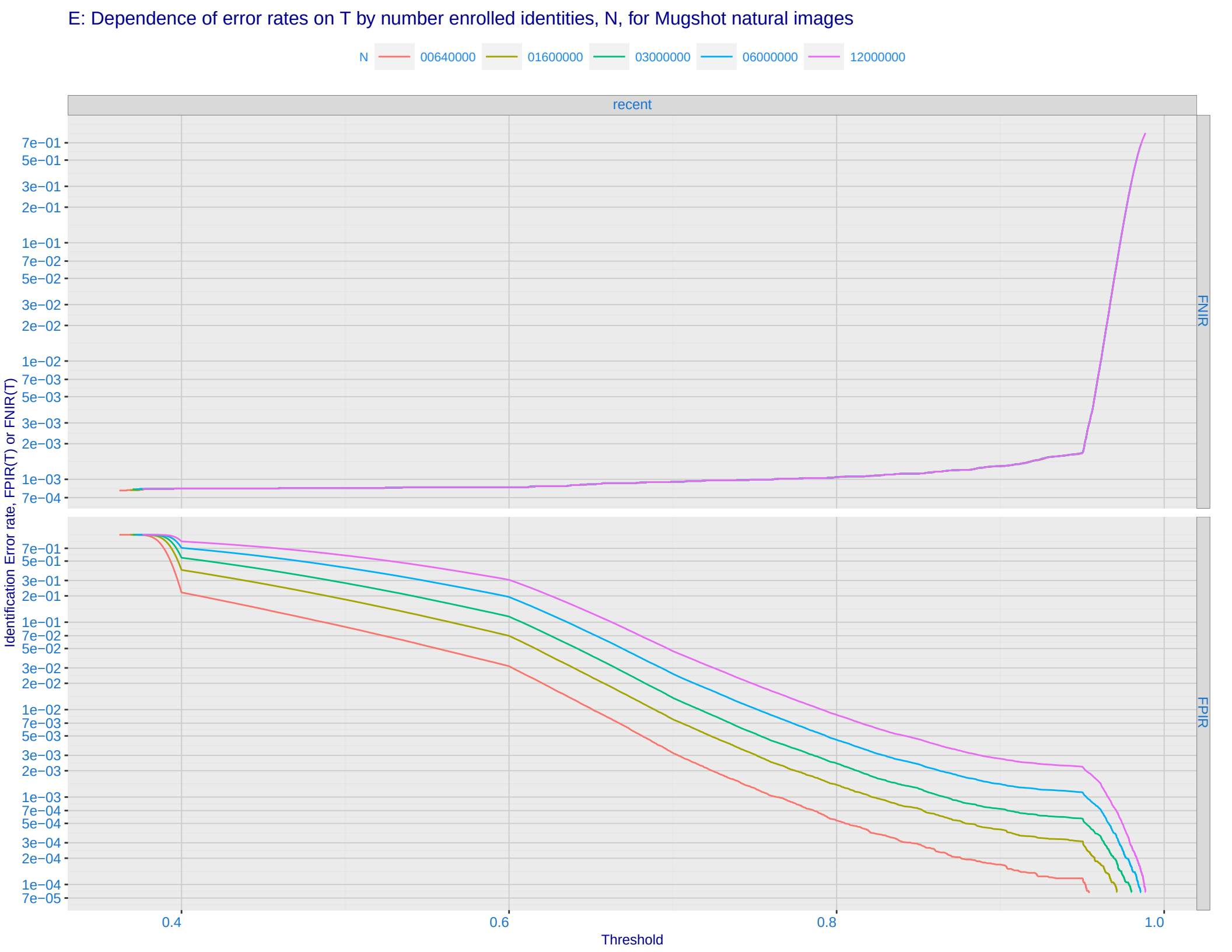
Immigration visa−border ranking 3 (out of 285) −− FNIR(1600000, T, L+1) = 0.0015, FPIR=0.001000 vs. lowest 0.0010 from cloudwalk_mt_002

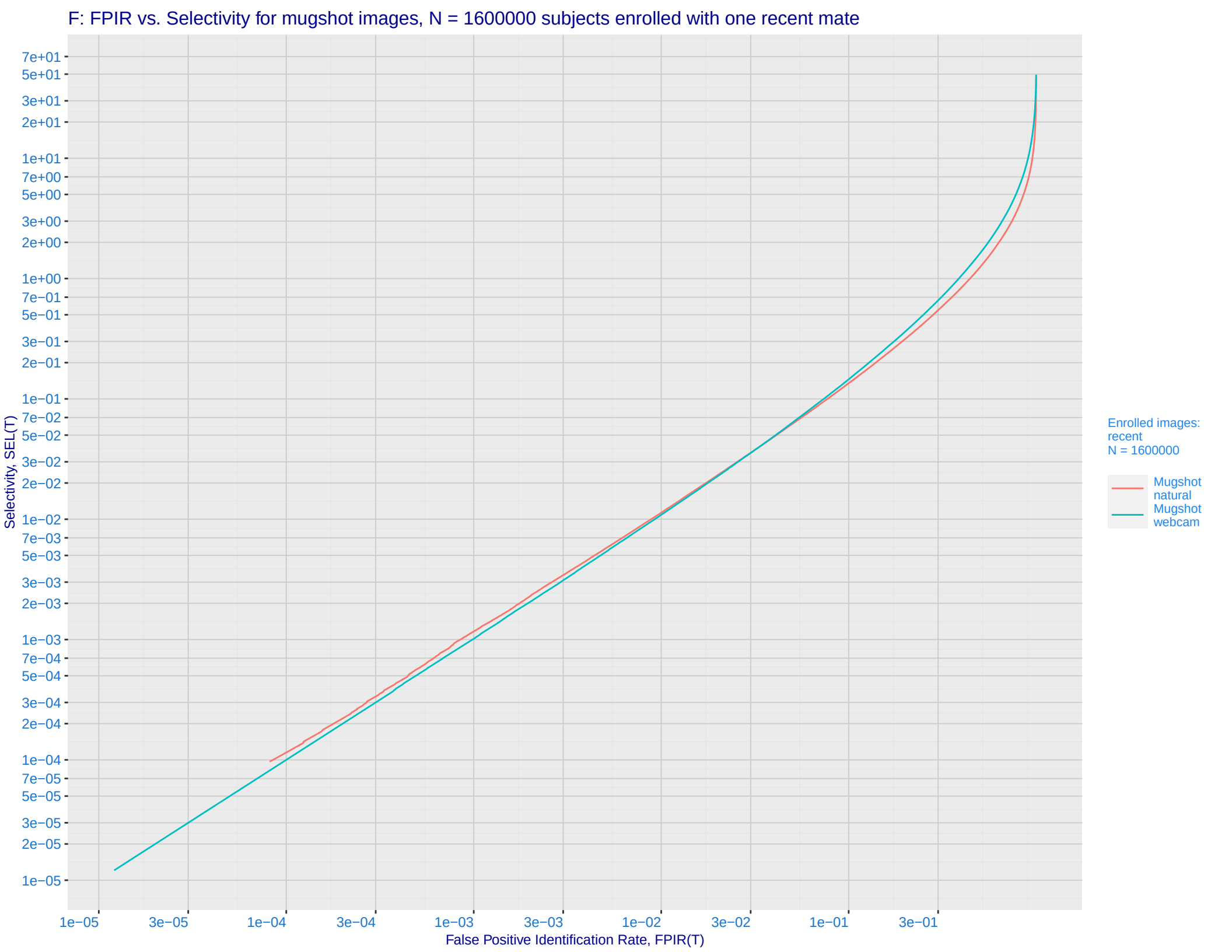
Immigration visa−kiosk ranking 13 (out of 231) −− FNIR(1600000, T, L+1) = 0.0763, FPIR=0.001000 vs. lowest 0.0517 from cloudwalk_mt_002

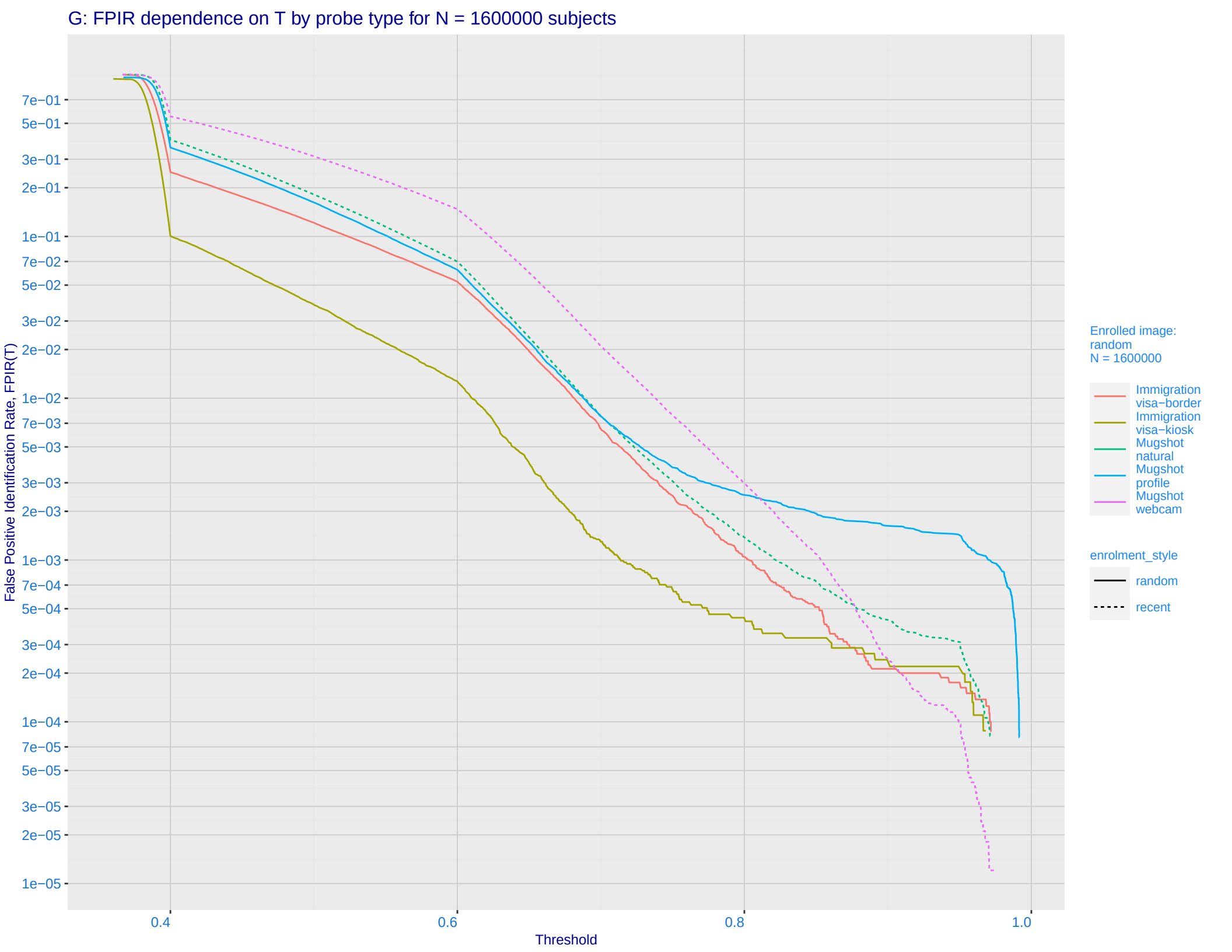

B: Mugshot natural images, identification mode: FNIR(N, L+1, T) vs. most accurate (cloudwalk_mt_002)
False negative identification rate, FNIR(N)
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e+06
3e+06
1e+07
Enrolled population size, N
Dataset:
2018 Mugshot
FNIR@FPIR = 0.001
cloudwalk_mt_002
sensetime_009
enrolment_style
recent

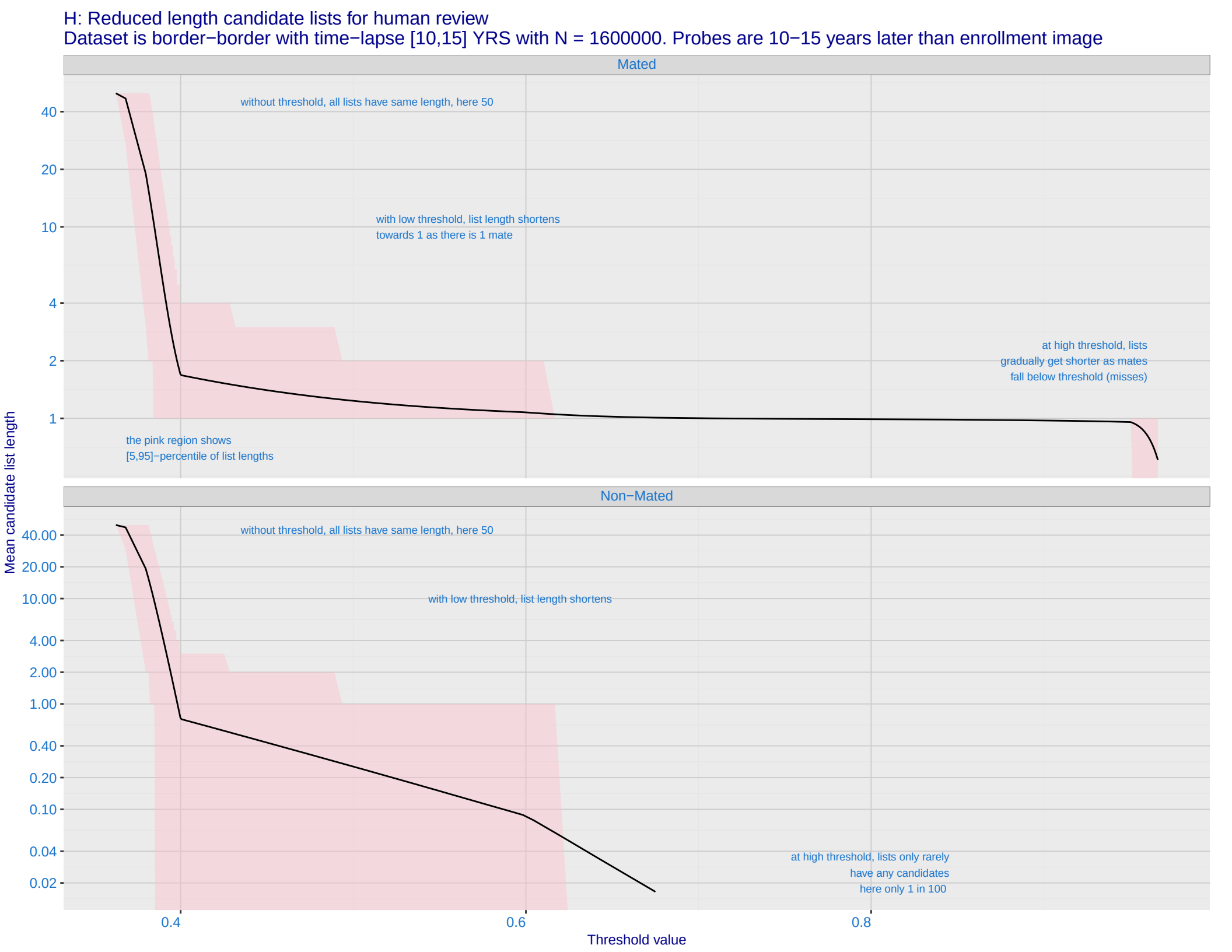

C: Evolution of accuracy for SENSETIME algorithms on three datasets 2018 − present
False negative identification rate (FNIR) at false match rate (FPIR) = 0.010000
1e+00
8e−01
6e−01
5e−01
4e−01
3e−01
2e−01
1e−01
8e−02
6e−02
5e−02
4e−02
3e−02
2e−02
1e−02
8e−03
6e−03
5e−03
4e−03
3e−03
2e−03
1e−03
8e−04
2018
2020
2022
Date algorithm submitted to FRVT
Dataset
Mugshot−Mugshot
Mugshot−ProfileView
Mugshot−Webcam
Visa−Border
Visa−Kiosk

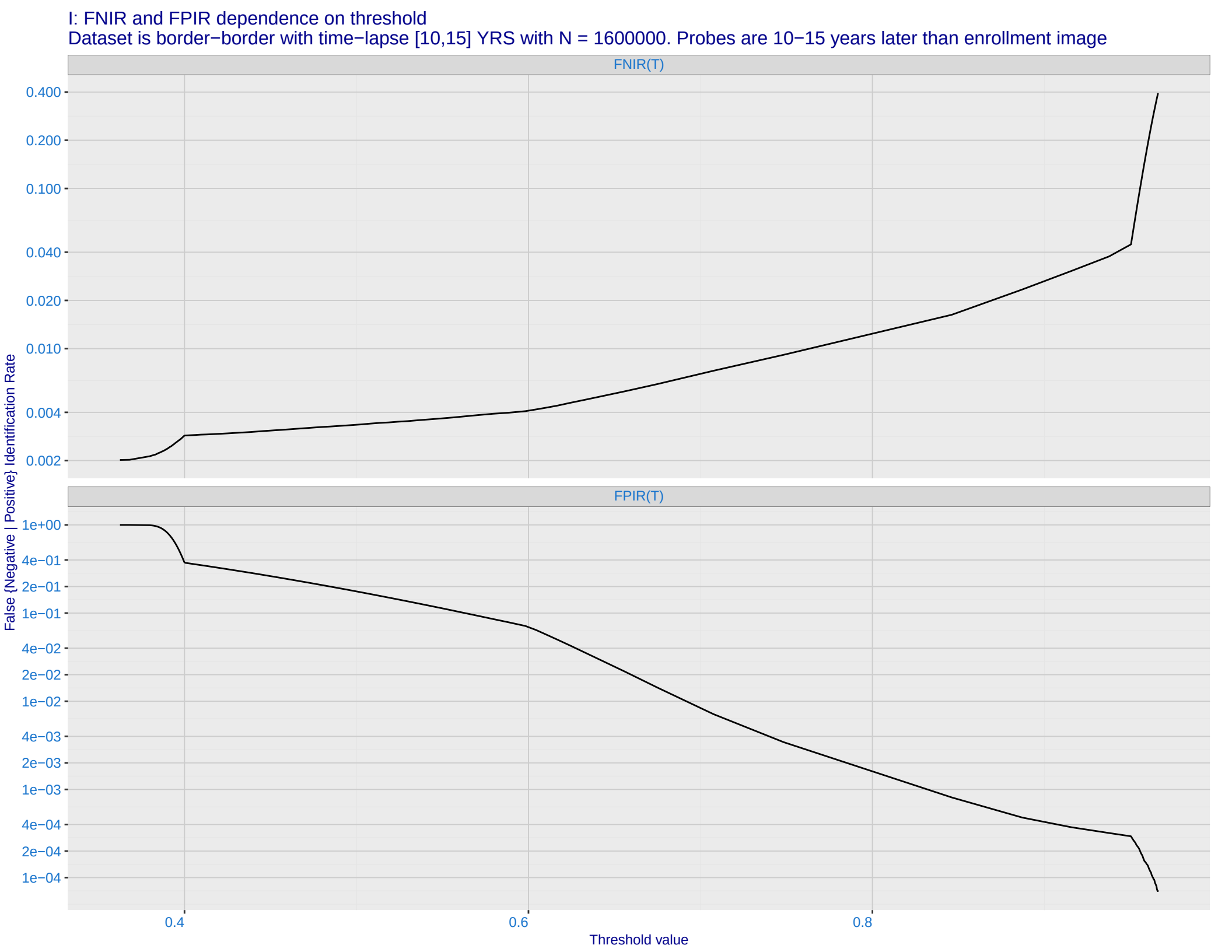

D: 1:N error tradeoff by dataset and enrollment type. N = 1600000 individuals
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
cloudwalk mt 002
sensetime 009
False negative identification rate, FNIR(T)
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e−04
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

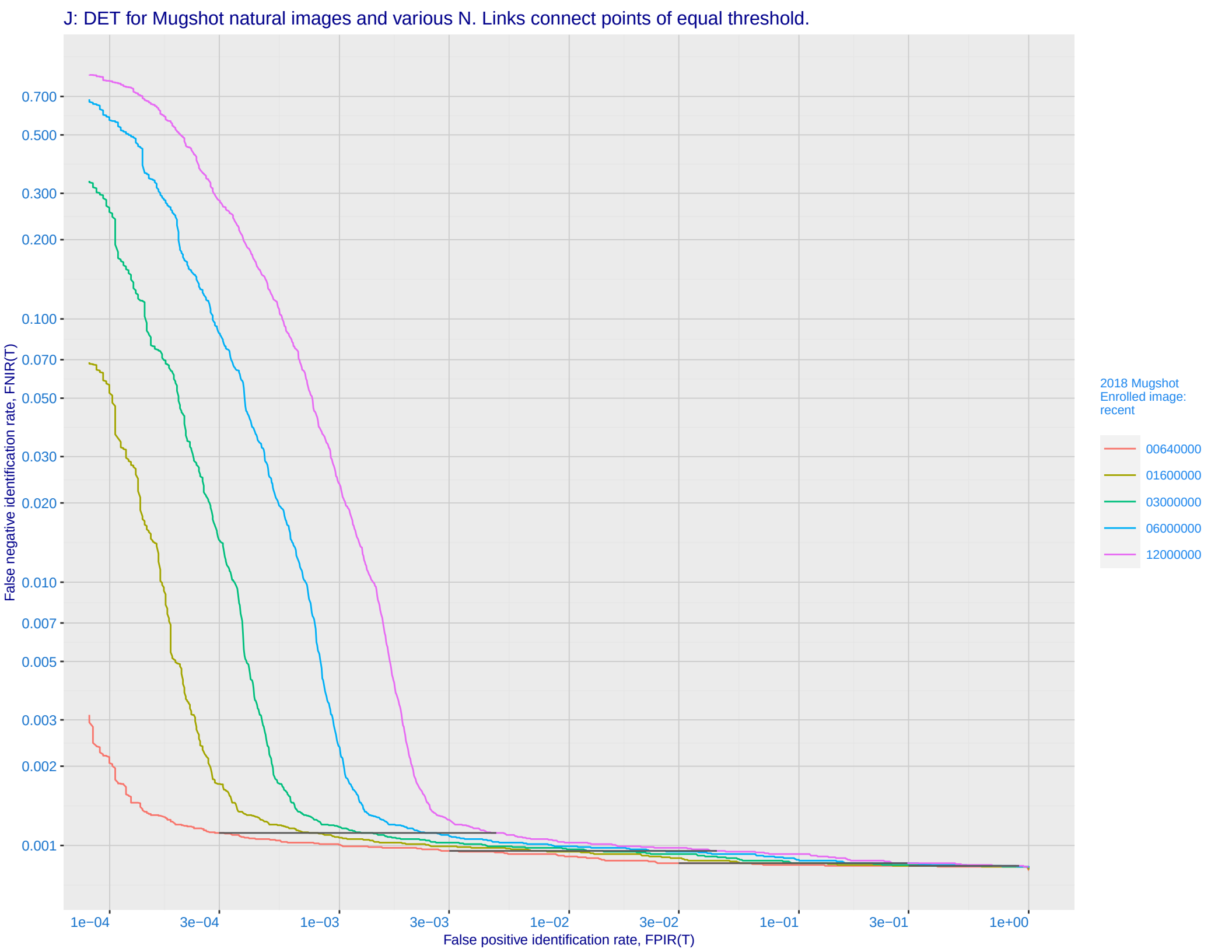

E: Dependence of error rates on T by number enrolled identities, N, for Mugshot natural images
N
00640000
01600000
03000000
06000000
12000000
recent
FNIR
FPIR
Identification Error rate, FPIR(T) or FNIR(T)
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04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

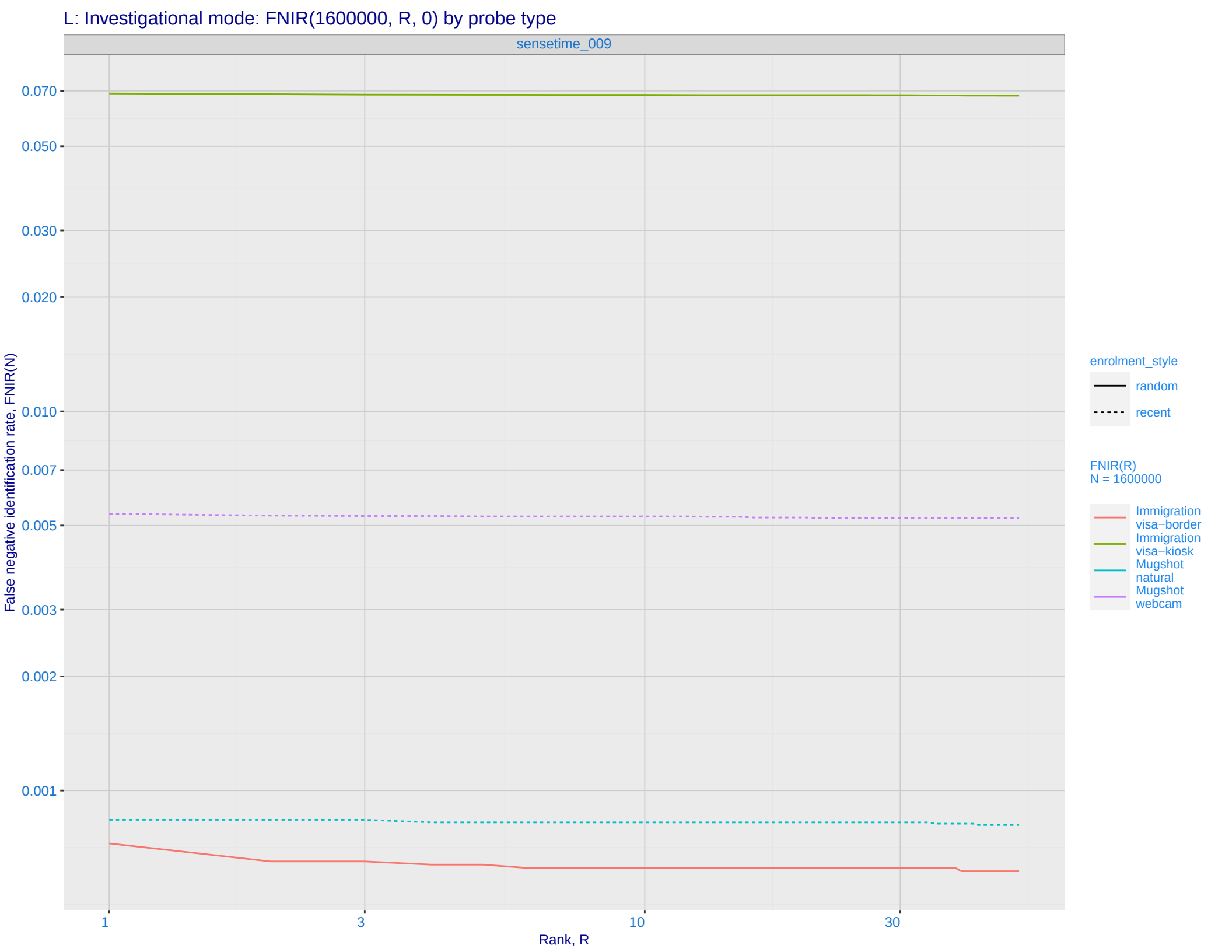

G: FPIR dependence on T by probe type for N = 1600000 subjects
False Positive Identification Rate, FPIR(T)
7e−01
5e−01
3e−01
2e−01
1e−01
7e−02
5e−02
3e−02
2e−02
1e−02
7e−03
5e−03
3e−03
2e−03
1e−03
7e−04
5e−04
3e−04
2e−04
1e−04
7e−05
5e−05
3e−05
2e−05
1e−05
0.4
0.6
0.8
1.0
Threshold
Enrolled image:
random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

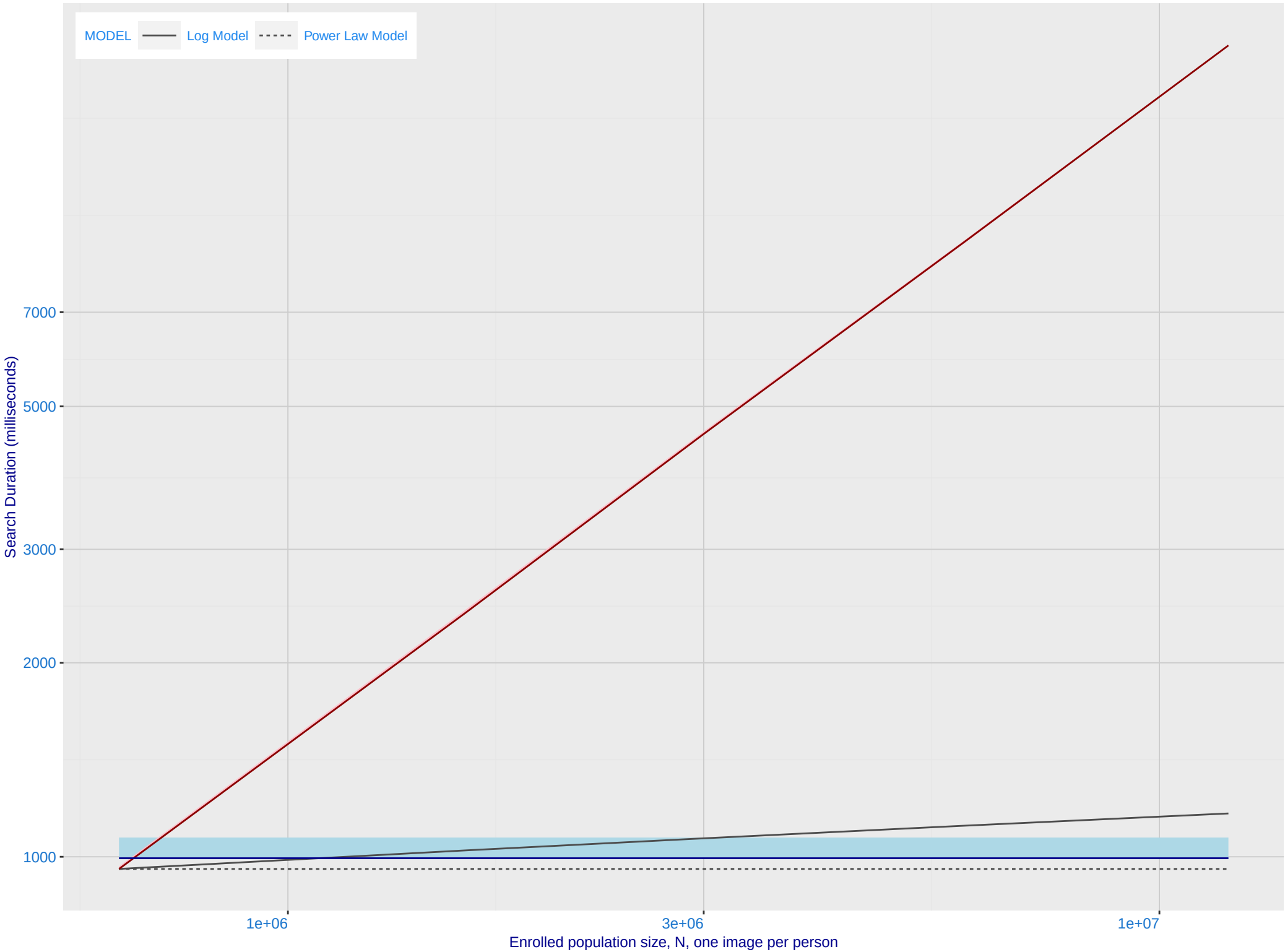

I: FNIR and FPIR dependence on threshold
Dataset is border−border with time−lapse [10,15] YRS with N = 1600000. Probes are 10−15 years later than enrollment image
FNIR(T)
0.400
0.200
0.100
0.040
0.020
0.010
0.004
0.002
FPIR(T)
1e+00
4e−01
2e−01
1e−01
4e−02
2e−02
1e−02
4e−03
2e−03
1e−03
4e−04
2e−04
1e−04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

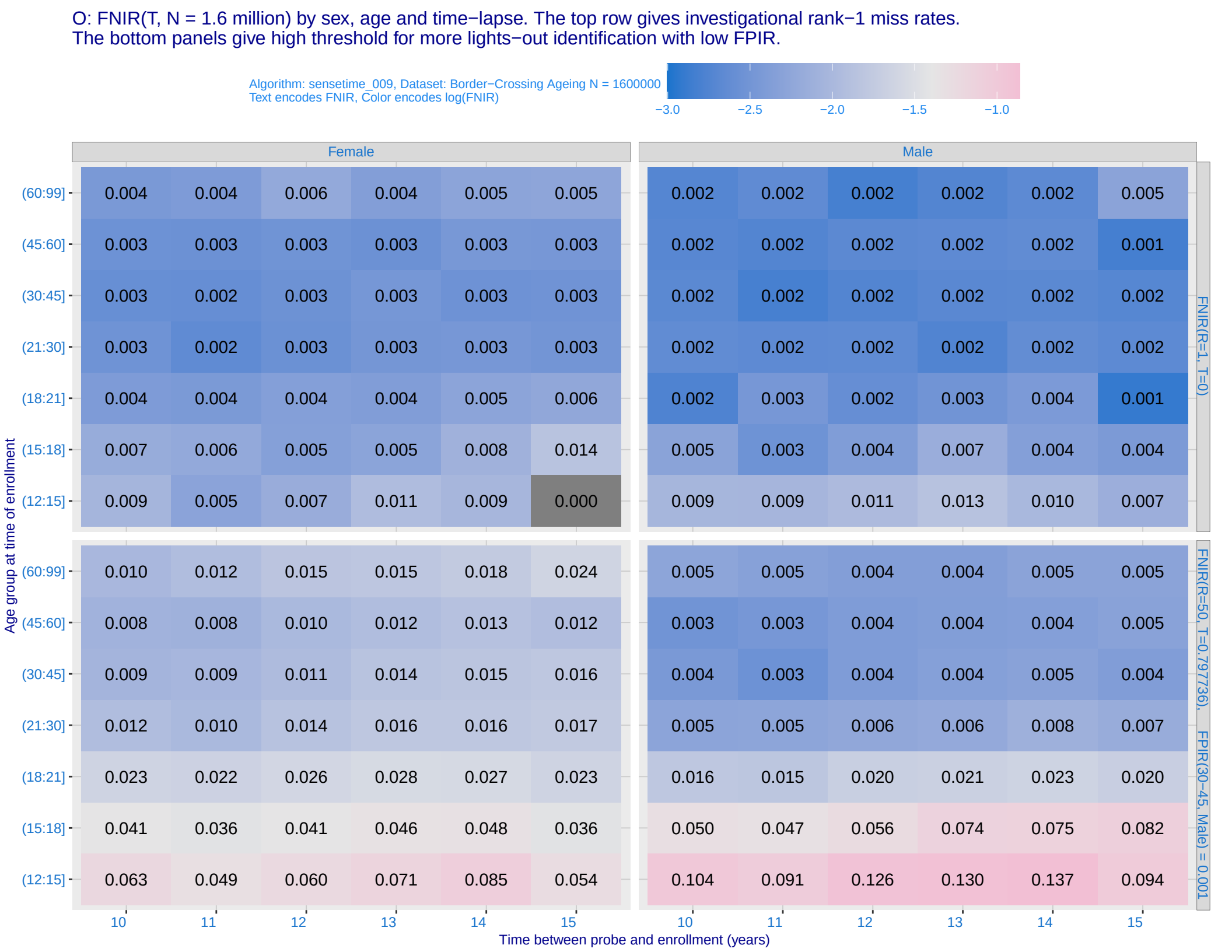

J: DET for Mugshot natural images and various N. Links connect points of equal threshold.
False negative identification rate, FNIR(T)
0.700
0.500
0.300
0.200
0.100
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
1e−04
3e−04
1e−03
3e−03
1e−02
3e−02
1e−01
3e−01
1e+00
False positive identification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

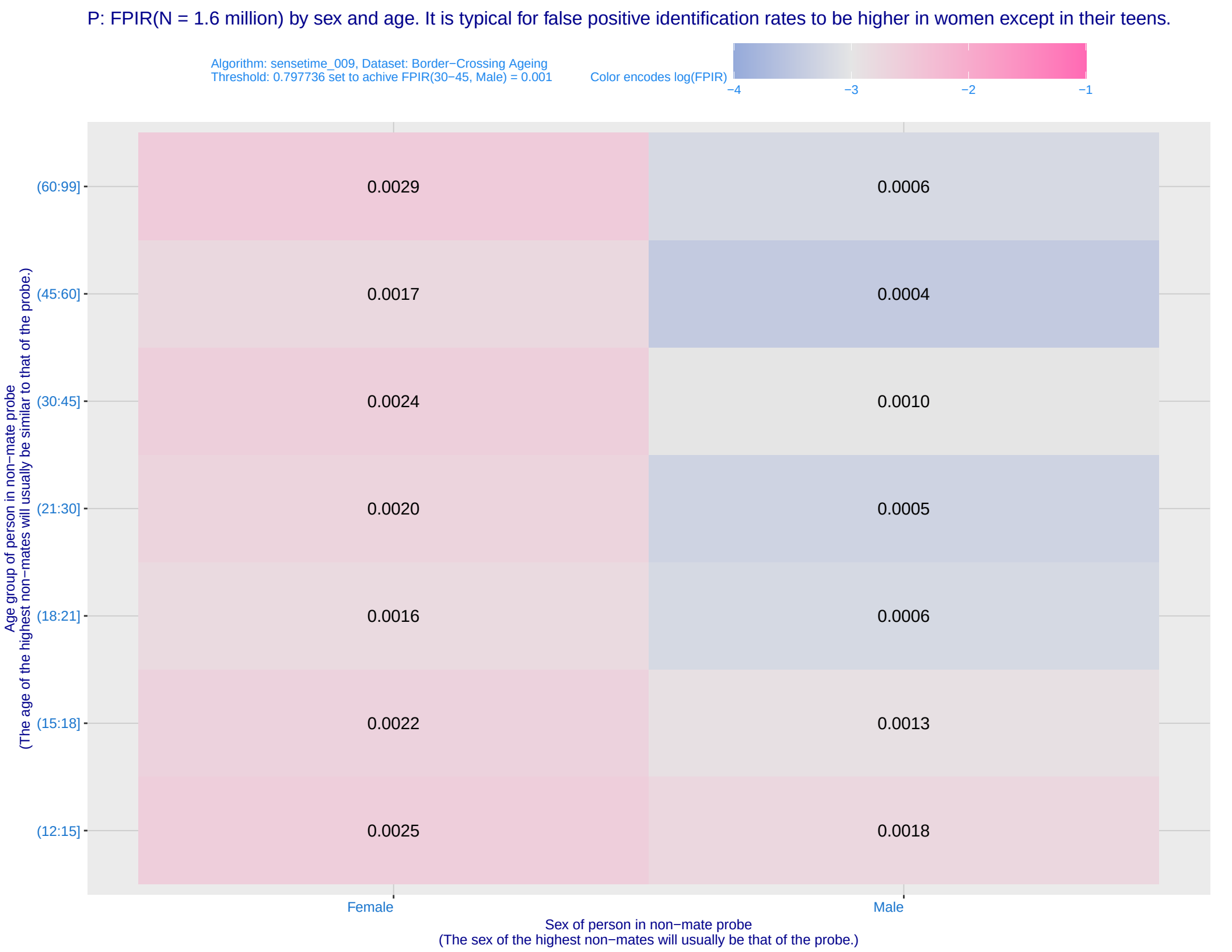

K: Investigational mode: FNIR(N, 1, 0) vs. most accurate (sensetime_009)
Immigration
visa−border
Immigration
visa−kiosk
Mugshot
natural
Mugshot
webcam
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
False negative identification rate, FNIR(N)
1e+06
3e+06
1e+07
Enrolled population size, N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

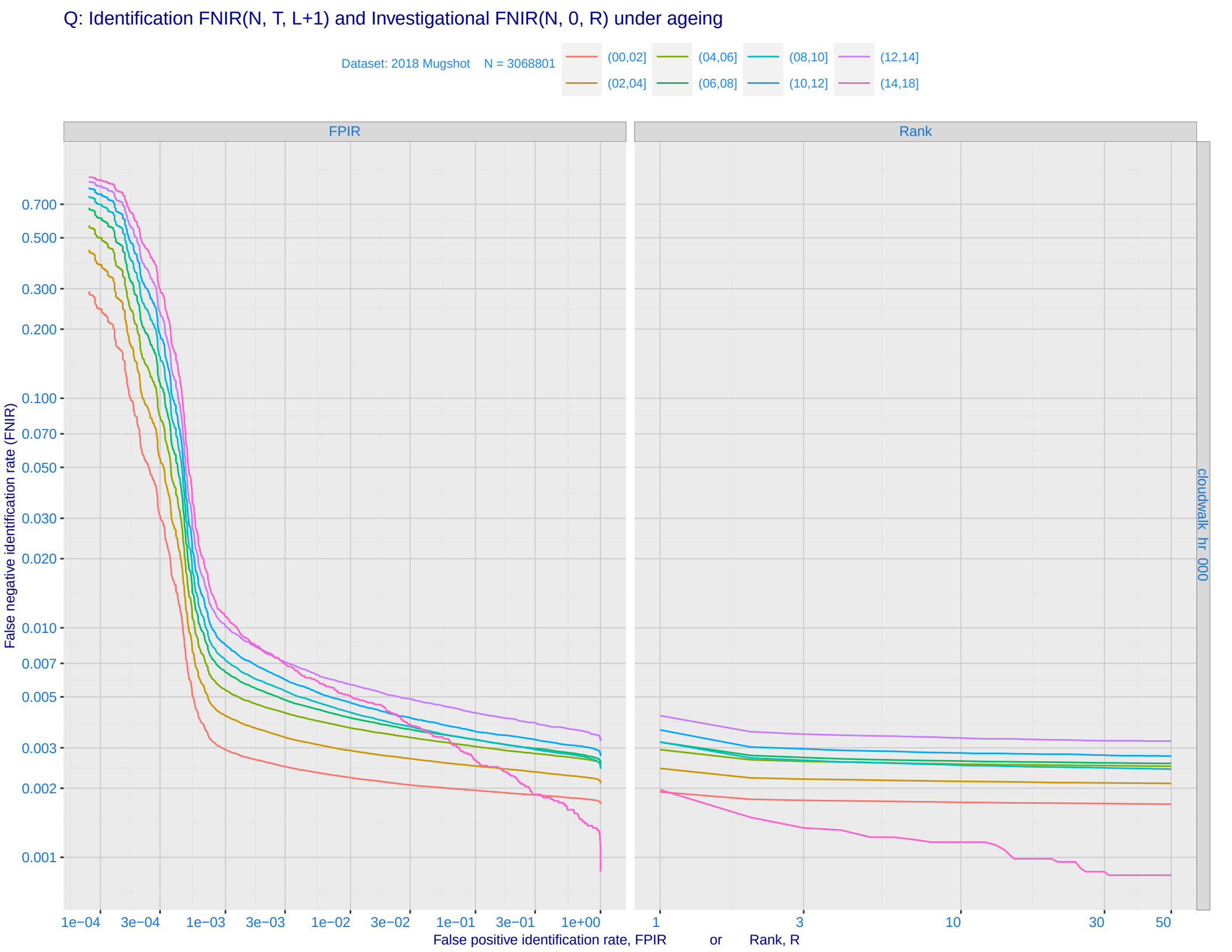

L: Investigational mode: FNIR(1600000, R, 0) by probe type
sensetime_009
0.070
0.050
0.030
0.020
0.010
0.007
0.005
0.003
0.002
0.001
False negative identification rate, FNIR(N)
1
3
10
30
Rank, R
enrolment_style
random
recent
FNIR(R)
N = 1600000
Immigration visa−border
Immigration visa−kiosk
Mugshot natural
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: sensetime_009, 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=0.797736), 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]
0.004 0.004 0.006 0.004 0.005 0.005
0.003 0.003 0.003 0.003 0.003 0.003
0.003 0.002 0.003 0.003 0.003 0.003
0.003 0.002 0.003 0.003 0.003 0.003
0.004 0.004 0.004 0.004 0.005 0.006
0.007 0.006 0.005 0.005 0.008 0.014
0.009 0.005 0.007 0.011 0.009 0.000
0.002 0.002 0.002 0.002 0.002 0.005
0.002 0.002 0.002 0.002 0.002 0.001
0.002 0.002 0.002 0.002 0.002 0.002
0.002 0.002 0.002 0.002 0.002 0.002
0.002 0.003 0.002 0.003 0.004 0.001
0.005 0.003 0.004 0.007 0.004 0.004
0.009 0.009 0.011 0.013 0.010 0.007
0.010 0.012 0.015 0.015 0.018 0.024
0.008 0.008 0.010 0.012 0.013 0.012
0.009 0.009 0.011 0.014 0.015 0.016
0.012 0.010 0.014 0.016 0.016 0.017
0.023 0.022 0.026 0.028 0.027 0.023
0.041 0.036 0.041 0.046 0.048 0.036
0.063 0.049 0.060 0.071 0.085 0.054
0.005 0.005 0.004 0.004 0.005 0.005
0.003 0.003 0.004 0.004 0.004 0.005
0.004 0.003 0.004 0.004 0.005 0.004
0.005 0.005 0.006 0.006 0.008 0.007
0.016 0.015 0.020 0.021 0.023 0.020
0.050 0.047 0.056 0.074 0.075 0.082
0.104 0.091 0.126 0.130 0.137 0.094
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: sensetime_009, Dataset: Border−Crossing Ageing
Threshold: 0.797736 set to achive FPIR(30−45, Male) = 0.001
Color encodes log(FPIR)
−4
−3
−2
−1
0.0029
0.0006
0.0017
0.0004
0.0024
0.0010
0.0020
0.0005
0.0016
0.0006
0.0022
0.0013
0.0025
0.0018
(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
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