NIST IR
NISTIR 8525

Face Analysis Technology Evaluation: Age Estimation and Verification

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NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

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May 2024

U.S. Department of Commerce
Gina M. Raimondo, Secretary

National Institute of Standards and Technology
Laurie E. Locascio, NIST Director and Under Secretary of Commerce for Standards and Technology

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Publication History

Approved by the NIST Editorial Review Board on 2024-05-24

How to cite this NIST Technical Series Publication:

Kayee Hanaoka, Mei Ngan, Joyce Yang, George W. Quinn, Austin Hom, Patrick Grother (2024) Face Analysis Technology Evaluation: Age Estimation and Verification . (National Institute of Standards and Technology, Gaithersburg, MD), NISTIR 8525. https://doi.org/10.6028/NIST.IR.8525

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NISTIR 8525
May 2024

Abstract

The report documents technical performance of prototype age estimation algorithms submitted to the Age Estimation and Verification (AEV) track of the Face Analysis Technology Evaluation (FATE) executed by the National Institute of Standards and Technology (NIST).

Acknowledgements

The authors are grateful to the Federal Bureau of Investigation (FBI) and the Department of Homeland Security (DHS) Office of Biometrics Identity Management (OBIM) for their support of this work. Additionally we are indebted to DHS Customs and Border Protection, DHS Citizenship and Immigration, and the FBI for allowing use of photographs in this FATE evaluation. Finally, the authors are grateful to colleagues in the NIST Biometrics Research Laboratory for excellent infrastructure supporting this evaluation.

Other Related Reports

Results from the Face Recognition Technology Evaluation (FRTE) and Face Analysis Technology Evaluation (FATE) activities appear in the series of NIST Interagency Reports tabulated below. From 1999 to July 2023, FRTE and FATE were collectively known as FRVT.

DATE	PROG.	NISTIR	TITLE
2014-03-20	FATE	7995	Performance of Automated Age Estimation Algorithms
2015-04-20	FATE	8052	Performance of Automated Gender Classification Algorithms
2014-05-21	FRTE	8009	Performance of Face Identification Algorithms
2017-03-07	FRTE	8173	FIVE - Face In Video Evaluation: Face Recognition of Non-Cooperative Subjects
2017-11-23	FRTE	8197	FRPC - The 2017 IARPA Face Recognition Prize Challenge
2020-01-03	FRTE	Draft	Part 1: Verification
2019-09-11	FRTE	8271	Part 2: Identification
2019-12-11	FRTE	8280	Part 3: Demographic Effects
2020-03-04	FATE	8292	Part 4: MORPH - Performance of Automated Face Morph Detection
2020-03-06	FATE	Draft	Part 5: Face Image Quality Assessment
2020-07-24	FRTE	8311	Part 6A: Face Recognition Accuracy with Face Masks using Pre-COVID-19 Algorithms
2022-01-20	FRTE	8331	Part 6B: Face Recognition Accuracy with Face Masks using Post-COVID-19 Algorithms
2022-07-13	FRTE	8381	Part 7: Identification for Paperless Travel and Immigration
2022-09-30	FRTE	PDF	Part 8: Summarizing Demographic Differentials
2022-09-30	FRTE	8439	Part 9A: Face Recognition Verification Accuracy on Distinguishing Twins
2023-09-20	FATE	8491	Part 10: Performance of Passive Software-based Presentation Attack Detection (PAD) Algorithms
2023-09-20	FATE	8485	Part 11: Face Image Quality Vector Assessment: Specific Image Defect Detection

Details appear on pages linked from https://www.nist.gov/programs-projects/face-projects.

Key words

Face Analysis Technology Evaluation; FATE; AEV; Age estimation; Age Verification; Age Assurance

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Executive Summary

Motivation

Age assurance is the subject of recent legislation both inside and outside the United States. This has driven the need for age assurance methods to support applications such as verification that a person is above age 18, 21, or other key ages (e.g., for sale of alcohol or online access). While the mechanism for estimating age may not be specified in legislation, software-based face analysis is one potential approach supported by ubiquitous inexpensive cameras. Age estimation can operate statelessly with no requirement for persistent storage of a photo or biometric data derived from it.

Overview

Age assurance applications can employ either an age verification (AV) algorithm that produces a yes/no guess at whether someone is above an age threshold, or an age estimation (AE) algorithm that emits a numeric age estimate that can be compared with the age threshold i.e. AV can be implemented with AE, or it can be computed without explicit AE.

This report quantifies the capability of six software-based AE and AV prototypes applied to around eleven million photos drawn from four operational repositories: immigration visas, arrest mugshots, border crossings, and immigration office photos. The report includes statements of age estimation (AE) accuracy globally and across demographic groups. It uses AE with thresholds to measure performance in age verification tasks and also reports the dependence on image quality. The report excludes performance measured in interactive sessions, in which a person can cooperatively present and re-present to a camera. It does not measure accuracy effects related to disguises, cosmetics, or other presentation attacks. It does not address policy nor recommend AV thresholds as these differ across applications and jurisdictions.

Audience

This report is of primary utility to actual and prospective deployers of the technology faced with selection of particular AE implementations. It is additionally intended to inform policymakers interested in assessing absolute capability and whether that is sufficient for particular use-cases. The report will be useful to developers in exposing factor affecting performance and in documenting capability relative to other prototypes. This report is a snapshot; the AEV benchmark remain opens for new and returning developers as a means to track technological gains.

Results

Age estimation accuracy has improved since we first measured it in 2014 - see NISTIR 7995. However, for both age estimation (e.g., MAE) and metrics appropriate to “challenge” that require alternative means of age assurance if age is not above some limit, accuracy is strongly influenced by algorithm, sex, image quality, region-of-birth, age itself, and interactions between those factors. There is no uniformly superior algorithm, and algorithm rankings differ across those factors. Accuracy also depends on the metric: age estimation error vs. challenge-25-like false positive rates. Given variation across demographic groups, we anticipate developers improving capability over time. Future FATE AEV reports will address online safety applications (for 13-16 year olds), report on new datasets, and include extended analyses. Detailed results follow in the Technical Summary.

Technical Summary

Algorithms: FATE AEV is an ongoing technology evaluation of age estimation implementations. This report is a snapshot of results documenting the application of six commercially-developed age estimation algorithms to four archived datasets. The algorithms are prototypes - so not necessarily available as mature integrable products. See sec. 4.

Datasets: We used four large operational sets of photographs. The sets are accompanied by subject metadata including age and, in some cases, sex and country-of-birth information. The four datasets are domestic *mugshots* collected in the United States after arrest, *application* photographs taken in immigration offices from a global population, *visa* photographs collected in consular offices in Mexico, and *border* crossing photographs of travelers entering the United States. See sec. 3.

Accuracy gains since 2014: This report includes results for a dataset used in our 2014 evaluation of age estimation algorithms. With a decade of research and development, and significant advances in deep neural network technology, we see five of six algorithms outperform the most accurate algorithm submitted to NIST in 2014. Using a common *visa* database, best mean absolute error (MAE) has reduced from 4.3 to 3.1 years. See sec. 5.1.

Age estimation accuracy: The AEV program aims to measure age estimation accuracy, and to quantify gains over time. This is done by running empirical trials using large datasets. Table 1 shows standard statements of age estimation error for all algorithms on the 18-24 subset of the four databases.

Table 1. *Mean, median and standard deviation of absolute error (MAE, MDAE, SD) and failure to process rate (FTP) for subjects between the age 18 to 24 year old. Num. Img shows how many images processed sucessfully by the algorithm. Lower values are better.*

Algorithm	Dataset	Num. Img	MAE	MDAE	SD	FTP
dermalog-001	Mugshot	376560	3.8	3.0	3.2	0.001
dermalog-001	Border	236251	5.1	4.6	3.6	0.000
dermalog-001	Application	111938	3.3	2.6	2.8	0.000
dermalog-001	Visa	857766	4.7	4.2	3.2	0.000
incode-000	Mugshot	376710	2.7	2.2	2.5	0.000
incode-000	Border	236181	4.5	3.6	3.9	0.000
incode-000	Application	111938	3.0	2.4	2.5	0.000
incode-000	Visa	857762	3.5	2.9	2.7	0.000
neurotechnology-000	Mugshot	376764	3.6	3.0	3.0	0.000
neurotechnology-000	Border	236169	3.4	2.8	2.8	0.000
neurotechnology-000	Application	111938	3.7	3.1	2.9	0.000
neurotechnology-000	Visa	857764	3.2	2.5	2.7	0.000
roc-000	Mugshot	376809	2.3	1.7	2.3	0.000
roc-000	Border	236191	4.0	3.4	3.1	0.000
roc-000	Application	111938	3.5	2.9	2.8	0.000
roc-000	Visa	857764	3.7	2.8	3.1	0.000
unissey-001	Mugshot	376776	3.5	3.0	3.1	0.000
unissey-001	Border	236182	3.4	3.0	2.8	0.000
unissey-001	Application	111938	4.0	3.5	3.1	0.000
unissey-001	Visa	857764	4.1	3.6	3.0	0.000
yoti-001	Mugshot	376274	2.7	2.1	2.5	0.002
yoti-001	Border	235988	5.1	4.5	3.8	0.001
yoti-001	Application	111936	4.1	3.4	3.3	0.000
yoti-001	Visa	857713	3.8	3.1	3.0	0.000

Notable from the table is that the main summary measure of how close age estimates are to ground truth - mean absolute error (MAE) - varies between algorithms operating on any one dataset, and between datasets using any one algorithm. This is a function of algorithm sensitivities to image quality and demographics, as discussed below. Within one dataset, aggregate MAE hides variation across sex and ethnicity. Moreover, MAE also does not specifically quantify how many age estimates are large overestimates, so it is not an appropriate metric for age verification (AV) tasks. See metrics in sec. 2.

Impact of image quality: Table 1 shows mugshots are easiest for three of six algorithms using the MAE metric, and border crossing photos are the hardest for four of six algorithms. Mugshots and application photos are collected with standardized photographic setups. The border photos are collected with a webcam and exhibit more variation in head orientation away from frontal, and lower contrast. On such images, algorithms perform less well than on office-collected application photos of the same people (i.e. the same demographics). We have not conducted a detailed cause-and-effect analysis to relate age estimation error to explicit measurements of standardized quality metrics such as sharpness, exposure and head orientation. The datasets are detailed in 3. See sec. 5.6.

Impact of eyeglasses: Eyeglasses have an effect on age estimation error. Four of six algorithms show higher age estimation error (over-estimation or under-estimation) in both male and female when wearing glasses vs. not wearing glasses. See sec. 5.6.1.

Age verification accuracy: For restricted-age applications such as alcohol purchase, a Challenge-T policy accepts people with age estimated at or above T but requires additional age assurance checks on anyone assessed to have age below T. Table 2 shows false positive rates (FPR) for people below a legal limit (18 in the first four columns, and 21 in the second four columns) but who are estimated to be at or above the challenge age T. FPR, which should be low, decreases with higher Challenge-T values. The use of higher T values will cause more people at or above legal age to be subject to additional age assurance. The tables show that for four of six algorithms, FPR is markedly lower in men than women, the opposite is true for another, and parity is almost achieved for one more.

Table 2. *For Application images, false positive rates (FPR) for 14-17 year olds, 14-20 years olds, at challenge ages, 25, 28 and 31. Values are lower the better.*

Algorithm	Male 14-17 T=25	Female 14-17 T=25	Male 14-17 T=28	Female 14-17 T=28	Male 14-20 T=28	Female 14-20 T=28	Male 14-20 T=31	Female 14-20 T=31
dermalog-001	0.051	0.112	0.012	0.036	0.034	0.069	0.010	0.021
incode-000	0.006	0.033	0.002	0.010	0.008	0.027	0.002	0.008
neurotechnology-000	0.248	0.178	0.062	0.035	0.101	0.057	0.028	0.014
roc-000	0.041	0.073	0.006	0.016	0.030	0.049	0.006	0.011
unissey-001	0.107	0.127	0.031	0.038	0.091	0.092	0.018	0.019
yoti-001	0.012	0.090	0.003	0.032	0.017	0.093	0.004	0.033

Table 2 uses two samples sets (14-17 and 14-20), but these subsets are imbalanced by age and sex per the characteristic demographics of the operational population the set was drawn from. Imbalance matters, because 14 year olds have markedly lower FPR than do those aged 17: Table 3 shows that Challenge-25 false positive rates increase by an order-of-magnitude as subjects age from 14 through 20 - for example for the roc-000 algorithm FPR at age 20 (0.295) is almost fifteen times larger than at age 14 (0.02). The implication of imbalance in a set is that a test that employs that set without taking any steps to correct for that imbalance, will yield unpresentative results - see the discussion in 2.6.3. A test of an operational system should typically proceed with operationally representative numbers of 14, 15, . . . year old males and females.

Table 3. *For Application images, false positive rates for Challenge-25 by actual age. The FPR values are averages of 12 FPR estimates from two sexes and six regions-of-birth. Lower values are the better.*

	Actual Age						
Algorithm	**14**	**15**	**16**	**17**	**18**	**19**	**20**
dermalog-001	0.039	0.060	0.097	0.134	0.151	0.226	0.284
incode-000	0.008	0.012	0.031	0.047	0.062	0.112	0.171
neurotechnology-000	0.200	0.231	0.293	0.353	0.380	0.426	0.465
roc-000	0.020	0.037	0.063	0.103	0.138	0.216	0.295
unissey-001	0.047	0.082	0.128	0.191	0.252	0.332	0.424
yoti-001	0.018	0.033	0.068	0.110	0.155	0.236	0.327

Table 4. *For Application images, false positive rates for Challenge-28 by actual age. The FPR values are averages of 12 FPR estimates from two sexes and six regions-of-birth. Lower values are the better.*

	Actual Age						
Algorithm	**14**	**15**	**16**	**17**	**18**	**19**	**20**
dermalog-001	0.011	0.018	0.028	0.041	0.047	0.077	0.107
incode-000	0.002	0.004	0.012	0.015	0.019	0.037	0.052
neurotechnology-000	0.058	0.071	0.094	0.123	0.138	0.162	0.191
roc-000	0.003	0.008	0.014	0.023	0.037	0.066	0.100
unissey-001	0.012	0.024	0.046	0.064	0.090	0.139	0.194
yoti-001	0.007	0.012	0.025	0.040	0.054	0.093	0.124

Table 4 shows the effect of increasing the challenge age to 28. FPR reduces universally (necessarily). Note that in both tables the large variation down the columns, showing that some algorithms are markedly better than others.

In the main results section, we include results for all ages and all thresholds. We also include results for other datasets, where FPR is increased with lower quality photos. See sec. 5.3.

Age verification accuracy vs age estimation: Our API includes age verification function which allow developers to implement a dedicated classifier indicating whether the subject is above an age limit. All algorithms show that age-verification classifier do not perform better when comparing to a regression-like estimator. See sec. 5.3.1

Demographics - Region of birth: In addition to age, we report performance for six regions-of-birth: E. Africa, W. Africa, E. Europe, S. Asia, S. E. Asia, and E. Asia. This forms a proxy for ethnicity, as explained in section 5.4. We do not attempt to recover skin tone information from images, because this is problematic for technical reasons and, more importantly, because face processing algorithms should be expected to be sensitive to skin tone *and* many other phenotypes present in a face such as square jaws, prominent eye brows, high cheekbones, aquiline noses etc.

Table 5. *For Application images, Challenge-25 FPR for men aged 17 by region of birth. Gini summarizes variability of the six FPR values to its right; lower values are better.*

Algorithm	**Gini**	**E Africa**	**E Asia**	**E Europe**	**S Asia**	**S E Asia**	**W Africa**
dermalog-001	0.21	0.10 ± 0.03	0.07 ± 0.01	0.04 ± 0.02	0.12 ± 0.02	0.10 ± 0.03	0.09 ± 0.03

incode-000	0.49	0.02 ± 0.01	0.006 ± 0.004	0.003 ± 0.003	0.017 ± 0.007	0.01 ± 0.01	0.05 ± 0.02
neurotechnology-000	0.45	0.76 ± 0.05	0.36 ± 0.02	0.06 ± 0.02	0.20 ± 0.02	0.28 ± 0.05	0.84 ± 0.04
roc-000	0.36	0.07 ± 0.03	0.12 ± 0.02	0.000 ± 0.000	0.04 ± 0.01	0.11 ± 0.03	0.11 ± 0.03
unissey-001	0.28	0.20 ± 0.04	0.26 ± 0.02	0.04 ± 0.02	0.15 ± 0.02	0.23 ± 0.04	0.14 ± 0.04
yoti-001	0.48	0.02 ± 0.01	0.036 ± 0.009	0.003 ± 0.003	0.021 ± 0.008	0.02 ± 0.01	0.08 ± 0.03

Table 5 shows false positive rates for a Challenge-25 policy for 17 year old males. The lowest FPR values are in East Europeans though this varies for women and for men of other ages; the highest values occur in various other regions. See sec. 5.4

Demographics - Sex: Another obvious demographic variable is sex. Table 6 shows false positive rates, again for just 17 year olds, but with both sexes and three regions-of-birth. The main observation is generally higher FPR in women than men, but with exceptions for some algorithms operating on some ethnicities. The MAE values are also generally higher in women.

Table 6. *For Application images, Challenge-25 FPR for subjects aged 17 by sex and region of birth. Lower values are the better.*

Algorithm	Gini	Female E Africa	Female E Asia	Female E Europe	Male E Africa	Male E Asia	Male E Europe
dermalog-001	0.41	0.13 ± 0.03	0.14 ± 0.02	0.31 ± 0.05	0.10 ± 0.03	0.07 ± 0.01	0.04 ± 0.02
incode-000	0.59	0.11 ± 0.03	0.05 ± 0.01	0.07 ± 0.03	0.02 ± 0.01	0.006 ± 0.004	0.003 ± 0.003
neurotechnology-000	0.46	0.39 ± 0.05	0.24 ± 0.02	0.12 ± 0.03	0.76 ± 0.05	0.36 ± 0.02	0.06 ± 0.02
roc-000	0.50	0.18 ± 0.04	0.17 ± 0.02	0.02 ± 0.01	0.07 ± 0.03	0.12 ± 0.02	0.000 ± 0.000
unissey-001	0.25	0.17 ± 0.04	0.26 ± 0.02	0.19 ± 0.04	0.20 ± 0.04	0.26 ± 0.02	0.04 ± 0.02
yoti-001	0.53	0.18 ± 0.04	0.14 ± 0.02	0.19 ± 0.04	0.02 ± 0.01	0.036 ± 0.009	0.003 ± 0.003

Weighted Challenge-25 metrics: In a Challenge-T application, the false positive rate varies by age and demographics. We therefore introduce an aggregated measure of ineffectiveness, which is a population- and risk-weighted average of FPR. The population weights quantify the age pyramid; the risk weights express how likely it is for a person of each age to attempt to use an AV system. The formula is presented and discussed in section 2.6.3; it is included not as a definitive model, rather to illustrate what an analyst might consider. For an 18 year legal limit application, Table 7 shows weighted Challenge-T FPR, aggregating both sexes and six regions-of-birth with equal weights, and $13,\ldots,17$ year olds with weights that de-emphasize the younger ages.

Table 7. *For Application images in an L = 18 age restriction application,* **ineffectiveness** *for four Challenge-T thresholds i.e. a population weighted aggregate of FPR. Lower values are better.*

Algorithm	T=22	T=25	T=28	T=31
dermalog-001	0.183 ± 0.029	0.052 ± 0.016	0.015 ± 0.008	0.005 ± 0.004
incode-000	0.032 ± 0.012	0.012 ± 0.007	0.004 ± 0.003	0.001 ± 0.001
neurotechnology-000	0.452 ± 0.035	0.220 ± 0.029	0.066 ± 0.018	0.016 ± 0.008
roc-000	0.131 ± 0.025	0.030 ± 0.011	0.006 ± 0.004	0.001 ± 0.001
unissey-001	0.120 ± 0.025	0.067 ± 0.019	0.019 ± 0.010	0.004 ± 0.003
yoti-001	0.069 ± 0.018	0.029 ± 0.011	0.011 ± 0.006	0.003 ± 0.003

We additionally quantify inconvenience experienced by persons above the legal age limit whose age verification are delayed by a failed Challenge-T attempt. The aggregated measure is again a weighted average this time of false negative rates (FNR). The formula is presented and discussed in section 2.6.4. Table 8 shows Challenge-T FNR computed over all ages $18,\ldots,71$ with equal weights representing uniform likelihood that adults would engage with the system.

Table 8. *For Application images in an L = 18 age restriction application,* **inconvenience** *for four Challenge-T thresholds i.e. a population weighted aggregate of FNR. Lower values are better.*

Algorithm	T=22	T=25	T=28	T=31
dermalog-001	0.051 ± 0.006	0.122 ± 0.008	0.193 ± 0.008	0.257 ± 0.009
incode-000	0.075 ± 0.005	0.120 ± 0.006	0.184 ± 0.006	0.247 ± 0.006
neurotechnology-000	0.040 ± 0.005	0.107 ± 0.007	0.209 ± 0.009	0.308 ± 0.010
roc-000	0.049 ± 0.004	0.099 ± 0.006	0.157 ± 0.006	0.221 ± 0.007
unissey-001	0.061 ± 0.006	0.091 ± 0.007	0.155 ± 0.008	0.246 ± 0.009
yoti-001	0.047 ± 0.004	0.082 ± 0.005	0.137 ± 0.006	0.199 ± 0.006

The two tables show the expected tradeoff between protecting young people and inconveniencing older subjects.

Children: We use a set of visa photos collected in one country, Mexico, to quantify age estimation accuracy in children between age 0 to 17. Accuracy is higher than in an adult population: For the most accurate algorithm mean absolute error in children under age 1 is 0.34 years (i.e. about four months) versus 3.5 years for a thirty year old. See sec. 5.5.

Future work: The FATE AEV evaluation remains open, so we will continue to evaluate and report on newly submitted prototypes. In future reports we will: evaluate performance of implementations that can exploit having a prior known-age reference photo of a subject (see our API); consider whether video clips afford improved accuracy over still photographs; and extend demographic and quality analyses.

1. Introduction

1.1. Role of AEV Technology

Age assurance (AA) systems are fielded to support validation of a person's eligibility to access age-restricted online content or physical world products or spaces. As the Future of Privacy Forum shows, an AA system may employ various methods depending on the purpose. These include human checks of a government-issued identification document, possession of a credit card or payment credential only issued to people of the required age, biometric verification against a photograph collected during a prior session in which age was verified, accessing high integrity age data from a trusted device, and use of face analysis to estimate age or verify age is above (or below) the limit.

This report is concerned only with evaluation of AE technologies used in an age verification process. It is intended to generically support applications including:

1. Verification that a person is above 18, 21 or other key ages, e.g. for sale of alcohol.
2. Verification that a person is below a certain age, e.g. entrance to a teen chat room.
3. Producing population age statistics for people visiting certain locations, e.g. movie theaters.
4. Digital advertising where a display might show an age-tailored advertisement.
5. Checks that a passport application photo is recent (not collected 10 years previously).
6. Age estimation for refugees, asylum seekers, and other undocumented individuals.

Age assurance is mandated in various jurisdictions for various purposes. In the United States, the Children's Online Privacy Protection Act (COPPA) of 1998[1], requires the Federal Trade Commission to prescribe regulations to protect the privacy of personal information collected from and about children on the internet, to provide greater parental control over the collection and use of that information, and for other purposes. Within the States, Arkansas[2], Mississippi[3], Montana[4], Louisiana[5], Utah[6], Virginia[7], and Texas[8] have passed age verification laws to require social media, adult websites, harmful to minors to use a reasonable age verification methods to verify the user's age eligibility.

There are new and emerging technical standards in this area. IEEE Standard 2089-2021 provides best practice for designing digital services that impact directly or indirectly on children[9]. ISO/IEC 27566 is a (recently renumbered) multipart standard for age assurance: Part 1 provides a framework including vocabulary; Part 2 guides architecture and interoperability; Part 3 concerns benchmarking and analysis.

1.2. Age Estimation is Not Face Recognition

We distinguish facial age estimation (AE) from face recognition (FR). AE analyses one face to produce an estimate of age. FR is concerned with *who* is in an image. The two techniques employ different algorithmic machinery for these two purposes: AE is trained on photos accompanied by known-age values; FR is trained on pairs of photographs with identity labels. AE typically proceeds with *one* photograph or video - the image is passed to an algorithm which emits an age estimate, and the photo can be deleted. FR, on the other hand, compares identity information extracted from *two* photos with the goal of determining if they are from the same person. The first sample is stored in a passport, or phone, or database. The second sample is collected for verification or identification. The Oxford English Dictionary is explicit in noting the "previous encounter". The utility of FR is in binding a new photograph to an older one and its informative metadata, for example, that a person is allowed to enter a facility, or had previously applied for a passport under the same (or different) name, or had previously been deported from a country.

1.3. Scope

NIST published Interagency Report 7995 Performance of Automated Age Estimation Algorithms in 2014. The report showed that the most accurate algorithm can estimate the age of a person within five years of their actual age 67% of the time[10]. With the increase in human-computer interaction and as the motivation of needs to use age estimation systems continues to grow, NIST revamped the age estimation study. We restructured and launched the Face Analysis Technology Evaluation - Age Estimation and Verification track. This is an ongoing evaluation to benchmark software-based facial age estimation algorithms.

This evaluation is not a certification program nor an evaluation of a full age verification process. It does not evaluate mechanisms for detecting active attacks on AV systems. It does not establish minimum accuracy criteria, because different applications have different requirements.

1.4. The Technical Challenge

An AE algorithm is tasked with mapping pixel values in an image to an estimate of the subject's age. The output estimate will generally be different to the actual age, and this estimate error should be low and bounded. An AE algorithm should tolerate at least four classes of variation. First are **photography-related** factors such as illumination, exposure, focus, and distortion. Second are **subject presentation** variations such as facial hair, eye glasses, dry vs. moisturized skin, and cosmetics. Third there are more **slowly varying** facial archetypes such as sun-damaged skin, creases, and jowls. Fourth there are **phenotypic** properties which includes skin tone but extends to a multitude of characteristics such as high cheek bones, bushy eye brows, dark eye brows, thin lips, square jaws, flat faces, and aquiline noses. This latter category are often properties of demographic groups associated with sex and ethnicity. Further more, should age estimation accuracy be constant across age, should it work as well in the old as the young? Ideally, yes, but operationally this is less important as many applications are focused on groups of people around a certain age, and algorithms could be tailored for that.

Figure 1 demonstrates some of the difficulty of the AE task. The figure shows the result of applying AE algorithms to self-portraits collected by artist Noah Kalina as part of his Everyday project. The images, collected daily since 2000, can seen via that link.

The figure reveals considerable **daily variance** in the age estimates. The daily increase should be 1/365 but the standard deviation of the absolute error is much larger - above 2 years in the best case. Why this occurs would require detailed developer investigation. Given the use of one camera model for the period 2009-2015 (age 27-34) and an impressively consistent two-arm frontal-selfie presentation to that camera, the sources of short-term variation are clothing, hair arrangement, ambient illumination which varies with the room, and sensor noise, none of which should affect estimated age. In the longer-run the subject does adopt a heavier beard, but that too is elective not essentially part of ageing.

The figure also shows **systematic error** for all six algorithms: They overestimate Kalina's age, with very few photographs ever giving an underestimate. The blue line $y = x$ represents perfect estimation; the green line represents best fit linear regression. The separation of those lines is around five years, and this often persists for the entire interval. Why this occurs is not known, but could be investigated by developers who should have access to the photographs. An incorrect birthdate would yield consistent error, but date of birth has been reported. The images have good quality, so either some aspect of the subject's appearance induces overestimation, or the algorithms are sensitive to information beyond the facial region. This concept - that some people look young, or old, for their age - is common in human experience, but whether Deep Neural Network (DNN) based algorithms can acquire information from photographs that humans cannot, or at least do not, is not clear.

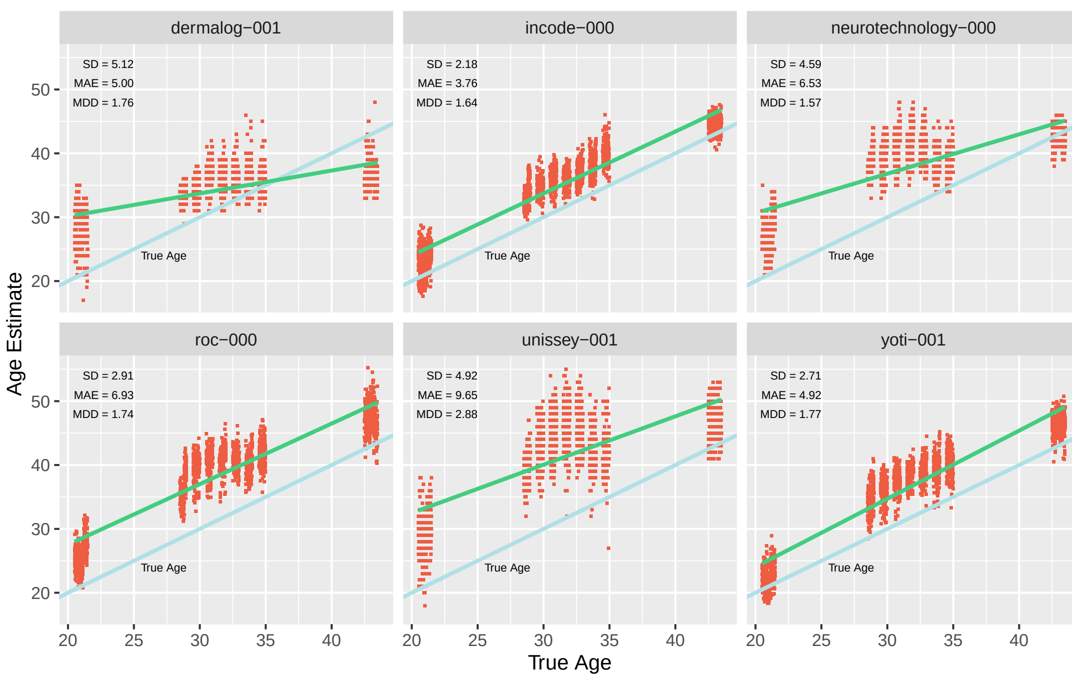
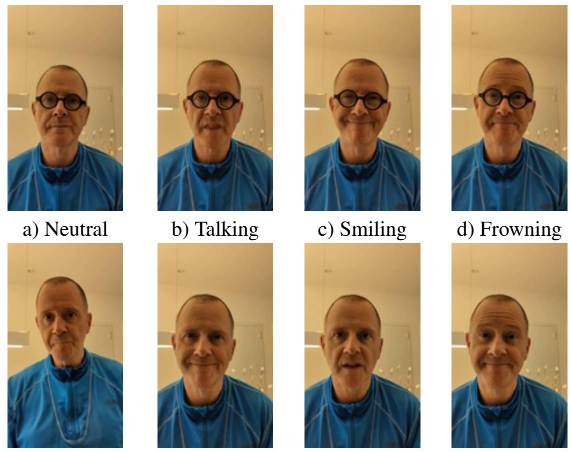


Fig. 1. *This figure shows age estimates plotted against ground truth age for six algorithms applied to 1991 photographs of the artist Noah Kalina taken daily throughout 2001, then between January and June in the years 2009 - 2015, then again throughout 2023. Note NIST purchased only photos for the first six months of each calendar year - the subject was born 1980-07-04. The inset values are standard deviation (SD) quantifying "noise", mean absolute error (MAE) quantifying accuracy, and mean sequential day difference (MDD) which would ideally be 1/365. The lower blue line gives ground truth age. The upper line gives least squares best fit.*

This kind of variation is evident in the very short term also. Figure 3 shows the results of applying AE algorithms to sequential frames in a 60 second video. The frames have size 1080x1920 and were extracted from an MP4 video captured by one of the authors using his mobile phone. The figure shows considerable inter-frame estimated age variation even in frames 0-180 and 900-1100 where the subject was largely motionless. In subsequent frames the subject talks, then smiles and frowns, and these induce larger variance. Age estimates tend to be higher with thick-rimmed glasses in the first half of the video, than without glasses in the second half.



a) Neutral b) Talking c) Smiling d) Frowning

e) Glasses Off f) Smiling g) Talking h) Frowning

Fig. 2. Image frames from a 60 second video when subject's facial expression changes, causing large variance.

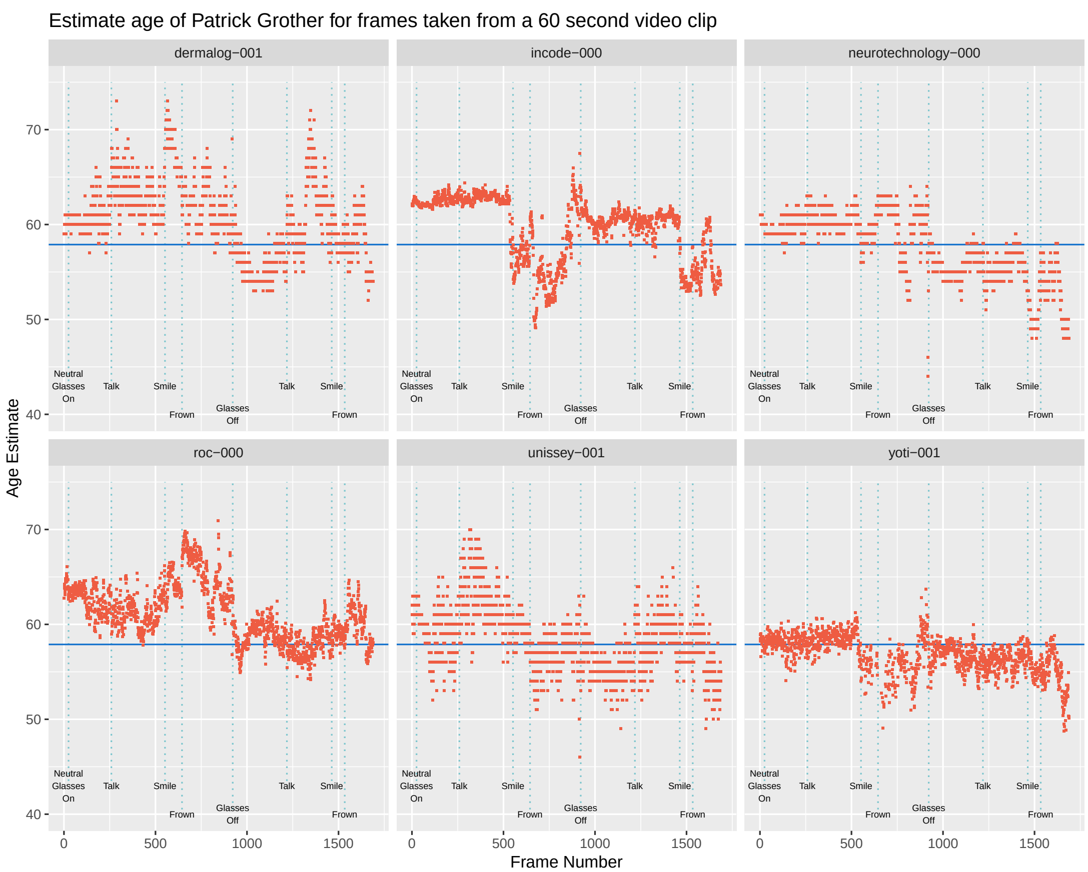


Fig. 3. This figure shows the variation of age estimates for six algorithms applied to 1688 frames of Patrick Grother (figure 2) extracted from a 60 second video captured using an Android phone. The blue line is the ground truth age.

Discussion: Face recognition (FR) algorithms have become highly insensitive to nuisance variables such as pose, illumination and expression. This has been achieved over time using diverse in-the-wild datasets, and more recently data augmentation (synthetically changing images to diversify appearance while maintaining identity). FR algorithms are tasked with extracting features related to a person's fixed identity; AE algorithms, on the other hand, are estimating a variable quantity, age. Whether AE can become insensitive to nuisance variables is not clear, and may actually be unnecessary. What is needed, at least in those applications involving determination that a person is younger or older than some limit, is to put bounds on AE measurement "noise" - i.e. to ensure that errors are inside some limit. In those Challenge-T applications, the appropriate task is to limit false positives.

2. Performance Metrics

This section details performance measures for age estimation algorithms. The metrics are statistics estimated by applying an AE algorithm to N images for which we have a known age, a_k, to get an estimated age, $\hat{a}_k$. Unless stated otherwise, these are based on the absolute error

$$\varepsilon_k = |\hat{a}_k - a_k| \tag{1}$$

2.1. Mean Absolute Error

Mean Absolute Error (MAE) is defined as the mean difference between the actual and estimated ages:

$$\text{MAE} = \frac{1}{N}\sum_{k=1}^{N} \varepsilon_k \tag{2}$$

This serves as our primary accuracy measure.

2.2. Median Absolute Error

Median Absolute Error (MDAE) is defined as the median of the absolute error values, ε_k. The median is a robust statistic meaning that it is insensitive to outliers. Given N ordered error values,

$$\text{MDAE} = \begin{cases} \varepsilon_{(N+1)/2}, & \text{if N is odd} \\ (\varepsilon_{N/2} + \varepsilon_{N/2+1})/2 & \text{if N is even} \end{cases} \tag{3}$$

2.3. Standard deviation

The **Standard Deviation (SD)** is used to quantify variation around the mean. It has been adopted in the AEV industry as a supplement MAE[1].

$$\text{SD} = \frac{1}{N-1}\sum_{k=1}^{N} (\varepsilon_k - \text{MAE})^2 \tag{4}$$

This statistic only quantifies variation around the mean, so an algorithm could have low SD yet be systematically underestimating or overestimating age, i.e. large MAE. For this reason we consider SD as a secondary performance indicator.

[1] Yoti, Age Esimation White Paper (December 2023), 15

2.4. Accuracy

Overall **Accuracy (ACC)** is defined as the proportion of test images for which the absolute error is below a threshold, T,

$$\mathrm{ACC}(T) = 1 - \frac{1}{N}\sum_{k=1}^{N} H(\varepsilon_k - T) \tag{5}$$

where $H(x)$ is the step function

$$H(x) = \begin{cases} 0, & \text{if } x < 0 \\ 1, & \text{if } x \geq 0 \end{cases} \tag{6}$$

2.5. Inequities Across Demographic Groups

The **Gini coefficient**[2] has long been used in Economics to quantify earning or wealth inequality in a population. Here we adopt it to express variability in accuracy across M demographic groups. This has been done for biometric error rates, particularly in ISO/IEC 19795-10:2024.

$$G = \frac{\sum_{i=1}^{M}\sum_{j=1}^{M}\left|x_i - x_j\right|}{2M(M-1)\mu}, \tag{7}$$

where μ is the arithmetic mean of x. This can be applied to MAE, MDAE or any other statistic.

2.6. Challenge-T

A main application of AEV systems is in verifying that a person is above a certain legally mandated age. For example, for alcohol purchases, this age is 21 years in most United States jurisdictions. Recognizing AEV algorithms naturally have age estimation errors, systems are typically configured to require another form of age verification if the estimated age is below a challenge age, T. The value of T depends on the legal restiction age, L, and the accuracy of the age estimator. For L = 18, T = 25 is common. For L = 21, a higher value of T would be required to achieve the same accuracy.

For an evaluation of AE algorithms we seek figures of merit for the effectivess at the stated objective and for convenience for the legal population.

2.6.1. False Positive Rate

In Challenge-T applications, a false positive occurs if the true age is less than the legal age limit, L, and the estimated age is greater than or equal to the challenge age, T. The false positive rate is estimated over a set of N samples for which $a_k < L$.

$$\mathrm{FPR} = \frac{1}{N}\sum_{i} H(\hat{a}_k - T) \tag{8}$$

[2] See https://mathworld.wolfram.com/GiniCoefficient.html.

2.6.2. False Negative Rate

In Challenge-T applications, a false negative occurs when someone above the legal age is estimated to have age below the challenge age, T. The false negative rate is estimated over a set of N samples for which $a_k \geq L$.

$$\text{FNR} = 1 - \frac{1}{N} \sum_i H(\hat{a}_k - T) \tag{9}$$

2.6.3. Ineffectiveness

The **Ineffectiveness** quantifies how well the system prevents people below the legal age limit (L) from accessing the prohibited service or item. We define it in terms of how often it allows under-age persons to go unchalleneged:

$$\text{INEFFECTIVENESS}(T) = \frac{\sum_{i=0}^{\text{L}-1} w_i \; p_i \; \text{FPR}_i}{\sum_{i=0}^{\text{L}-1} w_i \; p_i} \tag{10}$$

where w_i is the proportion of the population who have age i, p_i is the likelihood that a person of age i would even try to defeat the system, and FPR_i is an empirical false positive rate for persons of age i. The denominator normalizes so that ineffectiveness represents a false positive rate residing on $[0,1]$. FPR_i is estimated as the proportion of N_i individuals whose age is estimated at or above T

$$\text{FPR}_i(T) = \frac{1}{N_i} \sum_{k=1}^{N_i} H(a_k - T) \tag{11}$$

The weights w_i should be estimated by an analyst from demographic tables. The probabilities p_i might be estimated via empiricial observation or via social modelling. For the purpose of this report we assume an exponential model for this prior probability.

$$p_i = \alpha \frac{\exp(\text{L} - 1 - i)}{\exp(\text{L} - 1)} \tag{12}$$

For example, with L = 18 and $\alpha = 0.6$ the formula says that 60% of 17-year olds would try ($p_{17} = 0.6$) but only 1.1% of 13 year olds would ($p_{13} = 0.011$). This may be pessimistic for 17 year olds in many societies but for our purpose - comparison of AEV algorithms - we do not refine this further. To do so would require some sociological study. The model is ad hoc and certainly imprecise in real operations but is used here to illustrate what a local policy analyst should adapt or replace in real operations.

Note that if false positive rates vary across sex or ethnicity, the weights could be adapted for specific populations, for example it may be known that p_i for women is less than that for men. In that case equation 11 would include double sums over doubly subscripted variables (p_{is}, FPR_{is}, etc., with s denoting sex). Extending that further we could incorporate region-of-birth measurements into the formulate via p_{isr}.

2.6.4. Inconvenience

We additionally need a metric that quantifies how well the system does not inconvenience people above the legal age L. Inconvenience occurs when they are challenged and estimated to have age below T.

$$\text{INCONVENIENCE}(T) = \frac{\sum_{i=\text{L}}^{\text{MA}} w_i \; p_i \; \text{FNR}_i}{\sum_{i=\text{L}}^{\text{MA}} w_i \; p_i} \quad (13)$$

where T is the challenge age, MA is the maximum age of persons in the population, w_i is the proportion of the population who have age i, p_i is the likelihood that a person of age i would use the system at all, and FNR_i is an empirical false negative rate for persons of age i. This is estimated as the proportion of N_i individuals whose age is estimated below T.

This formulation treats everyone at or above the legal age equally. One might argue that those of, or older than, the legal age but younger than the challange age should expect to be inconvenienced and that this should be discounted in the equation. We reject this, maintaining the existence of a challenge policy is needed because the age estimation technology is imperfect.

3. Datasets

Table 9 shows the number of photographs and people in the datasets used in this report.

Name	Visa	Mugshots	Application	Border	Kalina Everyday
Section	3.1	3.2	3.3	3.4	3.5
DOB Precision	YYYY-MM-DD	YYYY	YYYY-MM-DD	YYYY-MM-DD	YYYY-MM-DD
Age Precision	YYYY-MM-DD	YYYY	YYYY-MM-DD	YYYY-MM-DD	YYYY-MM-DD
Age Range	0-99	18-99	14-98	14-91	20-21, 28-34, 42-43
Num. Images	6 249 294	1 482 667	1 054 704	2 715 230	1 991
Num. People	5 738 091	1 482 667	802 332	632 520	1
Purpose	Exact repeat of 2014 study	AE accuracy on standard photos	Challenge-T and demographics	Effect of of quality	Longitudinal demonstration

Table 9. *Properties of the datasets.*

3.1. Visa Images

These images were used in the NIST 2014 Performance of Automated Age Estimation Algorithms[10] study. The images are of size 252x300 pixels. The mean interocular distance(IOD) is 69 pixels. The images are of subjects who applied for visas in United States consular facilities in Mexico. Many of the images are live capture. A minority of the images are photographs of paper photographs. When these images are passed to the algorithm, they are labeled with type “iso”.

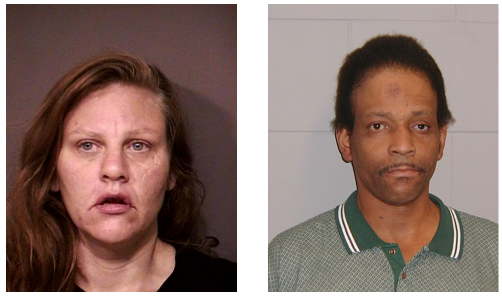


Fig. 4. Examples of mugshot images used in the evaluation. Image source: NIST Special Database 32: Multiple Encounter Deceased Subjects (MEDS).

3.2. Mugshot Images

The images are collected in the United States in routine post-arrest booking processes. While the images are accompanied by one of five race labels specified in an EBTS standard[3] we don't use them as they are unreliable. These images have reasonable compliance with the ANSI/NIST ITL 1-2011 Type 10 standard's subject acquisition profiles levels 10-20 for frontal images[11]. As shown in Figure 4 the images are of visually good quality, mostly sharp and well exposed per the standardized photographic equipment specified for their capture. The most common departure from standard requirements is the presence of mild pose variations around frontal. The images vary in size, with many being 480x600 pixels. They are JPEG compressed to produce filesizes of between 18 and 36 kilobytes. When these images are provided as input into the algorithm, they are labeled with the type "mugshot".

3.3. Application Images

The images are collected in an attended interview in immigration offices in the United States. The dataset is from a global population born in more than 100 countries, but for this study we use only those images from 34 countries grouped into six regions - see 5.4. The images are collected using dedicated capture equipment and lighting. They have a uniform, usually white background. As shown in Figure 5, the images have geometry in good conformance with the ISO/IEC19794-5 Full Frontal image type, pose is closely frontal, and eyeglasses are absent. The images, of size 300x300 pixels, are smaller than normally indicated by ISO. When these images are passed to an algorithm, they are labeled with the type "iso".

[3] This standard is published by the Criminal Justice Information Services (CJIS) Division of the Federal Bureau of Investigation in the United States Department of Justice. It defines data records for transactions that (law enforcement) agencies can make with the FBI. Version 10.0.7 of the standard was published on December 5, 2016. See https://www.fbibiospecs.cjis.gov.

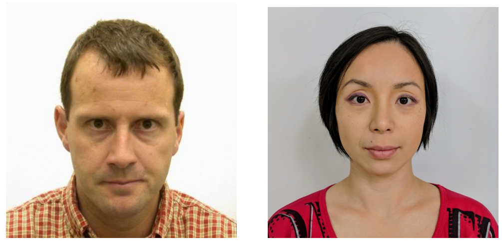


Fig. 5. *The figure gives simulated samples of application type image used in the evaluation. Image sources: Authors.*

3.4. Border Crossing Images

These images are taken with a webcam oriented by an immigration officer toward a cooperating subject - see the examples in Figure 6. The images are captured under time constraints, so roll, pitch and yaw often depart from frontal presentation, not exceeding ± 45 degrees. Images sometimes have moderate contrast because the background can be bright. This can lead to an under-exposed face. Resolution is limited by the use of inexpensive cameras, compression, and resizing to 240 x 300 pixels. The images have mean interocular distance of 38 pixels. We excluded images for which a leading face recognition engine found more than one face (typically from someone standing in the background). When these images are passed to an algorithm, they are labeled with the type "wild".

Fig. 6. *The figure gives simulated samples of border type images used in the evaluation. The ages are 18yr 4mo, 41yr 3mo, and 52yr 2mo. Image sources: Author (right) and NIST Special Database 32 the Multiple Encounter Deceased Subjects dataset.*

3.5. Kalina Everyday

The artist Noah Kalina has collected a self portrait every day since 2000. NIST purchased twelve months of photos for the years 2001 and 2023, and photos from January to June for each year 2009, 2010, 2011, 2012, 2013, 2014, and 2015. The images are attractive for longitudinal studies of age estimation (and face recognition), because they are collected with a fixed two-handed selfie technique. They therefore exhibit very little difference in head orientation, distance to camera, and margin around the head. The main sources of day-to-day variation are hairstyle and illumination. Also, the artist appears in various locations, so the backgrounds differ. All photos from 2001 have size 640x480, and all other years are 2816x2112. When these images are provided as input into the algorithm, they are labeled with the type "mugshot".

4. Algorithms

The FATE activity is open to participation worldwide, and the test will evaluate submissions on an ongoing basis. There is no charge to participate. The requirements to submit algorithms to NIST are described in the FATE Age Estimation And Verification Application Programming Interface (API)[12] document. Participants provide their submissions in the form of libraries compiled on a specific Linux kernel, which are linked against NIST's test harness to produce executables. NIST provides a validation package to participants to ensure that NIST's execution of submitted libraries produces the expected output on NIST's test machines.

Table 10. *Participant location, organization name, algorithm name, and submission date.*

	Location	Developer Name	Algorithm	Submission Date
1	DE	Dermalog	dermalog-001	2023-11-02
2	US	Incode Technologies Inc	incode-000	2023-09-05
3	LT	Neurotechnology	neurotechnology-000	2023-10-17
4	US	ROC	roc-000	2023-11-03
5	FR	Unissey	unissey-001	2023-09-19
6	GB	Yoti	yoti-001	2023-09-19

This report documents the results of algorithms submitted to FATE AEV for testing. Table 10 lists the algorithms that were tested.

Table 11. *Algorithm resources: The size of the algorithm (the models + the libraries); the median duration (in milliseconds) for AE function calls. Timing was conducted over 1000 function invocations with an input image of 640x480 pixels.*

	MB		Millisecs		
Algorithm	**Config**	**Lib**	**Estimate Age (One Media)**	**Verify Age (One Media)**	**Integer Age Estimates**
dermalog-001	0.00	187.52	26.70	30.86	Yes
incode-000	457.10	40.46	235.54	242.18	No
neurotechnology-000	113.42	95.91	153.18	156.60	Yes
roc-000	0.00	473.82	134.15	134.08	No
unissey-001	0.00	952.42	113.34	117.91	Yes
yoti-001	226.95	428.53	267.86	257.46	No

Table 11 gives technical information about the algorithms. Column two shows the size of static read-only data provided with the algorithms. FATE AEV is a black-box evaluation, so we don't know and don't inquire as to what this data is. It typically includes small configuration files and much larger deep neural network (DNN) model files for face detection and age estimation. Some developers (e.g. roc) include such data in the libraries contained in the "lib" directory whose size is noted in column three. The fourth and fifth columns note execution duration for a call to the age estimation function and age verification funcion, that accepts in-memory image data and produced an estimated age value, and true/false decision. The timing is measured by calling high-resolution C++ std::chrono timers immdiately before and after the function call. Timing is measured over 1000 images of size 640x480 pixels. Duration is measured on one core of a server-class Intel chip running in a machine that is otherwise idle. The final column notes whether age estimates are continuous (fractional parts of a year) or discrete (integer number of years).

Integer age estimates will imply increased MAE for those datasets where fractional actual age information is available.

Note the duration varies by an order of magnitude; the total size of the config and lib directory varies by about a factor of five - which may have relevance to the use of these algorithms on embedded or low-powered devices.

5. Results

The following subsections address accuracy gains since 2014, comparative accuracy, Challenge-T performance, demographics, and the effect of quality.

5.1. Age Estimation Improvements Since 2014

We measure algorithmic accuracy gains since 2014 by running the 2024 algorithms on the exact dataset used in 2014[4]. This set consists of 6.2 million *Visa* images with about 5.7 million people collected in Mexico with ages spanning 0 to 100.

Figure 7 shows the proportion of images estimated to have error less than the number of years given on the horizontal axis. The 2014 algorithms are shown with dotted lines, recent entries with solid lines. Table 12 shows the top-performing algorithm on this dataset, Incode-000, has a reduction of 1.19 years in mean absolute error (MAE) compared to the leader from 2014, Cognitec-001. Three other performance variables improve also. Only one algorithm is inferior.

Figure 8 shows the same gain in MAE and the proportion of images whose age estimate is better than the best 2014 algorithm. That proportion is never larger than 61%. This result implies a degree of randomness - an improved algorithm doesn't always give better estimates.

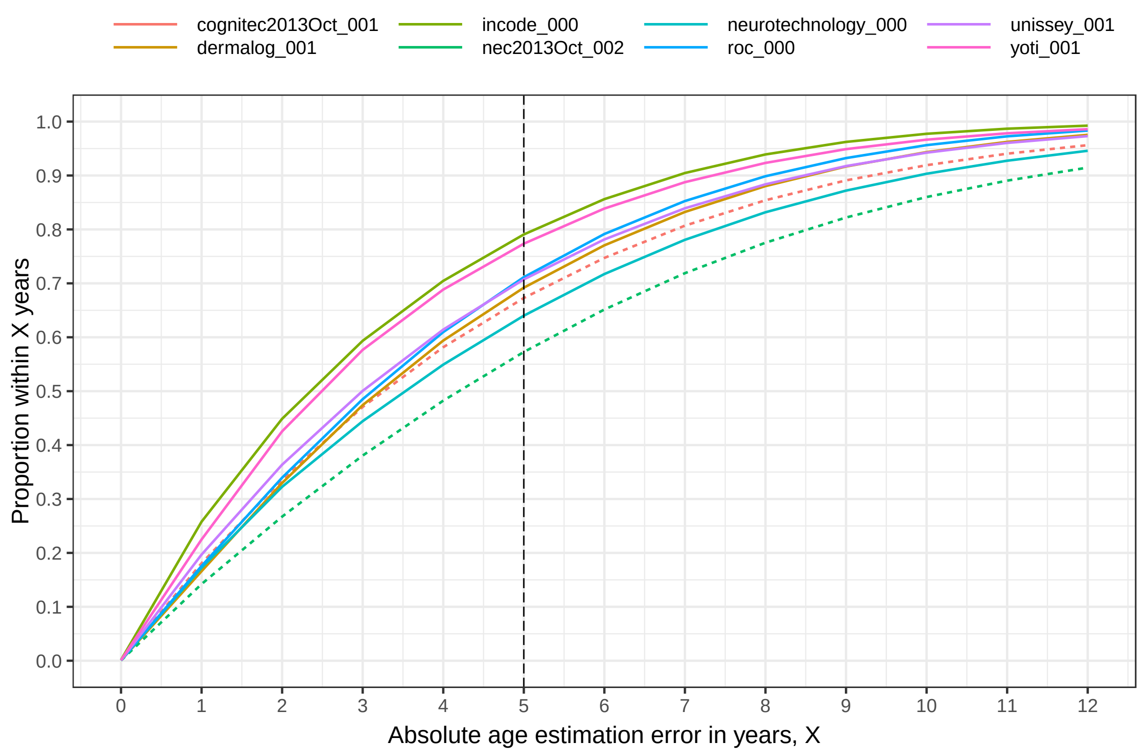


Fig. 7. *This plot shows the accuracy of the 2024 algorithms compared against two top-performing 2014 algorithms. The lines plot cumulative accuracy at absolute age estimation error levels. Results were generated with the 6 172 425 images of the Mexican visa population.*

[4] See NIST Interagency Report 7995.

Table 12. *Age estimation error statistics for the 2024 algorithms and the two most accurate algorithms from 2014 (in red). The values are mean and median absolute error (MAE, MDAE), standard deviation of the abs. error (SD), and mean error (ME). Dataset is the Mexican visa sample. MAE, MDAE, SD values are lower the better. ME values closer to zero the better, positive values are overestimate and negative values are underestimate.*

Algorithm	MAE	MDAE	ME	SD
incode-000	3.08	2.33	1.48	2.74
yoti-001	3.30	2.46	1.74	2.95
unissey-001	3.87	3.00	0.87	3.35
roc-000	3.81	3.12	2.64	3.05
dermalog-001	4.01	3.21	2.46	3.29
cognitec2013Oct-001	4.27	3.25	0.30	3.86
neurotechnology-000	4.54	3.52	-0.19	3.96
nec2013Oct-002	5.32	4.19	0.31	4.61

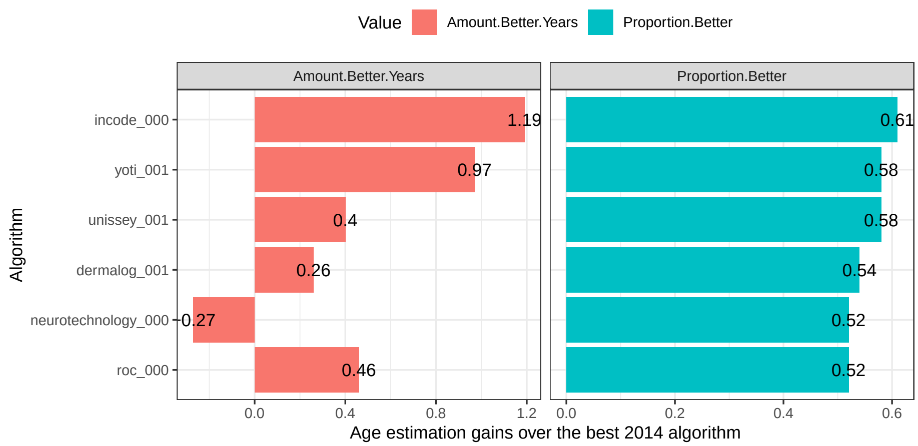


Fig. 8. *For 2024 algorithms, the right panel shows the fraction of images that have better accuracy estimates than the best-performing algorithm in our 2014 report (Cognitec-001 submitted to NIST 2013-10). The left panel shows the mean reduction in absolute age estimation error - negative values show worse performance now than in 2014. These results were generated over a consensus set of 6 166 298 images for which all algorithms returned an age estimate.*

5.2. Comparing Algorithms

The prior section gives a ranking of algorithms on one dataset. We consider here three different datasets. Table 13 summarizes the mean age absolute error (MAE) for men and women, in three age groups, and in three datasets.

The table also includes the failure-to-process rate (FTP). FTP is uniformly very low, meaning the algorithms are able to process almost all photographs. Some algorithms may include a quality filter to electively decline to process images that the algorithm considers not suitable for AE. Low FTP is likely a product of face detection algorithms today that have very low false negative rates on cooperative datasets such as these. Note also it is a characteristic of deep neural networks to operate on *any* array of input pixels regardless of their semantic content.

Table 13. *By sex, mean absolute error (MAE), and failure to process proportion (FTP) for three age bands. Lower values are better.*

			Ages 18-30		Ages 31-50		Ages 51-80	
			Female	Male	Female	Male	Female	Male
Algorithm	Dataset	FTP	MAE	MAE	MAE	MAE	MAE	MAE
dermalog-001	Mugshot	0.001	4.4	3.6	4.7	4.3	5.2	4.7
dermalog-001	Application	0.000	3.6	3.1	4.5	4.3	5.6	4.8
dermalog-001	Border	0.000	4.3	4.3	4.1	3.9	5.4	4.5
incode-000	Mugshot	0.000	3.6	2.6	3.5	3.1	3.7	3.9
incode-000	Application	0.000	3.3	2.7	3.5	3.2	3.5	3.6
incode-000	Border	0.001	4.8	4.3	4.5	4.1	4.8	4.3
neurotechnology-000	Mugshot	0.000	3.7	3.4	5.8	4.6	6.8	5.5
neurotechnology-000	Application	0.000	3.8	3.4	7.9	5.7	9.0	7.1
neurotechnology-000	Border	0.001	4.3	3.4	8.9	6.3	10.6	7.5
roc-000	Mugshot	0.000	3.0	2.5	3.9	3.2	4.4	3.8
roc-000	Application	0.000	3.6	3.4	3.8	3.2	4.2	3.9
roc-000	Border	0.001	3.9	3.8	4.2	3.4	4.8	4.3
unissey-001	Mugshot	0.000	4.3	3.6	6.3	4.8	6.0	5.3
unissey-001	Application	0.000	3.9	3.7	5.0	4.2	6.1	5.8
unissey-001	Border	0.001	4.1	3.4	7.1	5.8	8.4	7.2
yoti-001	Mugshot	0.002	3.8	2.4	3.9	3.4	3.7	3.7
yoti-001	Application	0.000	4.7	3.2	3.8	3.2	3.8	3.5
yoti-001	Border	0.003	5.2	4.1	4.8	4.0	5.1	4.2

The table shows MAE trending higher with age group, reflecting wider variation in the amount of ageing evidence in human faces. This effect is much larger in some algorithms, perhaps reflecting commercial focus on AE estimation in younger subjects, and is absent for one algorithm (yoti-001) operating on women. MAE is often highest in the lower quality *Border* image dataset, and lowest in the *Application* photos. There are exceptions and these observations are overlaid by a higher MAE in women than in men that applies to all algorithms, all datasets and both age groups. The lowest MAE values are 2.4 and 2.5 years from yoti-001 and roc-000 operating on *Mugshot* photos of men, age 18-30. The incode-001 algorithm achieves 2.7 years on *Application* photos.

5.3. Challenge Age Analysis

A primary application of AEV technology is in preventing underage subjects from accessing alcohol, cigarettes, and adult content. Given some legal restriction age L[5], AE is applied with a threshold age T, which is necessarily larger than L, with a supplemental challenge process being applied to anyone whose age estimate is below T. The difference $T-L$ is sometimes termed the buffer size. For $L = 18$ a seven year buffer is conventional, so $T = 25$ is typical. A false positive occurs if a person of age below L is estimated to have age at or above T. A false negative occurs if a person of age at or above L is estimated to have age below T. This is formalized in section 2. Smaller T values are desirable, because they imply lower false negative rates (FNR). Smaller T values are sustainable only if false positive rates (FPR) remain low enough to meet some policy-driven criterion.

To mimic a Challenge-25 application, Table 14 shows FPR for persons aged 14-17 who are estimated to have age at or above 25. The sample is from the global traveler population. Likewise Table 15 shows FPR for persons aged 14-20 who are estimated to have age at or above 28. The *Mugshot* entries are estimated from persons aged 18-20.

Table 14. *False positive rate (FPR) and mean absolute error (MAE) for persons 14-17 estimated at 25 or more. Border photos have inferior quality to the application photos. Lower values are better.*

		Male		Female	
Algorithm	**Data**	**FPR**	**MAE**	**FPR**	**MAE**
dermalog-001	Border	0.166	4.3	0.283	5.9
dermalog-001	Application	0.051	3.6	0.112	4.7
incode-000	Border	0.065	2.9	0.177	4.8
incode-000	Application	0.006	1.8	0.033	2.6
neurotechnology-000	Border	0.182	5.7	0.128	4.7
neurotechnology-000	Application	0.248	6.3	0.178	5.4
roc-000	Border	0.089	4.9	0.144	5.3
roc-000	Application	0.041	4.2	0.073	4.6
unissey-001	Border	0.080	3.1	0.106	3.5
unissey-001	Application	0.107	3.4	0.127	3.7
yoti-001	Border	0.103	3.4	0.196	5.0
yoti-001	Application	0.012	1.7	0.090	3.4

[5] For example, L = 18 for alcohol and cigarettes in the United Kingdom, and L = 21 in most jurisdictions in the United States.

Table 15. *False positive rate (FPR) and mean absolute error (MAE) for persons 14-20 estimated at 28 or more. Border photos have inferior quality to the mugshot and application photos. The mugshots are from people 18-20. Lower values are better.*

		Male		Female	
Algorithm	**Data**	**FPR**	**MAE**	**FPR**	**MAE**
dermalog-001	Mugshot	0.069	3.7	0.123	4.5
dermalog-001	Border	0.147	4.8	0.211	5.9
dermalog-001	Application	0.034	3.4	0.069	4.2
incode-000	Mugshot	0.010	1.9	0.048	3.1
incode-000	Border	0.061	3.1	0.138	4.8
incode-000	Application	0.008	2.0	0.027	2.9
neurotechnology-000	Mugshot	0.083	4.3	0.106	4.7
neurotechnology-000	Border	0.070	4.9	0.047	4.0
neurotechnology-000	Application	0.101	5.6	0.057	4.6
roc-000	Mugshot	0.010	2.0	0.026	2.7
roc-000	Border	0.058	4.4	0.093	4.7
roc-000	Application	0.030	3.8	0.049	4.1
unissey-001	Mugshot	0.064	2.9	0.082	3.2
unissey-001	Border	0.050	3.1	0.060	3.4
unissey-001	Application	0.091	3.7	0.092	3.8
yoti-001	Mugshot	0.007	1.8	0.057	3.2
yoti-001	Border	0.081	4.0	0.168	5.4
yoti-001	Application	0.017	2.3	0.093	4.1

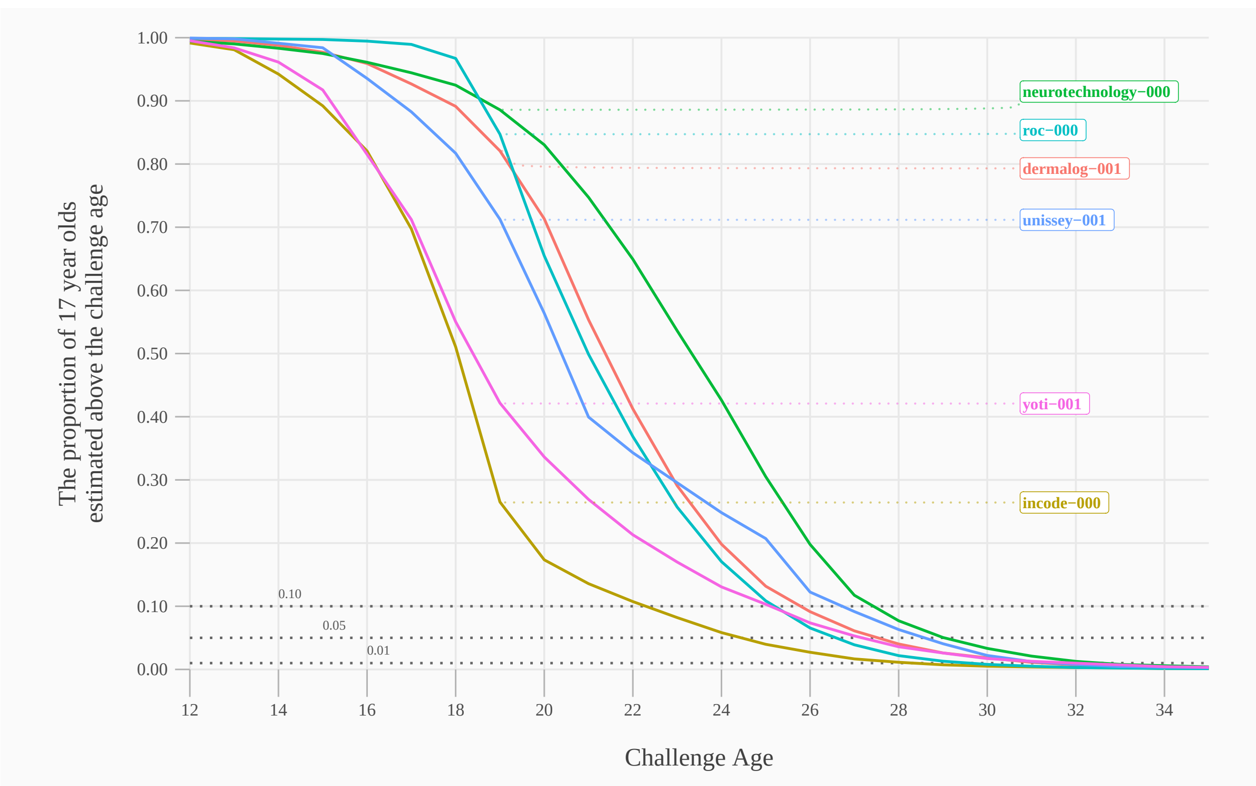


Fig. 9. *The proportion of 17 year olds whose age is estimated as at or above the given challenge age. The Application images are of subjects from the set of countries used in the demographics analysis.*

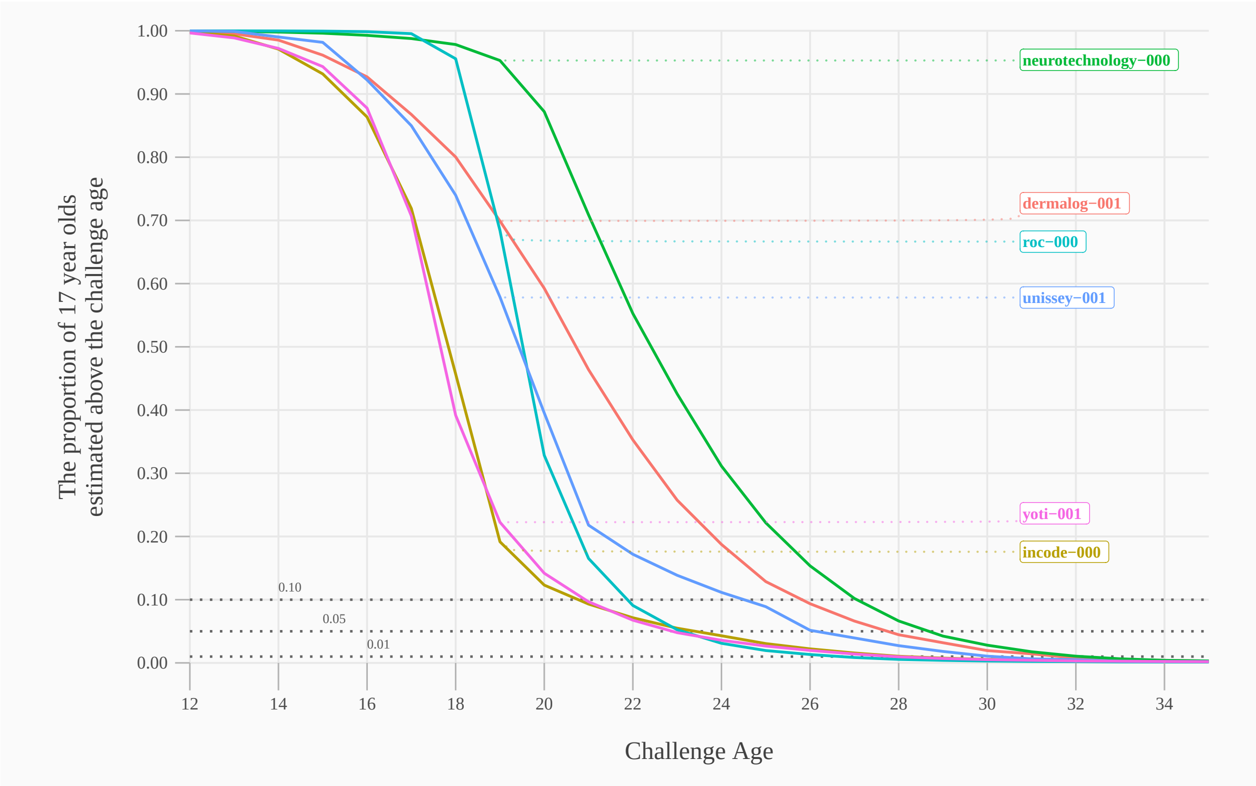


Fig. 10. *The proportion of 17 year olds whose age is estimated as at or above the given challenge age. The Mugshot images are of subjects from the set of countries used in the demographics analysis.*

The seven-year buffer has been adopted operationally (L = 18, T = 25). It would usually be useful, if FPR objectives can be met, to reduce the T value to give improved false negative rates. We consider this in two ways. First in Figures 9 and 10 we plot for 17 year olds FPR against challenge age, T. The curves vary by algorithm, and decline monotonically with challenge age T. We also show, in Table 16, the T value needed to achieve three particular FPR objectives, 10%, 5% and 1% for 17 year olds. The results improve for younger persons. The *Application* images are from a global population so the results are dependent on the underlying demographic-specific FPR values documented in the next section. The *Mugshot* images are from a domestic population, 72% of which are men.

While a rough model of this change is shift invariant FPR(A, T) ≈ FPR(A+k, T+k) meaning we'd expect similar FPR for Age-18-Challenge-25 as we would for Age-21-Challenge-28, it only holds approximately so empirical measurements should be preferred.

Table 16. *For Application images, challenge ages need to attain FPR below that specified, by actual age.*

	FPR = 0.10						FPR = 0.05						FPR = 0.01					
Algorithm	15	16	17	18	19	20	15	16	17	18	19	20	15	16	17	18	19	20
dermalog-001	25	25	26	27	28	29	26	27	28	28	30	30	30	31	32	32	33	34
incode-000	19	21	23	24	25	27	21	23	25	26	27	28	25	28	29	29	31	32
neurotechnology-000	27	27	28	28	29	29	28	29	30	30	30	31	32	32	33	33	33	34
roc-000	24	25	26	26	27	28	25	26	27	28	29	30	28	29	30	31	32	33
unissey-001	25	26	27	28	29	30	26	28	29	30	30	31	30	31	32	32	33	35
yoti-001	21	24	26	27	28	29	24	26	28	28	30	31	29	30	32	33	35	36

5.3.1. Age Verification vs. Age Estimation

Our API includes an age estimation function returning a continuous valued age *and* an age verification function returning a boolean value indicating whether the subject is above an age limit. This latter function is included to allow developers to build and submit a dedicated classifier for particular age thresholds.

Table 17 shows that five developers implemented the function by simply calling the general purpose age estimation function and return TRUE if the age is at or above the input threshold. One developer, Unissey, implemented the age verification function returning true if the age is above (not at-or-above) the challenge age; this matters because their AE algorithm only returns integer age estimates. So that the FPR value shown for their AV function is actually that for challenge-26 not challenge-25.

In conclusion, we do not have any evidence (yet) that an age-verification classifier can outperform a regression-like estimator on the same task.

Table 17. *Compare false positive rate (FPR) for AE and AV for persons 14-17 estimated at 25 or more. Border photos have inferior quality to the application photos. Lower values are better.*

		AE-FPR		AV-FPR	
Algorithm	**Data**	**Male**	**Female**	**Male**	**Female**
dermalog-001	Border	0.166	0.283	0.166	0.283
dermalog-001	Application	0.051	0.112	0.051	0.112
incode-000	Border	0.065	0.177	0.065	0.177
incode-000	Application	0.006	0.033	0.006	0.033
neurotechnology-000	Border	0.182	0.128	0.182	0.128
neurotechnology-000	Application	0.248	0.178	0.248	0.178
roc-000	Border	0.089	0.144	0.089	0.144
roc-000	Application	0.041	0.073	0.041	0.073
unissey-001	Border	0.080	0.106	0.044	0.060
unissey-001	Application	0.107	0.127	0.061	0.074
yoti-001	Border	0.103	0.196	0.103	0.196
yoti-001	Application	0.012	0.090	0.012	0.089

5.4. Demographic Analysis

The demographic analysis of race in this report is enabled by using country-of-birth as a proxy for ethnicity. We employ only those countries for which birth is a more or less reliable indication of ethnicity as discussed below. To increase sample sizes, and reduce the verbosity and complexity of our results tables, we group countries into regions as follows:

- ▷ **East Africa:** Ethiopia, Kenya, Somalia, Sudan, Tanzania
- ▷ **West Africa:** Nigeria, Liberia, Sierra Leone, Benin, Ghana, Mali, Senegal, Togo
- ▷ **East Europe:** Poland, Ukraine, Russia, Hungary, Romania, Czechia
- ▷ **East Asia:** Korea, China, Japan, Taiwan
- ▷ **South East Asia:** Cambodia, Indonesia, Malaysia, Thailand, Vietnam
- ▷ **South Asia:** Afghanistan, India, Myanmar, Nepal, Pakistan, Bangladesh

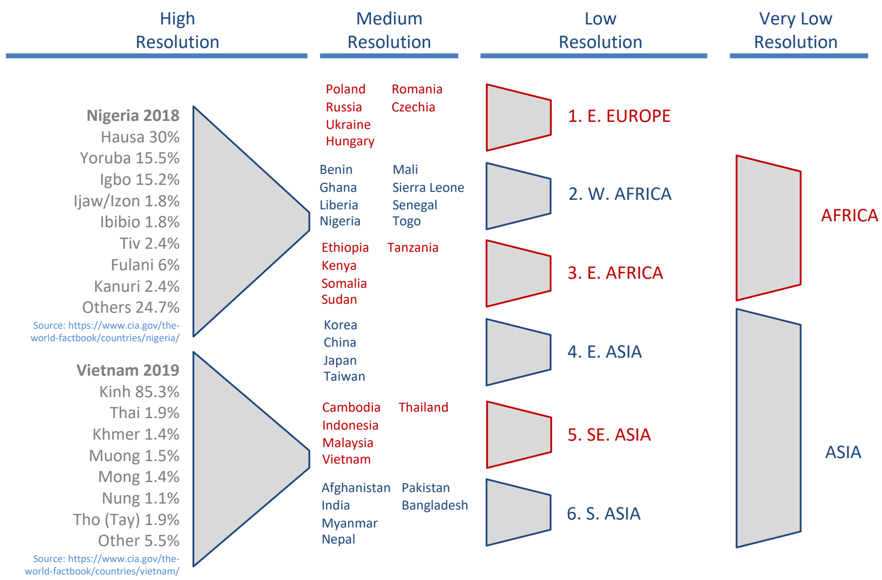


Fig. 11. *Countries and regions used in quantifying demographic dependence on race. The fine-grained or local ethnicities shown at left are not available to us. The rightmost grouping is possible but not useful.*

Our use of proxy is imperfect in two ways. First, it ignores local ethnic variations: As discussed in Figure 11 our country labels are a lower "resolution" indication of ethnicity than the local ethnicities shown for Nigeria and Vietnam as examples. Our metadata does not include local information, only country-of-birth. Our region labels are, in-turn, an even lower resolution indication of ethnicity. If we find that age estimation accuracy shows region-of-birth dependence, then it would suggest country-level analysis is warranted. Second, some part of a population will have trans-national ancestry. This is probably not problematic if that proportion is low relative to inter-country variability in AEV accuracy. For this reason, we ignore countries where there has been considerable transcontinental immigration, such as the United Kingdom, France, and the United States.

Country-of-birth information has obvious operational relevance to deployment. But a higher goal would be to understand the effect of phenotypes which are a large set of features evident in a face such as high cheek bones, aquiline nose, prominent eye brows, and skin tone. Skin tone, which is just one of those phenotypes, is sometimes considered synonymous with race, has been shown to be related to recognition false negative rates due to photography difficulties. However, for many face recognition algorithms, false positive rates vary with country-of-birth independent of skin tone e.g., they are higher in West Africa *and* China. This is considered to be an effect of under-representation of certain ethnicities in the algorithm training data.

5.4.1. Fitzpatrick Skin Type

We do not use the Fitzpatrick skin type (FST)[13]. It was designed as dermatological statement of photosensitivity (sun-burn) but in recent years has been appropriated by AI researchers as a ready means of quantifying racial sensitivity of algorithms. This is far from sufficient and problematic for three reasons. First, Fitzpatrick types are not an accurate measure of skin pigmentation[14]. Second, FST was orginally to be determined by a dermatological examination - recovery from a digital image is imprecise because the spectrum of the illuminant is usually unknown, and the settings of the camera and display device matter[15]. Finally, and most importantly, skin tone is but one phenotype accessible by AI algorithms extracting information from photographs of skin [16]. Deep neural networks for age estimation and other operations should be expected to find information that minimizes the cost function specified by the staff training the algorithm. A researcher would want to know whether hard tissue (e.g. high cheek bones, square jaws, aquiline noses) and soft tissue phenotypes (lips, eyelids, freckles) impact the cost function. For a summary of the issues see this presentation [17], and note slide 14 which shows intra-person variability of skin color in photographs.

We did not attempt to recover FST from our test photographs.

Table 18. *For Application images, Challenge-25 FPR, by region of birth and sex. The final columns indicate the groups that give the highest and lowest FPR and the Gini summary of variability. Gini is computed over the 12 FPR values to its left; lower values are better.*

Algorithm	Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Accept	min Accept	Gini
dermalog-001	16	0.10 ± 0.03	0.10 ± 0.02	0.21 ± 0.04	0.16 ± 0.02	0.16 ± 0.04	0.06 ± 0.03	0.05 ± 0.02	0.05 ± 0.01	0.04 ± 0.02	0.10 ± 0.02	0.08 ± 0.03	0.04 ± 0.02	E Europe F	W Africa M	0.32
dermalog-001	17	0.13 ± 0.03	0.14 ± 0.02	0.31 ± 0.05	0.24 ± 0.03	0.20 ± 0.04	0.07 ± 0.02	0.10 ± 0.03	0.07 ± 0.01	0.04 ± 0.02	0.12 ± 0.02	0.10 ± 0.03	0.09 ± 0.03	E Europe F	E Europe M	0.33
dermalog-001	18	0.13 ± 0.03	0.16 ± 0.02	0.27 ± 0.04	0.25 ± 0.02	0.20 ± 0.03	0.12 ± 0.03	0.13 ± 0.03	0.072 ± 0.010	0.05 ± 0.02	0.18 ± 0.02	0.10 ± 0.02	0.14 ± 0.04	E Europe F	E Europe M	0.26
incode-000	16	0.08 ± 0.03	0.026 ± 0.009	0.04 ± 0.02	0.03 ± 0.01	0.05 ± 0.02	0.09 ± 0.03	0.03 ± 0.02	0.002 ± 0.002	0.006 ± 0.006	0.004 ± 0.003	0.006 ± 0.006	0.01 ± 0.01	W Africa F	E Asia M	0.52
incode-000	17	0.11 ± 0.03	0.05 ± 0.01	0.07 ± 0.03	0.06 ± 0.02	0.06 ± 0.02	0.11 ± 0.03	0.02 ± 0.01	0.006 ± 0.004	0.003 ± 0.003	0.017 ± 0.007	0.01 ± 0.01	0.05 ± 0.02	E Africa F	E Europe M	0.46
incode-000	18	0.15 ± 0.03	0.07 ± 0.01	0.08 ± 0.02	0.08 ± 0.01	0.09 ± 0.02	0.13 ± 0.03	0.04 ± 0.01	0.013 ± 0.004	0.013 ± 0.007	0.023 ± 0.006	0.015 ± 0.008	0.06 ± 0.02	E Africa F	E Europe M	0.42
neurotechnology-000	16	0.31 ± 0.05	0.20 ± 0.02	0.08 ± 0.03	0.10 ± 0.02	0.16 ± 0.04	0.59 ± 0.06	0.66 ± 0.05	0.29 ± 0.02	0.03 ± 0.01	0.14 ± 0.02	0.19 ± 0.04	0.76 ± 0.06	W Africa M	E Europe M	0.47
neurotechnology-000	17	0.39 ± 0.05	0.24 ± 0.02	0.12 ± 0.03	0.13 ± 0.02	0.21 ± 0.04	0.64 ± 0.05	0.76 ± 0.05	0.36 ± 0.02	0.06 ± 0.02	0.20 ± 0.02	0.28 ± 0.05	0.84 ± 0.04	W Africa M	E Europe M	0.41
neurotechnology-000	18	0.40 ± 0.04	0.26 ± 0.02	0.13 ± 0.03	0.14 ± 0.02	0.23 ± 0.03	0.66 ± 0.04	0.77 ± 0.04	0.41 ± 0.02	0.10 ± 0.02	0.27 ± 0.02	0.34 ± 0.04	0.85 ± 0.03	W Africa M	E Europe M	0.38
roc-000	16	0.11 ± 0.03	0.14 ± 0.02	0.005 ± 0.005	0.03 ± 0.01	0.11 ± 0.03	0.14 ± 0.04	0.05 ± 0.02	0.06 ± 0.01	0.003 ± 0.003	0.018 ± 0.009	0.05 ± 0.02	0.05 ± 0.03	W Africa F	E Europe M	0.45
roc-000	17	0.18 ± 0.04	0.17 ± 0.02	0.02 ± 0.01	0.07 ± 0.01	0.13 ± 0.03	0.22 ± 0.04	0.07 ± 0.03	0.12 ± 0.02	0.000 ± 0.000	0.04 ± 0.01	0.11 ± 0.03	0.11 ± 0.03	W Africa F	E Europe M	0.38
roc-000	18	0.19 ± 0.03	0.22 ± 0.02	0.05 ± 0.02	0.07 ± 0.01	0.20 ± 0.03	0.26 ± 0.04	0.13 ± 0.03	0.17 ± 0.02	0.007 ± 0.005	0.07 ± 0.01	0.14 ± 0.02	0.15 ± 0.03	W Africa F	E Europe M	0.33
unissey-001	16	0.12 ± 0.03	0.19 ± 0.02	0.10 ± 0.03	0.10 ± 0.02	0.16 ± 0.04	0.19 ± 0.05	0.11 ± 0.03	0.17 ± 0.02	0.05 ± 0.02	0.10 ± 0.02	0.17 ± 0.04	0.08 ± 0.04	E Asia F	E Europe M	0.21
unissey-001	17	0.17 ± 0.04	0.26 ± 0.02	0.19 ± 0.04	0.15 ± 0.02	0.21 ± 0.04	0.29 ± 0.05	0.20 ± 0.04	0.26 ± 0.02	0.04 ± 0.02	0.15 ± 0.02	0.23 ± 0.04	0.14 ± 0.04	W Africa F	E Europe M	0.20
unissey-001	18	0.22 ± 0.03	0.32 ± 0.02	0.22 ± 0.03	0.18 ± 0.02	0.24 ± 0.03	0.32 ± 0.04	0.27 ± 0.03	0.32 ± 0.02	0.12 ± 0.03	0.26 ± 0.02	0.28 ± 0.03	0.25 ± 0.04	E Asia F	E Europe M	0.14
yoti-001	16	0.13 ± 0.03	0.08 ± 0.01	0.11 ± 0.03	0.12 ± 0.02	0.15 ± 0.04	0.17 ± 0.05	0.02 ± 0.01	0.010 ± 0.005	0.003 ± 0.003	0.006 ± 0.004	0.003 ± 0.003	0.02 ± 0.02	W Africa F	S E Asia M	0.54
yoti-001	17	0.18 ± 0.04	0.14 ± 0.02	0.19 ± 0.04	0.21 ± 0.03	0.18 ± 0.04	0.24 ± 0.05	0.02 ± 0.01	0.036 ± 0.009	0.003 ± 0.003	0.021 ± 0.008	0.02 ± 0.01	0.08 ± 0.03	W Africa F	E Europe M	0.46
yoti-001	18	0.23 ± 0.03	0.19 ± 0.02	0.26 ± 0.04	0.25 ± 0.02	0.26 ± 0.03	0.32 ± 0.04	0.07 ± 0.02	0.059 ± 0.010	0.03 ± 0.01	0.04 ± 0.01	0.04 ± 0.01	0.10 ± 0.03	W Africa F	E Europe M	0.40

5.4.2. Empirical results

Using sex and region-of-birth metadata, Table 18 shows dependence of Challenge-25 false positive rates on twelve demographic groups. The images are higher quality office application portraits. Expanded information is given in Appendix A.3 which includes Tables 33 to 44 showing Challenge-25 false positive rates for ages 14-34, both sexes, six regions of birth and all algorithms.

Each tabulated data point is computed from hundreds or thousands of images. For 17 year olds, the largest group is East Asian men with 1563 images and the smallest group is 316 West African men. For 18 year olds those numbers rise to 2269 and 420. The uncertainty estimates reflect this; they are computed by bootstrapping 1000 times and computing the interval that gives 95% coverage of the FPR values i.e. quantile (0.025,0.975).

For 16-18 year olds, general accuracy trends are few but we see FPR varies substantially with algorithm, sex, and region of birth. Generally, FPR is higher in women, but the degree is quite strongly algorithm dependent, and for unissey-001 men usually have higher FPR. We expect performance variations to be algorithm-specific, because 1) AI-based models are widely held to underperform on demographic groups that are under-represented in the training data and 2) algorithms are usually trained on image sets curated or owned by the developer.

Figures 12- 23 give one summary of those tables by showing the groups that have worst- and best-case overall mean error for all true age values from 14 to 45. Figures are included for *Application* and *Border* images, both on one page. The figures include both positive and negative errors, positive corresponding to overestimation of age by an algorithm, and negative stating underestimation. A smaller magnitude of error is better. The images are application-type images.

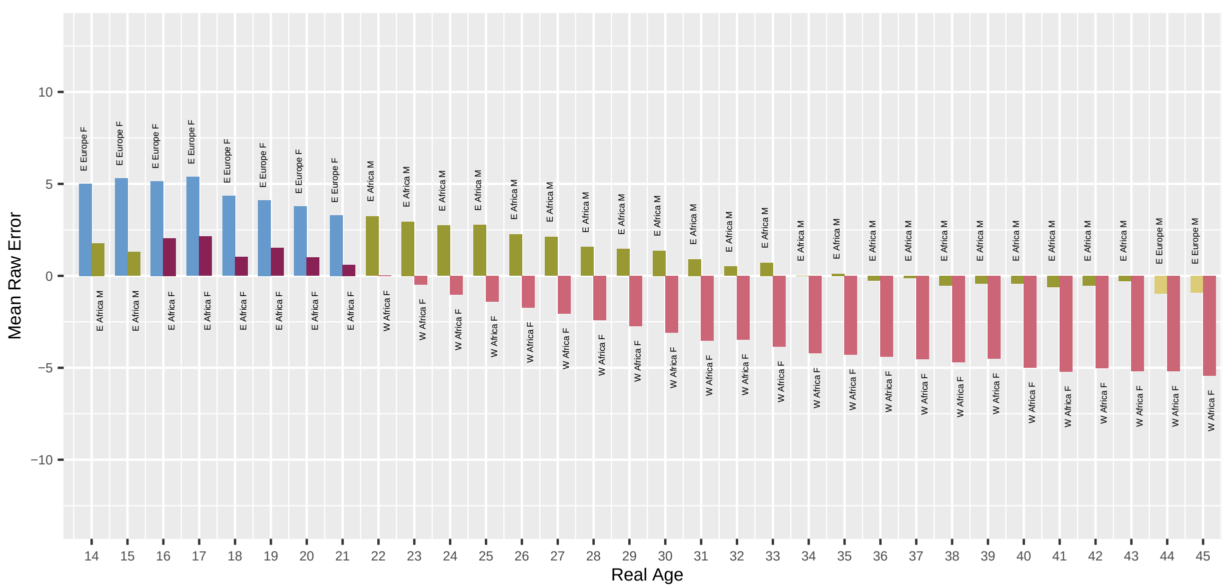


Fig. 12. *For algorithm dermalog-001 applied to Application photos, the bar chart shows which demographic groups have the highest and lowest mean age estimation error, by age. Values closer to zero are better. Positive values are overestimate and negative values are underestimate.*

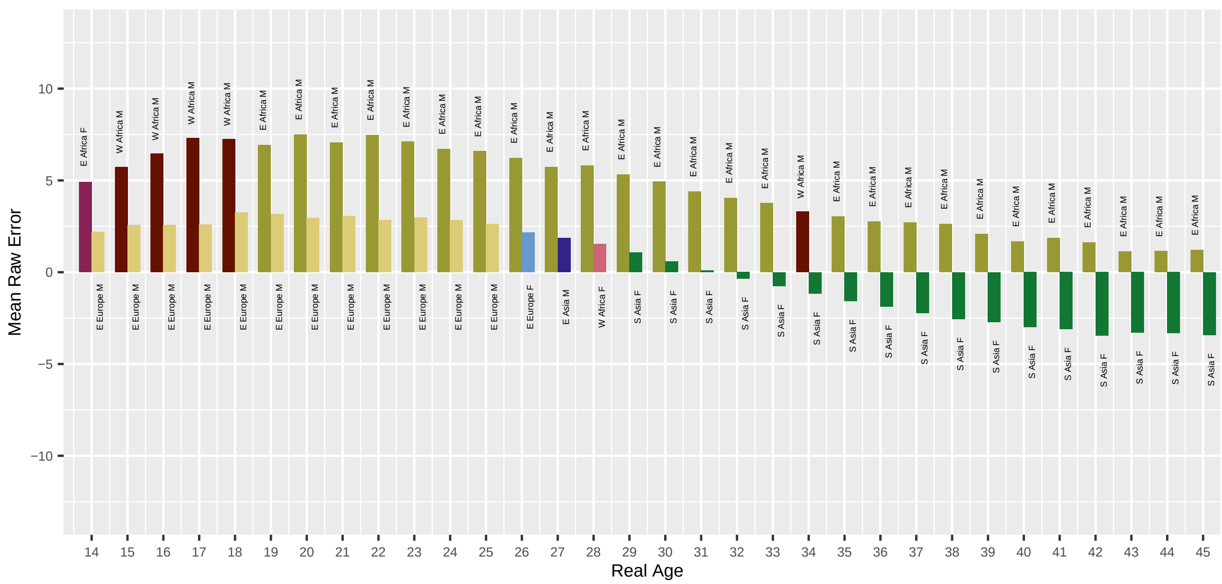


Fig. 13. *For algorithm dermalog-001 applied to Border photos, the bar chart shows which demographic groups have the highest and lowest mean age estimation error, by age. Values closer to zero are better. Positive values are overestimate and negative values are underestimate.*

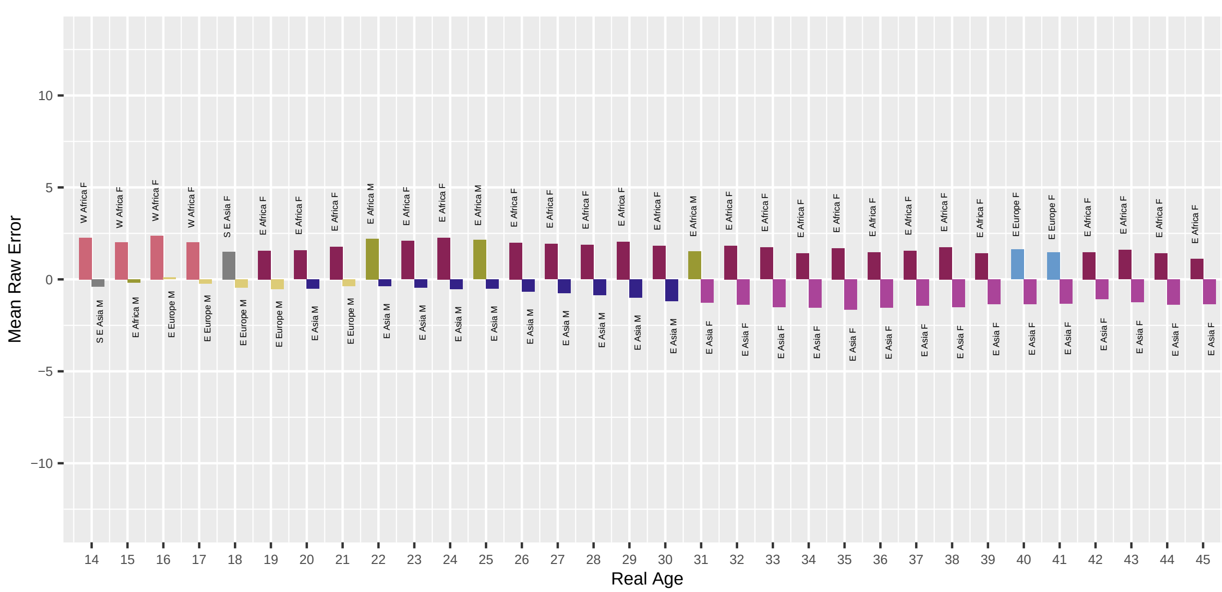


Fig. 14. *For algorithm incode-000 applied to Application photos, the bar chart shows which demographic groups have the highest and lowest mean age estimation error, by age. Values closer to zero are better. Positive values are overestimate and negative values are underestimate.*

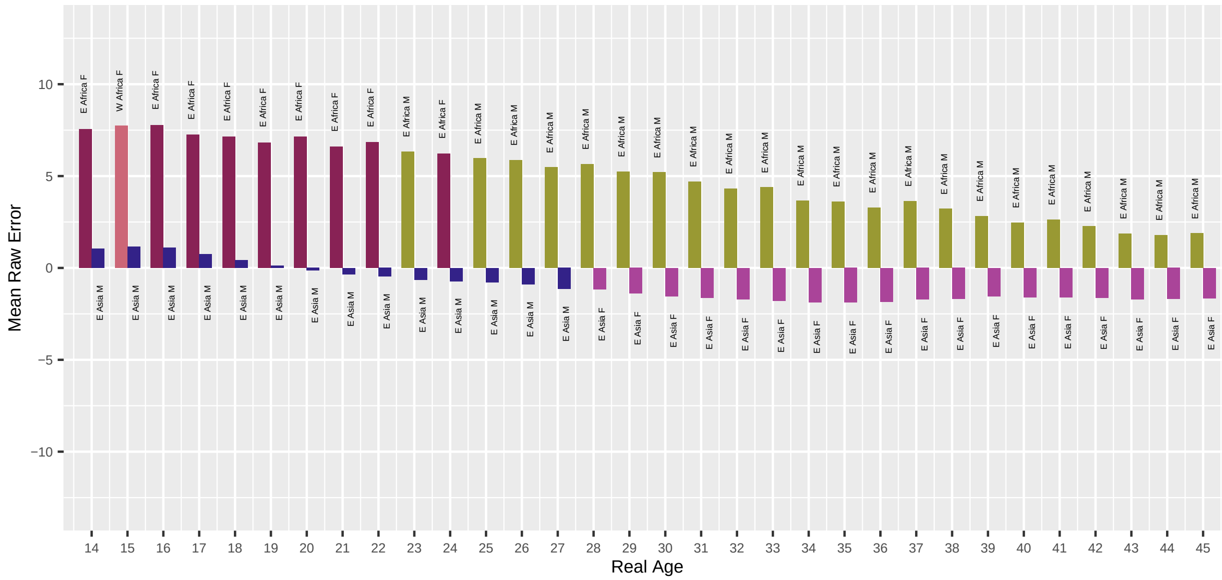


Fig. 15. *For algorithm incode-000 applied to Border photos, the bar chart shows which demographic groups have the highest and lowest mean age estimation error, by age. Values closer to zero are better. Positive values are overestimate and negative values are underestimate.*

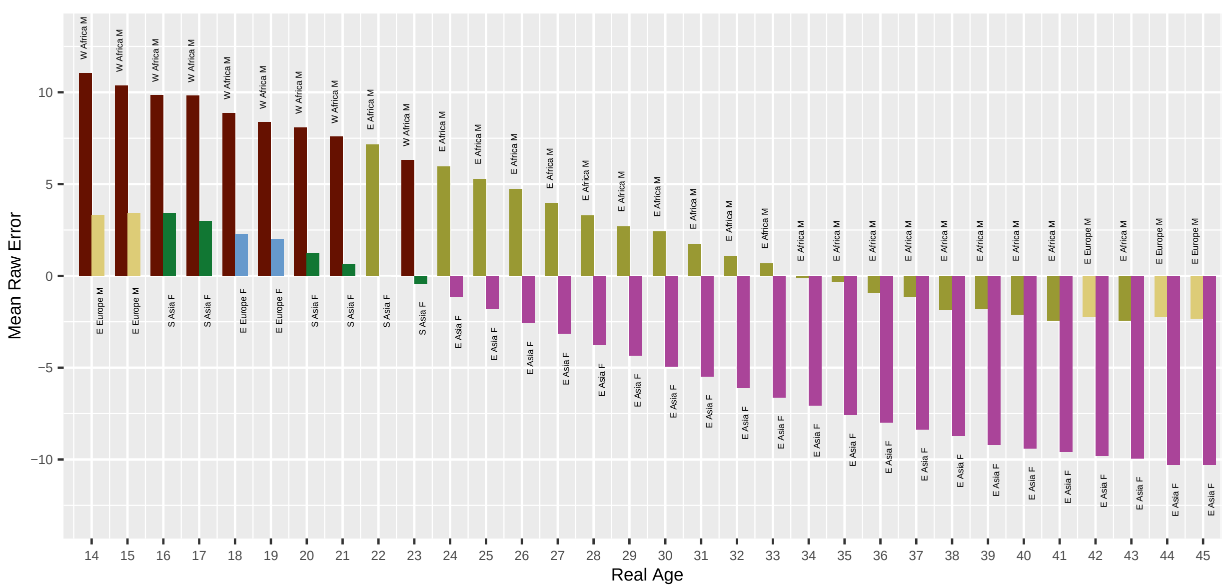


Fig. 16. *For algorithm neurotechnology-000 applied to Application photos, the bar chart shows which demographic groups have the highest and lowest mean age estimation error, by age. Values closer to zero are better. Positive values are overestimate and negative values are underestimate.*

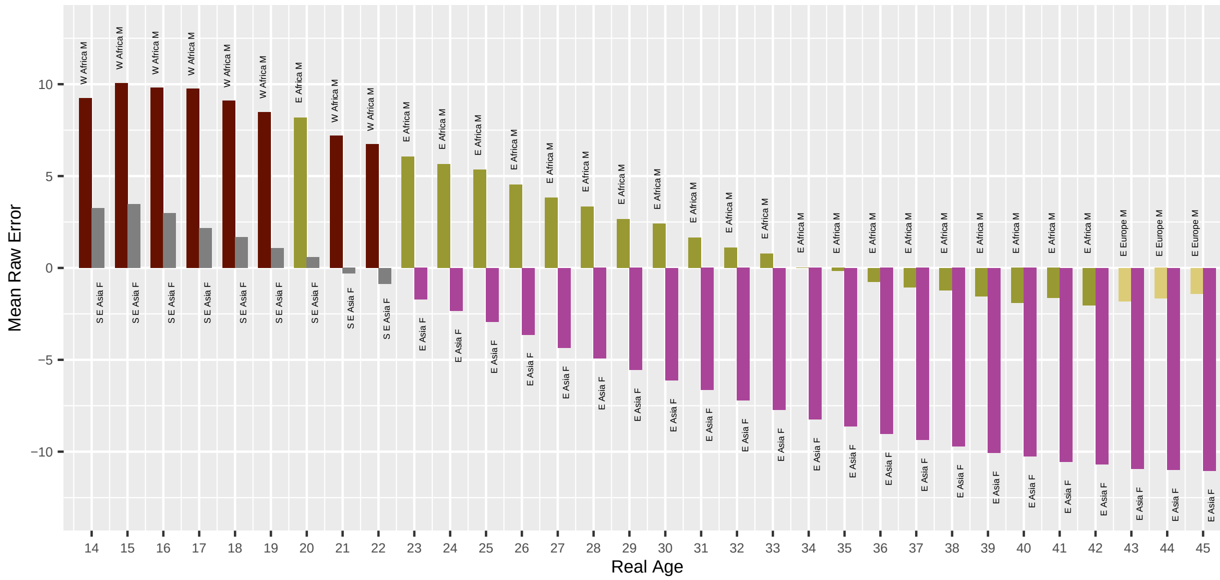


Fig. 17. *For algorithm neurotechnology-000 applied to Border photos, the bar chart shows which demographic groups have the highest and lowest mean age estimation error, by age. Values closer to zero are better. Positive values are overestimate and negative values are underestimate.*

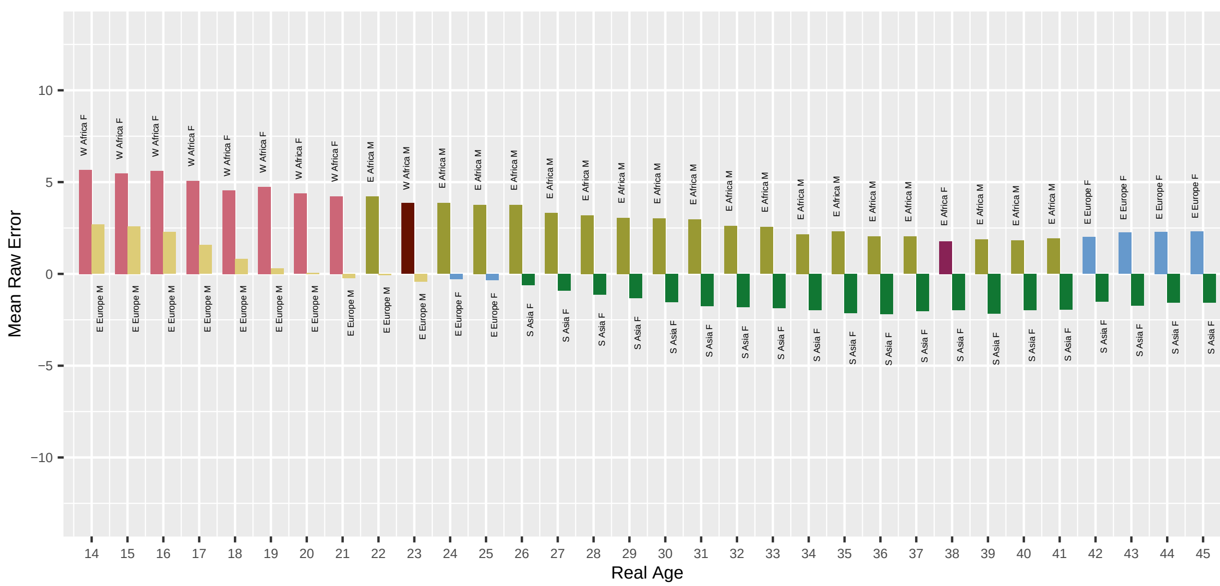


Fig. 18. *For algorithm roc-000 applied to Application photos, the bar chart shows which demographic groups have the highest and lowest mean age estimation error, by age. Values closer to zero are better. Positive values are overestimate and negative values are underestimate.*

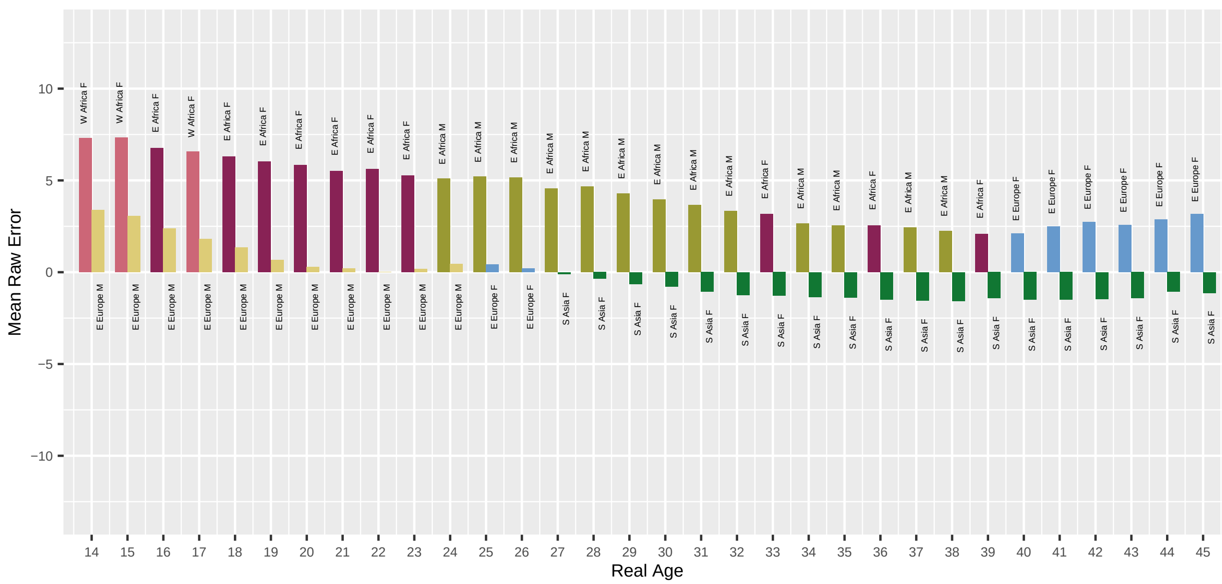


Fig. 19. *For algorithm roc-000 applied to Border photos, the bar chart shows which demographic groups have the highest and lowest mean age estimation error, by age. Values closer to zero are better. Positive values are overestimate and negative values are underestimate.*

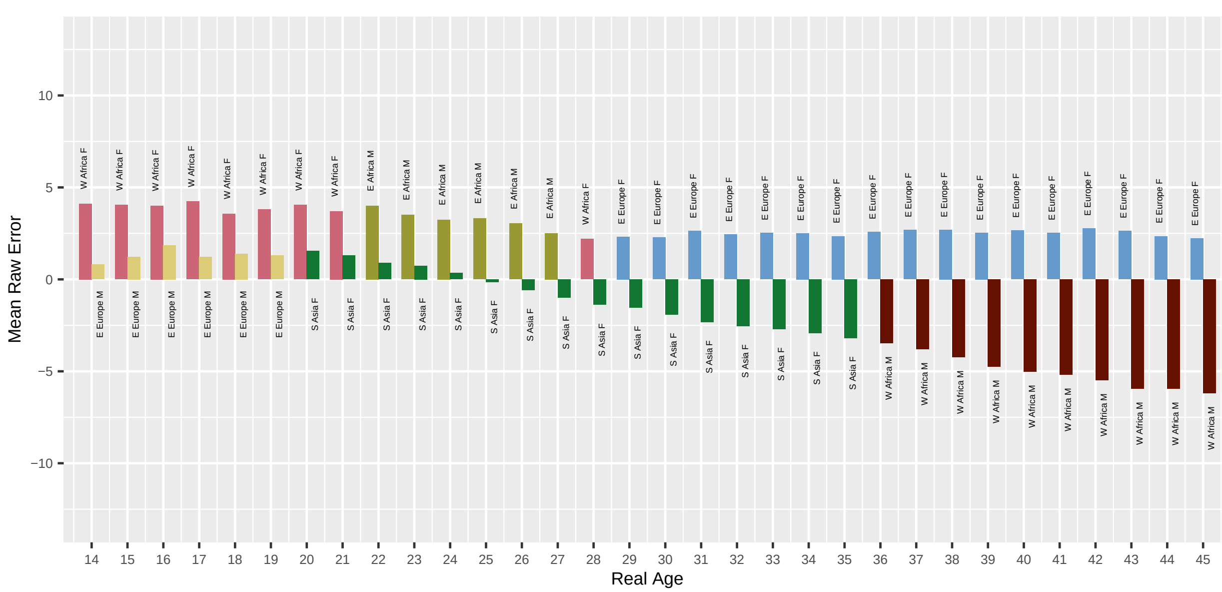


Fig. 20. *For algorithm unissey-001 applied to Application photos, the bar chart shows which demographic groups have the highest and lowest mean age estimation error, by age. Values closer to zero are better. Positive values are overestimate and negative values are underestimate.*

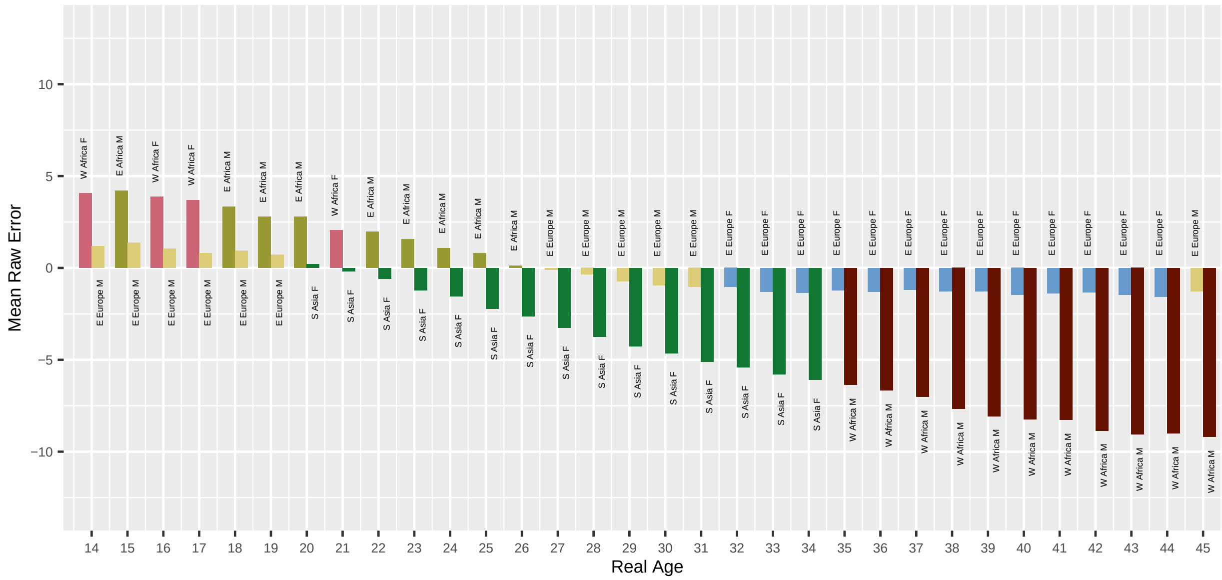


Fig. 21. *For algorithm unissey-001 applied to Border photos, the bar chart shows which demographic groups have the highest and lowest mean age estimation error, by age. Values closer to zero are better. Positive values are overestimate and negative values are underestimate.*

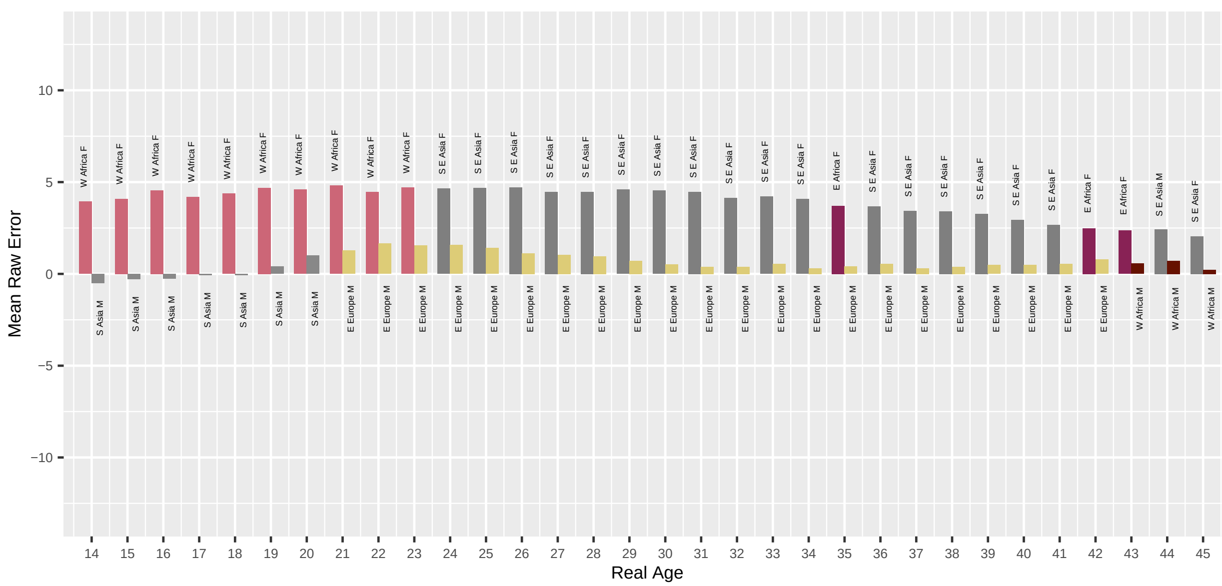


Fig. 22. *For algorithm yoti-001 applied to Application photos, the bar chart shows which demographic groups have the highest and lowest mean age estimation error, by age. Values closer to zero are better. Positive values are overestimate and negative values are underestimate.*

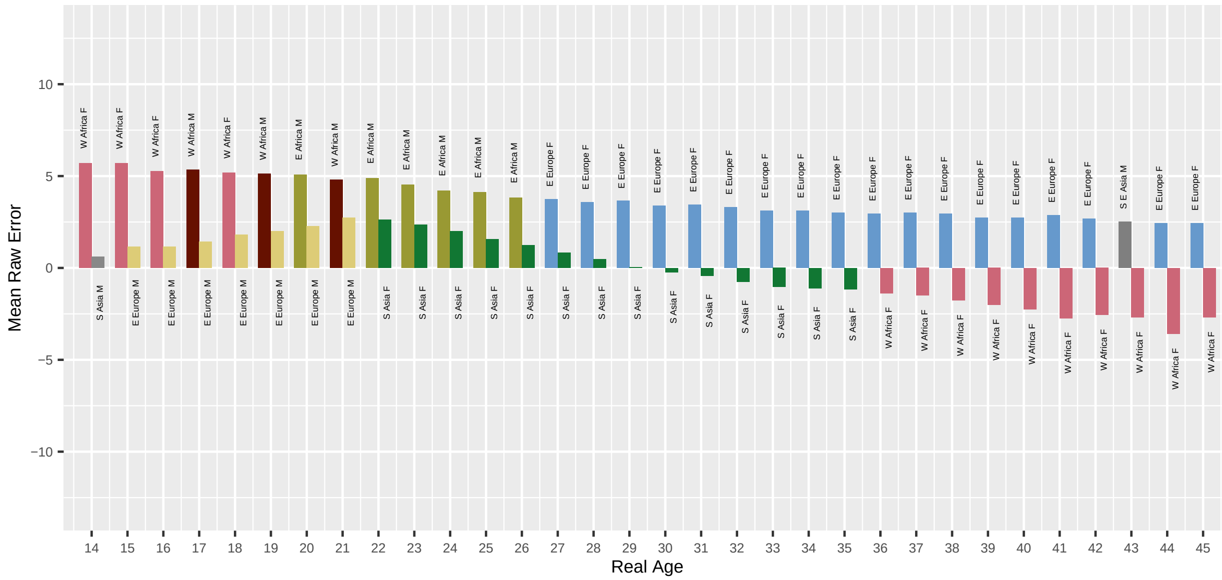


Fig. 23. *For algorithm yoti-001 applied to Border photos, the bar chart shows which demographic groups have the highest and lowest mean age estimation error, by age. Values closer to zero are better. Positive values are overestimate and negative values are underestimate.*

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5.5. Children

Table 19. *AE error statistics in children age 0 to 17. Acc(1) is the proportion of age estimates within 1 years (higher value is better), MAE is mean absolute error (lower value is better), and FTP is the proportion of images the algorithm failed to process (lower is better). Dataset is the Mexican visa sample.*

		dermalog-001			**incode-000**			**neuro-000**			**roc-000**			**unissey-001**			**yoti-001**		
Age	Num. Images	Acc(1)	MAE	FTP	Acc(1)	MAE	FTP	Acc(1)	MAE	FTP	Acc(1)	MAE	FTP	Acc(1)	MAE	FTP	Acc(1)	MAE	FTP
0	133387	0.183	2.05	0.001	0.983	0.34	0	0.469	1.23	0	0.270	2.28	0	0.962	0.60	0	0.418	1.39	0.012
1	94475	0.298	1.84	0.000	0.895	0.63	0	0.582	1.11	0	0.326	1.80	0	0.229	1.31	0	0.396	1.46	0.005
2	82596	0.400	1.89	0.000	0.614	0.92	0	0.559	1.25	0	0.335	1.78	0	0.414	1.32	0	0.303	1.73	0.004
3	82473	0.395	2.12	0.000	0.538	1.10	0	0.467	1.50	0	0.342	1.75	0	0.577	1.24	0	0.249	1.82	0.003
4	84055	0.353	2.37	0.000	0.492	1.24	0	0.412	1.64	0	0.370	1.64	0	0.477	1.36	0	0.289	1.67	0.003
5	92521	0.266	2.64	0.000	0.478	1.34	0	0.389	1.76	0	0.396	1.59	0	0.502	1.60	0	0.367	1.51	0.002
6	91639	0.174	2.98	0.000	0.489	1.36	0	0.365	1.96	0	0.412	1.60	0	0.332	2.02	0	0.475	1.34	0.002
7	89993	0.108	3.34	0.000	0.508	1.27	0	0.329	2.39	0	0.416	1.66	0	0.214	2.49	0	0.529	1.30	0.001
8	89428	0.116	3.27	0.000	0.449	1.42	0	0.302	2.83	0	0.375	1.88	0	0.251	2.71	0	0.490	1.42	0.000
9	89644	0.123	3.10	0.000	0.406	1.56	0	0.261	3.25	0	0.312	2.19	0	0.226	2.81	0	0.447	1.55	0.000
10	98337	0.168	2.84	0.000	0.373	1.71	0	0.206	3.68	0	0.243	2.64	0	0.162	2.80	0	0.415	1.68	0.000
11	97415	0.233	2.65	0.000	0.351	1.87	0	0.165	4.16	0	0.185	3.18	0	0.107	2.79	0	0.391	1.80	0.000
12	94326	0.290	2.60	0.000	0.399	2.03	0	0.122	4.68	0	0.124	3.76	0	0.261	2.81	0	0.340	1.97	0.000
13	94047	0.324	2.87	0.000	0.345	2.31	0	0.084	5.17	0	0.072	4.18	0	0.198	3.07	0	0.298	2.17	0.000
14	96915	0.274	3.43	0.000	0.220	2.58	0	0.051	5.34	0	0.037	4.20	0	0.222	3.36	0	0.299	2.35	0.000
15	97599	0.208	4.06	0.000	0.171	2.71	0	0.035	5.29	0	0.019	4.00	0	0.200	3.67	0	0.294	2.61	0.000
16	96388	0.158	4.50	0.000	0.207	2.73	0	0.035	4.96	0	0.023	3.65	0	0.152	3.86	0	0.292	2.85	0.000
17	99462	0.122	4.69	0.000	0.303	2.69	0	0.047	4.46	0	0.104	3.29	0	0.166	3.85	0	0.287	3.06	0.000

Table 19 shows MAE and two other performance statistics for a large dataset of *Visa* images of children. The most accurate algorithm, Incode-000, is markedly more accurate than others on babies and infants. It estimates the age of children less than 1 year old with MAE 0.34, i.e. about four months. This rises almost monotonically through 17 years. All other algorithms exhibit a similar trend.

5.6. Image Quality

Clearly age estimation accuracy will depend on the quality of the images. If the image is out of focus, or underexposed, or has some other properties that sufficiently depart from standardized portrait format, then either the age estimation algorithms will elect to not process the image, or it will emit a degraded age estimate.

We do not have the resources to conduct an exhaustive exploration of the effect of quality variables (resolution, exposure, blur, etc.) on AE error. Instead, we note that *Border* images give generally degraded age estimation metrics, relative to *Application* images. As described in section 3, the *Border* images are collected under time constraints using inexpensive webcams, with mild departures from frontal head orientation.

Given collection condition 1 (*Border*), person i of age a_{i1} and estimated age e_{i1} the age estimation error is $\varepsilon_{i1} = e_{i1} - a_{i1}$. Likewise for the second (*Application*) photo of the same person $\varepsilon_{i2} = e_{i2} - a_{i2}$. We use only those people aged 14 to 36, for which the photos are collected within two years of each other $|a_{i1} - a_{i2}| \leq 2$. Figure 24 shows the distribution of the change in age estimation error between two collection conditions, $\varepsilon_{i1} - \varepsilon_{i2}$. Positive values indicate larger error in *Border* images. Pairwise analysis gives more powerful insight than simply comparing the two error distributions. The figure breaks out this change by sex and region-of-birth. The figure includes two summary statistics: First is median change in error, D; second is the proportion of images with a decrease in error, F. For example, for dermalog-001 operating on E. African women, 24% of persons have a better age estimate using *Border* images than *Application* images, but the median change in error is 3.9 years.

The ideal form of this plot is for the violins to be wide and not tall, showing little change in AE error between imaging conditions. Neurotechnology-000, roc-000 and yoti-001 give generally smaller changes in error. We note most algorithms give worse age estimates on *Border* images, with the exception of unissey-001 which has generally lower error.

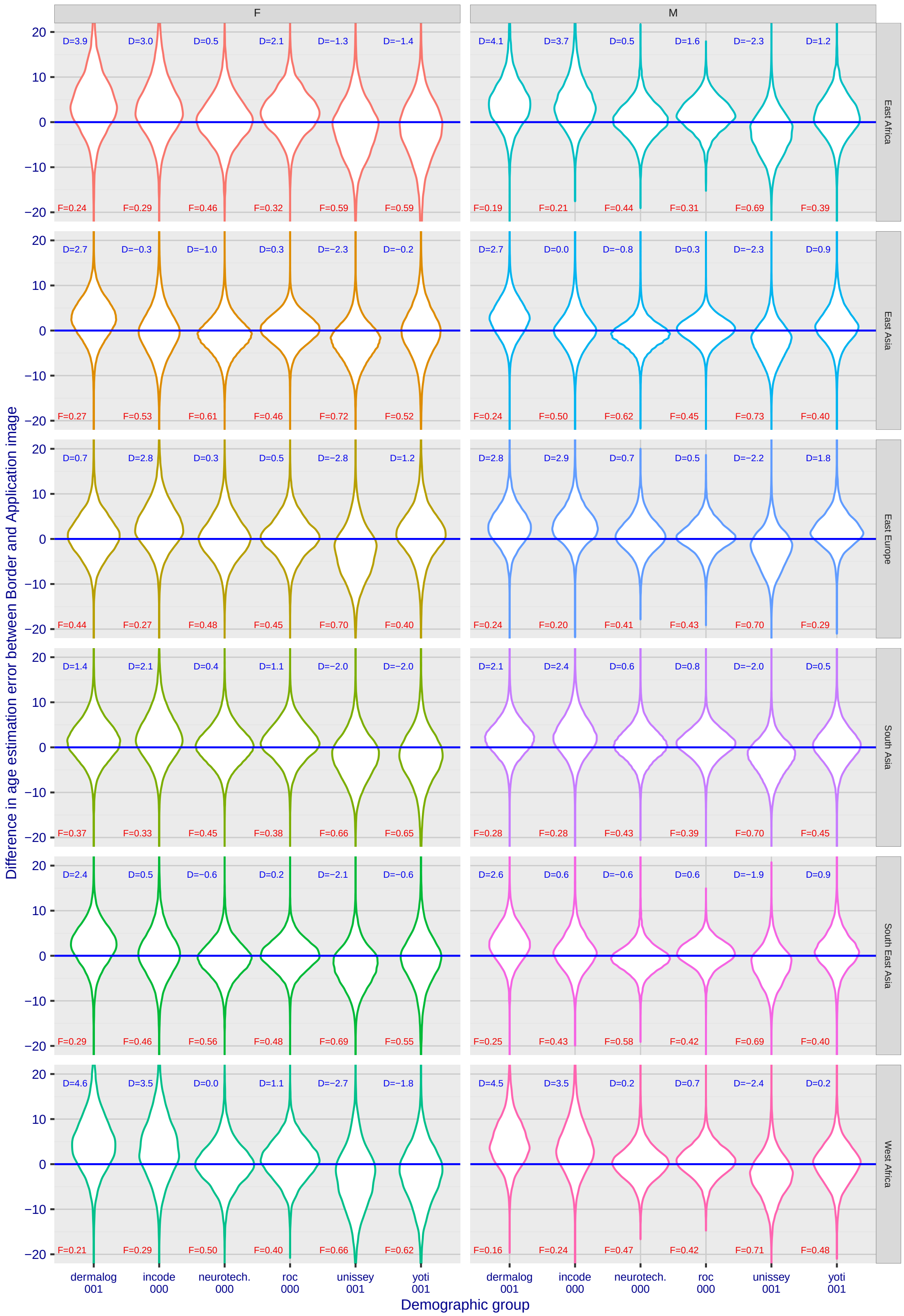

Fig. 24. *Distribution of the pairwise age estimation error difference for Border and Application images. Positive values indicate larger error on Border images.*

5.6.1. Effect of Eyeglasses

Figure 25 shows age estimation error results for subjects photographed with and without glasses. The photographs are a subset of the border images described in section 3.4. The population consists of 9181 subjects for whom we have paired photos - one with glasses and one without taken within three months years of each other. There are 16677 pairs. All subjects are between 14 and 36 years old.

Ground truth for presence of eyeglasses is established automatically using a Specific Image Defect Detection (SIDD) algorithm to determine the presence of glasses, setting a threshold of 0.5 on the quality component. The SIDD algorithm is chosen based on both accuracy and speed. More information regarding SIDD algorithms' performance can be found in the FATE SIDD report which is a regularly updated verion of NIST Interagency Report 8485.

Error bars are computed by bootstrapping the calculation of mean error 1000 times and taking the interval that gives 95% coverage of the mean. Note that the error bars are not a measure of the deviation of the actual error values.

The figure shows that dermalog_001 and incode_000 overestimate age of both men and women more with glasses than without. Yoti_001 does the same but only in women. The roc_000 algorithm overestimates age of both sexes without glasses more than with glasses. In contrast, neurotechnology_000 and unissey_001 have large mean age estimate error for underestimate the age of subjects wearing glasses.

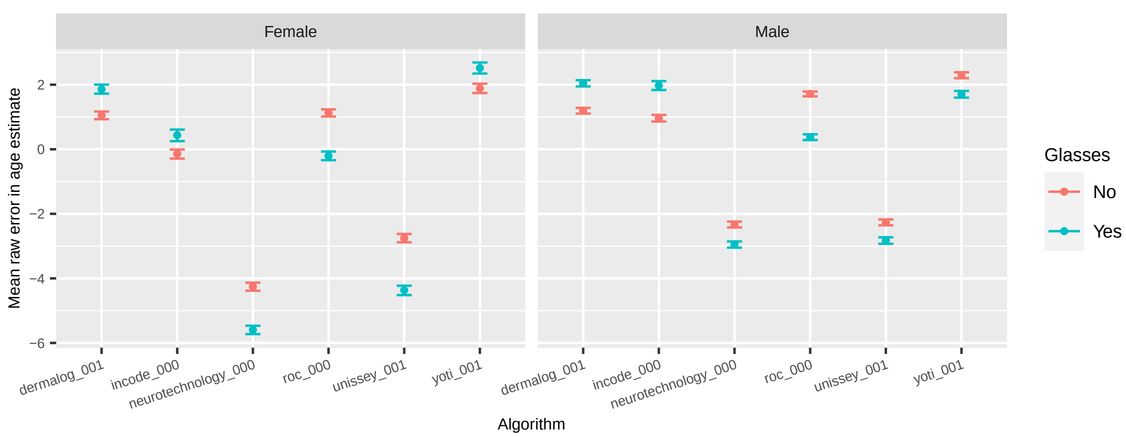

Fig. 25. *Mean raw age estimation error for border crossing subjects for whom we have images with and without eyeglasses.*

In Figure 26, the difference-in-error with and without glasses is calculated for the same images as in the previous plot, pairwise by subject. The error bars are computed by calculating mean difference-in-error 1000 times and taking the interval that gives 95% coverage of the mean. The results are consistent with those in the previous figure.

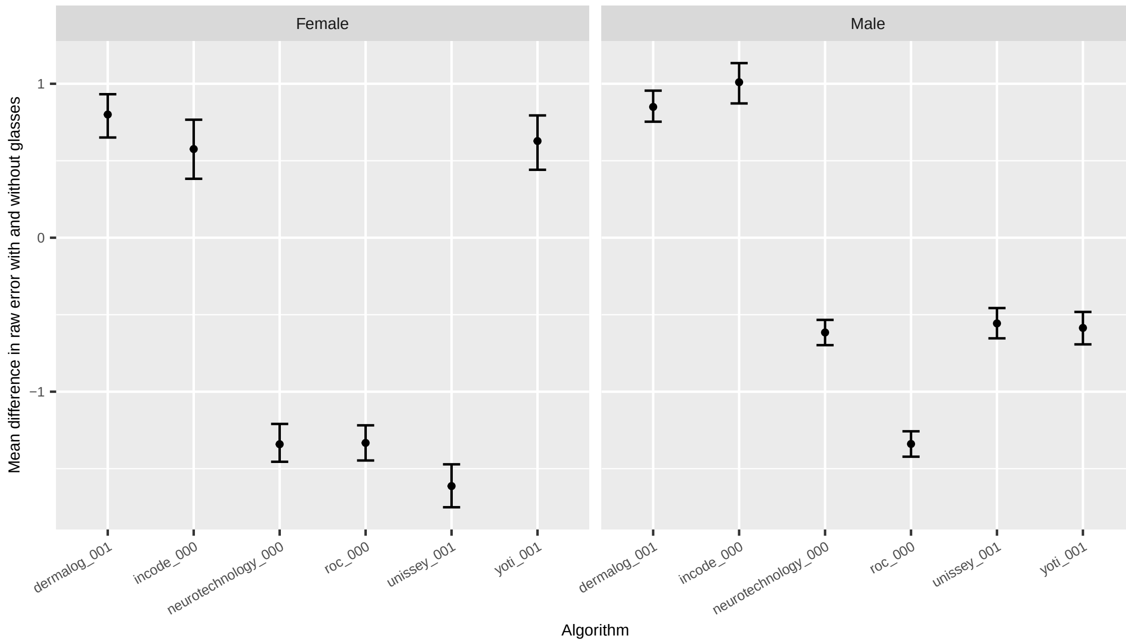

Fig. 26. *Difference in age estimation error for border crossing subjects with and without eyeglasses.*

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Appendix A. Detailed Algorithm Results

Appendix A.1. Age Estimation Performance by Age

Table 20. *For visa images AE error statistics by age, 0 to 90. Acc(3) is proportion of age estimates within 3 years (higher value is better), MAE is mean absolute error (MAE, lower is better), and the failure to process proportion (FTP, lower is better).*

		dermalog-001			**incode-000**			**neuro-000**			**roc-000**			**unissey-001**			**yoti-001**		
Age	Num. Images	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP
0	133387	0.90	2.05	0.001	1.00	0.34	0	0.97	1.23	0	0.72	2.28	0	1.00	0.60	0	0.96	1.39	0.012
1	94475	0.87	1.84	0.000	1.00	0.63	0	0.96	1.11	0	0.83	1.80	0	0.99	1.31	0	0.93	1.46	0.005
2	82596	0.84	1.89	0.000	0.99	0.92	0	0.92	1.25	0	0.83	1.78	0	0.95	1.32	0	0.88	1.73	0.004
3	82473	0.76	2.12	0.000	0.98	1.10	0	0.88	1.50	0	0.84	1.75	0	0.95	1.24	0	0.88	1.82	0.003
4	84055	0.69	2.37	0.000	0.96	1.24	0	0.86	1.64	0	0.87	1.64	0	0.87	1.36	0	0.91	1.67	0.003
5	92521	0.63	2.64	0.000	0.93	1.34	0	0.84	1.76	0	0.88	1.59	0	0.85	1.60	0	0.92	1.51	0.002
6	91639	0.57	2.98	0.000	0.91	1.36	0	0.82	1.96	0	0.87	1.60	0	0.79	2.02	0	0.93	1.34	0.002
7	89993	0.46	3.34	0.000	0.93	1.27	0	0.75	2.39	0	0.85	1.66	0	0.70	2.49	0	0.91	1.30	0.001
8	89428	0.50	3.27	0.000	0.91	1.42	0	0.67	2.83	0	0.80	1.88	0	0.59	2.71	0	0.89	1.42	0.000
9	89644	0.59	3.10	0.000	0.89	1.56	0	0.60	3.25	0	0.73	2.19	0	0.49	2.81	0	0.86	1.55	0.000
10	98337	0.68	2.84	0.000	0.88	1.71	0	0.53	3.68	0	0.64	2.64	0	0.68	2.80	0	0.84	1.68	0.000
11	97415	0.74	2.65	0.000	0.83	1.87	0	0.45	4.16	0	0.53	3.18	0	0.61	2.79	0	0.83	1.80	0.000
12	94326	0.74	2.60	0.000	0.76	2.03	0	0.35	4.68	0	0.39	3.76	0	0.67	2.81	0	0.80	1.97	0.000
13	94047	0.68	2.87	0.000	0.68	2.31	0	0.25	5.17	0	0.26	4.18	0	0.59	3.07	0	0.77	2.17	0.000
14	96915	0.59	3.43	0.000	0.64	2.58	0	0.18	5.34	0	0.19	4.20	0	0.53	3.36	0	0.74	2.35	0.000
15	97599	0.48	4.06	0.000	0.68	2.71	0	0.16	5.29	0	0.30	4.00	0	0.49	3.67	0	0.70	2.61	0.000
16	96388	0.41	4.50	0.000	0.73	2.73	0	0.20	4.96	0	0.52	3.65	0	0.49	3.86	0	0.66	2.85	0.000
17	99462	0.37	4.69	0.000	0.70	2.69	0	0.31	4.46	0	0.62	3.29	0	0.57	3.85	0	0.62	3.06	0.000
18	98765	0.33	4.89	0.000	0.62	2.98	0	0.44	3.93	0	0.60	3.25	0	0.53	3.86	0	0.56	3.46	0.000
19	105717	0.32	4.92	0.000	0.56	3.28	0	0.52	3.47	0	0.59	3.28	0	0.48	3.93	0	0.52	3.70	0.000
20	118643	0.34	4.81	0.000	0.53	3.50	0	0.59	3.15	0	0.58	3.38	0	0.44	4.03	0	0.48	3.79	0.000
21	124060	0.36	4.71	0.000	0.49	3.63	0	0.64	2.91	0	0.55	3.60	0	0.40	4.16	0	0.46	3.83	0.000
22	128864	0.37	4.59	0.000	0.46	3.65	0	0.65	2.88	0	0.51	3.81	0	0.43	4.23	0	0.45	3.85	0.000
23	133507	0.39	4.51	0.000	0.47	3.59	0	0.63	2.97	0	0.46	3.99	0	0.37	4.23	0	0.46	3.83	0.000
24	138094	0.41	4.42	0.000	0.49	3.50	0	0.58	3.12	0	0.43	4.14	0	0.37	4.15	0	0.48	3.76	0.000
25	139920	0.40	4.36	0.000	0.51	3.44	0	0.53	3.35	0	0.41	4.28	0	0.40	4.14	0	0.50	3.69	0.000
26	141741	0.42	4.30	0.000	0.53	3.36	0	0.49	3.60	0	0.40	4.37	0	0.45	4.14	0	0.52	3.61	0.000
27	138491	0.41	4.27	0.000	0.54	3.36	0	0.44	3.90	0	0.39	4.49	0	0.49	4.11	0	0.53	3.59	0.000
28	133633	0.43	4.27	0.000	0.54	3.39	0	0.41	4.18	0	0.37	4.58	0	0.46	4.10	0	0.53	3.60	0.000
29	129054	0.42	4.26	0.000	0.53	3.44	0	0.38	4.46	0	0.37	4.65	0	0.52	4.13	0	0.53	3.64	0.000
30	123437	0.44	4.25	0.000	0.52	3.52	0	0.36	4.71	0	0.36	4.73	0	0.49	4.21	0	0.51	3.70	0.000
31	118174	0.45	4.28	0.000	0.51	3.63	0	0.35	4.93	0	0.35	4.75	0	0.45	4.31	0	0.50	3.78	0.000
32	113131	0.46	4.32	0.000	0.49	3.74	0	0.33	5.17	0	0.35	4.77	0	0.40	4.43	0	0.48	3.84	0.000
33	109146	0.46	4.38	0.000	0.46	3.84	0	0.33	5.36	0	0.35	4.77	0	0.35	4.59	0	0.46	3.90	0.000
34	105908	0.44	4.45	0.000	0.44	3.95	0	0.32	5.52	0	0.34	4.78	0	0.33	4.65	0	0.45	3.94	0.000
35	103149	0.44	4.54	0.000	0.42	4.00	0	0.31	5.69	0	0.35	4.73	0	0.36	4.61	0	0.45	3.95	0.000
36	99901	0.41	4.65	0.000	0.41	4.02	0	0.31	5.79	0	0.35	4.73	0	0.40	4.50	0	0.45	3.95	0.000

Table 20. *For visa images AE error statistics by age, 0 to 90. Acc(3) is proportion of age estimates within 3 years (higher value is better), MAE is mean absolute error (MAE, lower is better), and the failure to process proportion (FTP, lower is better). (continued)*

		dermalog-001			**incode-000**			**neuro-000**			**roc-000**			**unissey-001**			**yoti-001**		
Age	Num. Images	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP
37	97516	0.39	4.73	0.000	0.41	3.99	0	0.30	5.91	0	0.35	4.67	0	0.44	4.32	0	0.45	3.92	0.000
38	93939	0.35	4.78	0.000	0.42	3.92	0	0.29	5.98	0	0.37	4.60	0	0.47	4.24	0	0.46	3.86	0.000
39	91461	0.36	4.80	0.000	0.45	3.80	0	0.30	6.00	0	0.37	4.55	0	0.48	4.21	0	0.47	3.84	0.000
40	94056	0.33	4.89	0.000	0.47	3.72	0	0.29	6.06	0	0.38	4.50	0	0.52	4.22	0	0.47	3.83	0.000
41	90173	0.34	4.81	0.000	0.49	3.62	0	0.29	6.07	0	0.39	4.43	0	0.45	4.25	0	0.48	3.80	0.000
42	86423	0.35	4.71	0.000	0.51	3.56	0	0.29	6.09	0	0.40	4.36	0	0.41	4.29	0	0.48	3.80	0.000
43	83252	0.36	4.63	0.000	0.52	3.52	0	0.30	6.04	0	0.41	4.33	0	0.39	4.31	0	0.48	3.80	0.000
44	80602	0.39	4.51	0.000	0.51	3.52	0	0.30	6.03	0	0.41	4.30	0	0.37	4.35	0	0.47	3.83	0.000
45	77502	0.40	4.41	0.000	0.51	3.54	0	0.30	5.95	0	0.42	4.27	0	0.42	4.33	0	0.46	3.85	0.000
46	74182	0.42	4.29	0.000	0.50	3.59	0	0.31	5.83	0	0.42	4.27	0	0.41	4.24	0	0.46	3.86	0.000
47	70698	0.44	4.18	0.000	0.50	3.65	0	0.32	5.72	0	0.43	4.25	0	0.44	4.13	0	0.46	3.89	0.000
48	67856	0.43	4.13	0.000	0.50	3.72	0	0.33	5.57	0	0.43	4.25	0	0.46	4.06	0	0.46	3.90	0.000
49	65674	0.45	4.08	0.000	0.51	3.79	0	0.35	5.46	0	0.43	4.24	0	0.48	4.04	0	0.47	3.89	0.000
50	64896	0.45	4.02	0.000	0.51	3.89	0	0.37	5.27	0	0.44	4.23	0	0.51	4.01	0	0.47	3.90	0.000
51	63410	0.46	3.99	0.000	0.50	4.03	0	0.39	5.13	0	0.43	4.26	0	0.47	4.04	0	0.47	3.90	0.000
52	60991	0.46	3.94	0.000	0.48	4.16	0	0.40	5.04	0	0.43	4.24	0	0.45	4.07	0	0.47	3.92	0.000
53	59550	0.46	3.90	0.000	0.44	4.28	0	0.41	4.94	0	0.44	4.18	0	0.44	4.13	0	0.46	3.91	0.000
54	56895	0.47	3.89	0.000	0.38	4.36	0	0.41	4.88	0	0.44	4.18	0	0.43	4.20	0	0.45	3.93	0.000
55	55297	0.46	3.87	0.000	0.32	4.38	0	0.41	4.80	0	0.44	4.13	0	0.42	4.29	0	0.44	3.89	0.000
56	52574	0.48	3.83	0.000	0.28	4.30	0	0.42	4.72	0	0.44	4.08	0	0.40	4.30	0	0.44	3.85	0.000
57	49823	0.48	3.84	0.000	0.31	4.10	0	0.41	4.74	0	0.45	4.02	0	0.44	4.40	0	0.44	3.77	0.000
58	48570	0.49	3.84	0.000	0.41	3.78	0	0.41	4.74	0	0.45	3.97	0	0.44	4.46	0	0.46	3.64	0.000
59	46040	0.49	3.85	0.000	0.51	3.39	0	0.41	4.78	0	0.46	3.90	0	0.44	4.52	0	0.48	3.52	0.000
60	46037	0.47	3.90	0.000	0.58	2.99	0	0.40	4.82	0	0.46	3.85	0	0.42	4.69	0	0.50	3.38	0.000
61	43860	0.47	3.95	0.000	0.64	2.70	0	0.40	4.88	0	0.47	3.77	0	0.41	4.86	0	0.53	3.25	0.000
62	41407	0.47	4.03	0.000	0.70	2.52	0	0.39	4.98	0	0.49	3.69	0	0.39	5.12	0	0.57	3.07	0.000
63	39444	0.45	4.12	0.000	0.71	2.47	0	0.38	5.20	0	0.49	3.64	0	0.30	5.35	0	0.60	2.96	0.001
64	37425	0.43	4.17	0.000	0.70	2.50	0	0.38	5.39	0	0.50	3.59	0	0.29	5.56	0	0.63	2.83	0.001
65	34834	0.42	4.27	0.000	0.66	2.57	0	0.35	5.64	0	0.50	3.54	0	0.28	5.71	0	0.65	2.81	0.001
66	32020	0.41	4.31	0.000	0.63	2.68	0	0.31	5.91	0	0.51	3.52	0	0.28	5.87	0	0.65	2.82	0.001
67	28898	0.40	4.36	0.000	0.59	2.84	0	0.26	6.39	0	0.50	3.54	0	0.26	6.07	0	0.63	2.91	0.001
68	26630	0.37	4.44	0.000	0.56	3.03	0	0.20	6.94	0	0.51	3.55	0	0.27	6.19	0	0.60	3.12	0.001
69	24864	0.38	4.43	0.000	0.53	3.17	0	0.13	7.46	0	0.50	3.56	0	0.27	6.33	0	0.55	3.38	0.002
70	23407	0.39	4.32	0.000	0.52	3.29	0	0.06	8.08	0	0.49	3.64	0	0.27	6.36	0	0.49	3.69	0.002
71	20736	0.39	4.29	0.000	0.49	3.45	0	0.01	8.66	0	0.48	3.72	0	0.27	6.42	0	0.43	4.07	0.001
72	18423	0.43	4.22	0.000	0.48	3.63	0	0.00	9.36	0	0.48	3.79	0	0.27	6.49	0	0.36	4.52	0.002
73	16215	0.47	4.11	0.000	0.46	3.78	0	0.00	9.98	0	0.45	3.97	0	0.28	6.49	0	0.30	4.95	0.002
74	14848	0.51	3.93	0.000	0.45	3.91	0	0.00	10.65	0	0.45	4.06	0	0.28	6.43	0	0.24	5.42	0.002

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Table 20. *For visa images AE error statistics by age, 0 to 90. Acc(3) is proportion of age estimates within 3 years (higher value is better), MAE is mean absolute error (MAE, lower is better), and the failure to process proportion (FTP, lower is better). (continued)*

		dermalog-001			**incode-000**			**neuro-000**			**roc-000**			**unissey-001**			**yoti-001**		
Age	Num. Images	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP	Acc(3)	MAE	FTP
75	13197	0.52	3.93	0.000	0.43	4.15	0	0.00	11.39	0	0.41	4.35	0	0.28	6.53	0	0.17	6.09	0.003
76	11886	0.56	3.86	0.000	0.41	4.33	0	0.00	12.02	0	0.39	4.51	0	0.29	6.46	0	0.12	6.68	0.002
77	10839	0.54	4.10	0.000	0.37	4.61	0	0.00	12.85	0	0.36	4.84	0	0.29	6.50	0	0.08	7.33	0.003
78	9361	0.50	4.27	0.000	0.35	4.86	0	0.00	13.55	0	0.33	5.21	0	0.30	6.58	0	0.04	7.97	0.004
79	7540	0.42	4.57	0.000	0.32	5.05	0	0.00	14.40	0	0.30	5.45	0	0.32	6.46	0	0.01	8.56	0.003
80	6267	0.35	4.98	0.000	0.30	5.33	0	0.00	15.18	0	0.29	5.75	0	0.32	6.62	0	0.00	9.37	0.007
81	5221	0.28	5.34	0.000	0.26	5.63	0	0.00	16.00	0	0.25	6.09	0	0.34	6.48	0	0.00	10.02	0.005
82	3962	0.18	5.95	0.000	0.23	5.98	0	0.00	16.78	0	0.23	6.46	0	0.34	6.56	0	0.00	10.72	0.007
83	3277	0.12	6.50	0.000	0.20	6.48	0	0.00	17.66	0	0.19	7.06	0	0.35	6.63	0	0.00	11.61	0.007
84	2615	0.06	7.19	0.000	0.18	6.80	0	0.00	18.45	0	0.17	7.45	0	0.34	6.85	0	0.00	12.26	0.007
85	2206	0.03	7.81	0.000	0.17	7.17	0	0.00	19.29	0	0.14	7.88	0	0.33	6.98	0	0.00	13.07	0.008
86	1831	0.01	8.42	0.000	0.14	7.56	0	0.00	20.24	0	0.12	8.26	0	0.29	7.18	0	0.00	13.86	0.011
87	1402	0.00	9.20	0.001	0.11	8.16	0	0.00	21.17	0	0.09	9.02	0	0.23	7.61	0	0.00	14.69	0.011
88	1254	0.00	10.04	0.000	0.09	8.59	0	0.00	22.10	0	0.07	9.67	0	0.19	8.13	0	0.00	15.78	0.014
89	907	0.00	10.57	0.000	0.06	8.85	0	0.00	22.86	0	0.07	9.85	0	0.15	7.91	0	0.00	16.57	0.012
90	670	0.00	11.48	0.000	0.02	9.77	0	0.00	24.05	0	0.06	10.89	0	0.10	8.24	0	0.00	17.55	0.015

Appendix A.2. Age Estimation Performance Across Demographics

Table 21. *Mean raw error for Application-type images for algorithm dermalog-001. Values closer to zero are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Group	min Group
14	2.2 ± 0.4	4.4 ± 0.2	5.0 ± 0.3	4.1 ± 0.2	4.9 ± 0.4	3.0 ± 0.4	1.8 ± 0.3	3.3 ± 0.1	2.4 ± 0.3	2.6 ± 0.2	3.1 ± 0.3	2.4 ± 0.3	E Europe F	E Africa M
15	2.7 ± 0.5	4.4 ± 0.2	5.3 ± 0.3	5.0 ± 0.3	4.9 ± 0.4	2.7 ± 0.4	1.3 ± 0.3	3.6 ± 0.1	2.6 ± 0.3	3.5 ± 0.2	3.6 ± 0.3	2.7 ± 0.3	E Europe F	E Africa M
16	2.0 ± 0.5	4.3 ± 0.2	5.2 ± 0.3	4.7 ± 0.3	5.1 ± 0.4	2.6 ± 0.4	2.2 ± 0.3	3.6 ± 0.1	2.9 ± 0.3	3.9 ± 0.2	4.1 ± 0.3	3.0 ± 0.4	E Europe F	E Africa F
17	2.1 ± 0.5	3.9 ± 0.2	5.4 ± 0.4	4.8 ± 0.2	4.6 ± 0.3	2.2 ± 0.3	2.2 ± 0.4	3.2 ± 0.1	2.4 ± 0.3	3.9 ± 0.2	3.6 ± 0.3	3.2 ± 0.4	E Europe F	E Africa F
18	1.0 ± 0.4	3.2 ± 0.1	4.3 ± 0.3	4.0 ± 0.2	3.8 ± 0.2	1.5 ± 0.4	2.3 ± 0.3	2.4 ± 0.1	1.9 ± 0.2	3.5 ± 0.2	3.0 ± 0.2	2.8 ± 0.3	E Europe F	E Africa F
19	1.5 ± 0.4	2.7 ± 0.1	4.1 ± 0.3	3.8 ± 0.2	3.3 ± 0.2	1.5 ± 0.4	2.8 ± 0.3	2.0 ± 0.1	1.7 ± 0.2	3.5 ± 0.2	2.5 ± 0.2	2.8 ± 0.4	E Europe F	E Africa F
20	1.0 ± 0.4	2.4 ± 0.1	3.8 ± 0.3	3.5 ± 0.2	2.9 ± 0.2	1.0 ± 0.3	2.8 ± 0.4	1.7 ± 0.1	1.6 ± 0.2	3.5 ± 0.1	2.2 ± 0.2	2.7 ± 0.3	E Europe F	E Africa F
21	0.6 ± 0.4	1.9 ± 0.1	3.3 ± 0.2	3.2 ± 0.2	2.5 ± 0.2	0.7 ± 0.4	2.7 ± 0.3	1.1 ± 0.1	1.0 ± 0.2	3.1 ± 0.1	1.8 ± 0.2	2.6 ± 0.3	E Europe F	E Africa F
22	0.7 ± 0.4	1.2 ± 0.1	3.1 ± 0.2	2.8 ± 0.1	1.8 ± 0.2	0.0 ± 0.3	3.2 ± 0.3	0.7 ± 0.1	1.0 ± 0.2	2.8 ± 0.1	1.4 ± 0.2	2.3 ± 0.3	E Africa M	W Africa F
23	0.2 ± 0.3	0.9 ± 0.1	2.7 ± 0.2	2.6 ± 0.1	1.5 ± 0.2	-0.5 ± 0.3	2.9 ± 0.3	0.1 ± 0.1	0.6 ± 0.2	2.5 ± 0.1	0.9 ± 0.2	2.3 ± 0.3	E Africa M	W Africa F
24	0.0 ± 0.3	0.4 ± 0.1	2.3 ± 0.2	2.2 ± 0.1	1.1 ± 0.1	-1.0 ± 0.3	2.7 ± 0.3	-0.2 ± 0.1	0.4 ± 0.2	2.3 ± 0.1	0.4 ± 0.2	2.0 ± 0.3	E Africa M	W Africa F
25	-0.7 ± 0.3	-0.0 ± 0.1	1.9 ± 0.2	1.9 ± 0.1	0.5 ± 0.1	-1.4 ± 0.3	2.8 ± 0.3	-0.7 ± 0.1	-0.1 ± 0.2	1.9 ± 0.1	0.4 ± 0.2	1.5 ± 0.3	E Africa M	W Africa F
26	-0.7 ± 0.3	-0.4 ± 0.1	1.7 ± 0.2	1.3 ± 0.1	0.4 ± 0.1	-1.7 ± 0.3	2.3 ± 0.3	-1.0 ± 0.1	-0.2 ± 0.2	1.6 ± 0.1	-0.1 ± 0.2	1.1 ± 0.2	E Africa M	W Africa F
27	-1.0 ± 0.3	-0.7 ± 0.1	1.4 ± 0.1	0.8 ± 0.1	-0.1 ± 0.1	-2.1 ± 0.3	2.1 ± 0.3	-1.3 ± 0.1	-0.2 ± 0.2	1.2 ± 0.1	-0.1 ± 0.2	0.8 ± 0.2	E Africa M	W Africa F
28	-1.2 ± 0.3	-1.1 ± 0.1	1.2 ± 0.1	0.5 ± 0.1	-0.5 ± 0.1	-2.4 ± 0.3	1.6 ± 0.3	-1.6 ± 0.1	-0.4 ± 0.2	0.8 ± 0.1	-0.5 ± 0.2	0.4 ± 0.2	E Africa M	W Africa F
29	-1.7 ± 0.3	-1.4 ± 0.1	0.9 ± 0.2	0.2 ± 0.1	-0.8 ± 0.2	-2.7 ± 0.3	1.5 ± 0.3	-1.8 ± 0.1	-0.8 ± 0.2	0.46 ± 0.10	-0.9 ± 0.2	0.2 ± 0.2	E Africa M	W Africa F
30	-1.9 ± 0.3	-1.6 ± 0.1	0.4 ± 0.2	-0.3 ± 0.1	-1.0 ± 0.2	-3.1 ± 0.3	1.4 ± 0.3	-2.1 ± 0.1	-1.0 ± 0.2	0.04 ± 0.10	-1.1 ± 0.2	-0.1 ± 0.2	E Africa M	W Africa F
31	-2.4 ± 0.3	-1.9 ± 0.1	0.3 ± 0.2	-0.7 ± 0.1	-1.4 ± 0.2	-3.5 ± 0.3	0.9 ± 0.3	-2.2 ± 0.1	-1.2 ± 0.2	-0.31 ± 0.10	-1.4 ± 0.2	-0.4 ± 0.2	E Africa M	W Africa F
32	-2.4 ± 0.3	-2.1 ± 0.1	0.1 ± 0.2	-1.1 ± 0.1	-1.6 ± 0.2	-3.5 ± 0.3	0.5 ± 0.3	-2.4 ± 0.1	-1.4 ± 0.2	-0.53 ± 0.10	-1.4 ± 0.2	-0.8 ± 0.2	E Africa M	W Africa F
33	-3.0 ± 0.4	-2.3 ± 0.1	-0.0 ± 0.2	-1.4 ± 0.1	-1.8 ± 0.2	-3.9 ± 0.3	0.7 ± 0.3	-2.7 ± 0.1	-1.3 ± 0.2	-1.0 ± 0.1	-1.6 ± 0.3	-0.8 ± 0.2	E Africa M	W Africa F
34	-2.8 ± 0.4	-2.4 ± 0.1	-0.4 ± 0.2	-1.7 ± 0.1	-1.9 ± 0.2	-4.2 ± 0.3	0.0 ± 0.3	-2.8 ± 0.1	-1.7 ± 0.2	-1.3 ± 0.1	-1.6 ± 0.3	-1.2 ± 0.2	E Africa M	W Africa F
35	-3.0 ± 0.4	-2.6 ± 0.1	-0.7 ± 0.2	-2.1 ± 0.1	-2.3 ± 0.2	-4.3 ± 0.3	0.1 ± 0.3	-3.0 ± 0.2	-1.8 ± 0.2	-1.6 ± 0.1	-2.1 ± 0.3	-1.4 ± 0.3	E Africa M	W Africa F
36	-2.9 ± 0.4	-2.7 ± 0.1	-0.6 ± 0.2	-2.4 ± 0.1	-2.4 ± 0.2	-4.4 ± 0.4	-0.3 ± 0.3	-3.2 ± 0.1	-1.7 ± 0.3	-2.0 ± 0.1	-2.0 ± 0.3	-1.6 ± 0.3	E Africa M	W Africa F
37	-3.4 ± 0.4	-2.9 ± 0.1	-0.9 ± 0.2	-2.7 ± 0.1	-2.5 ± 0.2	-4.5 ± 0.4	-0.1 ± 0.3	-3.1 ± 0.2	-1.9 ± 0.3	-2.3 ± 0.1	-2.3 ± 0.3	-1.8 ± 0.3	E Africa M	W Africa F
38	-3.1 ± 0.5	-3.1 ± 0.1	-1.0 ± 0.2	-2.9 ± 0.1	-2.4 ± 0.2	-4.7 ± 0.4	-0.5 ± 0.4	-3.3 ± 0.2	-1.9 ± 0.3	-2.6 ± 0.1	-1.5 ± 0.3	-1.7 ± 0.3	E Africa M	W Africa F
39	-3.3 ± 0.5	-3.3 ± 0.1	-1.3 ± 0.2	-3.2 ± 0.2	-2.6 ± 0.2	-4.5 ± 0.4	-0.4 ± 0.4	-3.4 ± 0.2	-1.6 ± 0.3	-2.7 ± 0.1	-1.8 ± 0.3	-2.2 ± 0.3	E Africa M	W Africa F
40	-3.1 ± 0.5	-3.4 ± 0.1	-1.2 ± 0.2	-3.2 ± 0.2	-2.8 ± 0.2	-5.0 ± 0.4	-0.4 ± 0.4	-3.5 ± 0.2	-1.9 ± 0.3	-2.9 ± 0.1	-1.8 ± 0.3	-2.5 ± 0.3	E Africa M	W Africa F
41	-3.8 ± 0.5	-3.5 ± 0.1	-1.4 ± 0.2	-3.5 ± 0.2	-2.9 ± 0.2	-5.2 ± 0.5	-0.6 ± 0.4	-3.3 ± 0.2	-1.6 ± 0.3	-2.9 ± 0.2	-1.7 ± 0.3	-2.2 ± 0.4	E Africa M	W Africa F
42	-2.9 ± 0.5	-3.5 ± 0.1	-1.4 ± 0.3	-3.3 ± 0.2	-3.0 ± 0.2	-5.0 ± 0.5	-0.5 ± 0.4	-3.3 ± 0.2	-1.3 ± 0.3	-3.1 ± 0.2	-1.4 ± 0.3	-2.3 ± 0.3	E Africa M	W Africa F
43	-3.2 ± 0.5	-3.7 ± 0.1	-1.3 ± 0.3	-3.8 ± 0.2	-3.2 ± 0.2	-5.2 ± 0.5	-0.3 ± 0.4	-3.0 ± 0.2	-1.5 ± 0.3	-3.1 ± 0.2	-1.2 ± 0.3	-2.8 ± 0.4	E Africa M	W Africa F
44	-2.9 ± 0.6	-4.0 ± 0.1	-1.8 ± 0.3	-3.6 ± 0.2	-2.7 ± 0.2	-5.2 ± 0.5	-1.1 ± 0.4	-2.9 ± 0.2	-1.0 ± 0.3	-3.2 ± 0.2	-1.0 ± 0.3	-2.6 ± 0.4	E Europe M	W Africa F
45	-3.6 ± 0.6	-3.9 ± 0.1	-1.9 ± 0.3	-3.8 ± 0.2	-3.0 ± 0.3	-5.4 ± 0.5	-1.3 ± 0.5	-2.9 ± 0.2	-0.9 ± 0.4	-2.9 ± 0.2	-1.1 ± 0.3	-2.9 ± 0.4	E Europe M	W Africa F
46	-2.8 ± 0.6	-4.1 ± 0.1	-2.0 ± 0.3	-3.6 ± 0.2	-3.3 ± 0.3	-5.0 ± 0.5	-1.2 ± 0.5	-2.8 ± 0.2	-0.8 ± 0.4	-2.8 ± 0.2	-1.1 ± 0.3	-3.2 ± 0.4	E Europe M	W Africa F
47	-2.7 ± 0.7	-4.0 ± 0.1	-1.9 ± 0.3	-3.6 ± 0.2	-3.1 ± 0.3	-5.1 ± 0.5	-0.7 ± 0.5	-2.4 ± 0.2	-0.8 ± 0.3	-2.9 ± 0.2	-0.6 ± 0.3	-2.7 ± 0.4	S E Asia M	W Africa F
48	-3.0 ± 0.7	-4.1 ± 0.1	-2.0 ± 0.3	-3.7 ± 0.3	-3.2 ± 0.3	-5.0 ± 0.6	-1.2 ± 0.5	-2.5 ± 0.2	-0.8 ± 0.4	-2.9 ± 0.2	-0.9 ± 0.3	-3.1 ± 0.4	E Europe M	W Africa F
49	-3.1 ± 0.7	-4.2 ± 0.2	-2.1 ± 0.3	-3.7 ± 0.2	-3.0 ± 0.3	-5.4 ± 0.6	-1.6 ± 0.6	-2.4 ± 0.2	-0.7 ± 0.3	-2.8 ± 0.2	-1.0 ± 0.3	-3.4 ± 0.4	E Europe M	W Africa F
50	-3.5 ± 0.8	-4.3 ± 0.2	-2.1 ± 0.3	-3.7 ± 0.2	-3.3 ± 0.3	-5.0 ± 0.6	-1.9 ± 0.5	-2.2 ± 0.2	-0.9 ± 0.4	-2.9 ± 0.2	-0.5 ± 0.3	-3.2 ± 0.4	S E Asia M	W Africa F
51	-2.9 ± 0.6	-4.5 ± 0.2	-2.2 ± 0.3	-3.9 ± 0.2	-3.3 ± 0.3	-5.2 ± 0.6	-1.7 ± 0.6	-2.2 ± 0.2	-0.8 ± 0.3	-2.8 ± 0.3	-0.8 ± 0.3	-3.4 ± 0.5	S E Asia M	W Africa F
52	-3.0 ± 0.7	-4.4 ± 0.2	-2.2 ± 0.3	-4.3 ± 0.2	-3.1 ± 0.3	-5.8 ± 0.6	-1.8 ± 0.6	-2.2 ± 0.2	-1.1 ± 0.4	-2.9 ± 0.3	-1.1 ± 0.3	-3.6 ± 0.5	S E Asia M	W Africa F

Table 22. *Mean raw error for Application-type images for algorithm incode-000. Values closer to zero are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Group	min Group
14	1.2 ± 0.3	0.7 ± 0.1	1.3 ± 0.3	0.9 ± 0.2	1.0 ± 0.3	2.3 ± 0.3	0.1 ± 0.3	-0.2 ± 0.1	-0.2 ± 0.2	-0.4 ± 0.1	-0.4 ± 0.2	0.4 ± 0.3	W Africa F	S Asia M
15	1.4 ± 0.4	0.9 ± 0.2	1.3 ± 0.3	1.3 ± 0.2	1.4 ± 0.4	2.0 ± 0.4	-0.2 ± 0.3	0.0 ± 0.1	-0.1 ± 0.2	-0.1 ± 0.1	0.2 ± 0.2	0.8 ± 0.3	W Africa F	E Africa M
16	1.3 ± 0.4	0.9 ± 0.2	1.8 ± 0.3	1.4 ± 0.2	1.6 ± 0.4	2.4 ± 0.5	0.7 ± 0.3	0.1 ± 0.1	0.1 ± 0.2	0.2 ± 0.1	0.3 ± 0.2	0.7 ± 0.3	W Africa F	E Asia M
17	1.8 ± 0.5	0.9 ± 0.2	1.6 ± 0.4	1.3 ± 0.2	1.4 ± 0.3	2.0 ± 0.4	0.3 ± 0.3	0.1 ± 0.1	-0.2 ± 0.2	0.5 ± 0.1	0.5 ± 0.2	1.0 ± 0.4	W Africa F	E Europe M
18	1.0 ± 0.4	0.5 ± 0.2	0.9 ± 0.3	0.9 ± 0.2	1.5 ± 0.2	1.3 ± 0.4	0.2 ± 0.3	-0.3 ± 0.1	-0.5 ± 0.2	0.2 ± 0.1	0.3 ± 0.2	0.3 ± 0.3	S E Asia F	E Europe M
19	1.6 ± 0.4	0.6 ± 0.2	1.0 ± 0.3	1.0 ± 0.2	1.4 ± 0.2	1.5 ± 0.4	0.8 ± 0.3	-0.3 ± 0.1	-0.5 ± 0.2	0.5 ± 0.1	0.1 ± 0.2	0.7 ± 0.4	E Africa F	E Europe M
20	1.6 ± 0.4	0.7 ± 0.2	1.0 ± 0.3	1.0 ± 0.2	1.3 ± 0.2	1.4 ± 0.4	1.0 ± 0.3	-0.5 ± 0.1	-0.2 ± 0.2	0.7 ± 0.1	0.3 ± 0.2	0.9 ± 0.4	E Africa F	E Asia M
21	1.8 ± 0.4	0.7 ± 0.2	1.0 ± 0.3	0.8 ± 0.2	1.4 ± 0.2	1.7 ± 0.4	1.4 ± 0.3	-0.4 ± 0.1	-0.3 ± 0.2	0.9 ± 0.1	0.4 ± 0.2	0.8 ± 0.4	E Africa F	E Asia M
22	1.8 ± 0.4	0.5 ± 0.1	1.1 ± 0.2	0.7 ± 0.2	1.1 ± 0.2	1.1 ± 0.4	2.2 ± 0.3	-0.4 ± 0.1	0.2 ± 0.2	1.0 ± 0.2	0.1 ± 0.2	0.6 ± 0.3	E Africa M	E Asia M
23	2.1 ± 0.3	0.3 ± 0.1	1.2 ± 0.2	0.7 ± 0.1	1.0 ± 0.2	1.3 ± 0.3	2.0 ± 0.3	-0.5 ± 0.1	0.2 ± 0.2	1.1 ± 0.1	0.2 ± 0.2	1.2 ± 0.3	E Africa F	E Asia M
24	2.3 ± 0.4	0.0 ± 0.1	1.3 ± 0.2	0.5 ± 0.1	0.8 ± 0.1	1.0 ± 0.3	2.0 ± 0.3	-0.5 ± 0.1	0.4 ± 0.2	1.1 ± 0.1	0.1 ± 0.2	1.1 ± 0.3	E Africa F	E Asia M
25	1.8 ± 0.3	0.0 ± 0.1	1.0 ± 0.2	0.3 ± 0.1	0.6 ± 0.1	1.2 ± 0.3	2.1 ± 0.3	-0.5 ± 0.1	0.4 ± 0.2	1.2 ± 0.1	0.1 ± 0.2	0.9 ± 0.3	E Africa M	E Asia M
26	2.0 ± 0.3	-0.3 ± 0.1	1.1 ± 0.1	0.1 ± 0.1	0.5 ± 0.1	1.1 ± 0.3	1.9 ± 0.3	-0.7 ± 0.1	0.3 ± 0.2	1.1 ± 0.1	0.1 ± 0.2	0.7 ± 0.2	E Africa F	E Asia M
27	1.9 ± 0.3	-0.54 ± 0.10	1.1 ± 0.1	-0.1 ± 0.1	0.3 ± 0.1	1.0 ± 0.3	1.8 ± 0.3	-0.7 ± 0.1	0.4 ± 0.2	0.8 ± 0.1	0.1 ± 0.2	0.5 ± 0.3	E Africa F	E Asia M
28	1.9 ± 0.3	-0.80 ± 0.09	1.0 ± 0.1	-0.3 ± 0.1	0.0 ± 0.1	0.9 ± 0.3	1.6 ± 0.2	-0.9 ± 0.1	0.5 ± 0.2	0.8 ± 0.1	-0.2 ± 0.2	0.2 ± 0.2	E Africa F	E Asia M
29	2.1 ± 0.3	-0.99 ± 0.09	1.0 ± 0.1	-0.5 ± 0.1	0.0 ± 0.1	0.7 ± 0.3	1.6 ± 0.2	-1.0 ± 0.1	0.3 ± 0.2	0.53 ± 0.10	-0.3 ± 0.2	0.6 ± 0.2	E Africa F	E Asia M
30	1.8 ± 0.3	-1.11 ± 0.09	0.9 ± 0.1	-0.7 ± 0.1	-0.1 ± 0.1	0.4 ± 0.3	1.5 ± 0.3	-1.2 ± 0.1	0.3 ± 0.2	0.38 ± 0.10	-0.2 ± 0.2	0.4 ± 0.2	E Africa F	E Asia M
31	1.5 ± 0.3	-1.27 ± 0.10	1.1 ± 0.2	-0.9 ± 0.1	-0.2 ± 0.1	0.3 ± 0.3	1.5 ± 0.2	-1.2 ± 0.1	0.3 ± 0.2	0.30 ± 0.10	-0.4 ± 0.2	0.4 ± 0.2	E Africa M	E Asia F
32	1.8 ± 0.3	-1.4 ± 0.1	1.0 ± 0.2	-0.9 ± 0.1	-0.3 ± 0.2	0.4 ± 0.3	1.2 ± 0.3	-1.3 ± 0.1	0.4 ± 0.2	0.2 ± 0.1	-0.3 ± 0.2	0.3 ± 0.2	E Africa F	E Asia F
33	1.7 ± 0.3	-1.5 ± 0.1	1.0 ± 0.2	-0.9 ± 0.1	-0.4 ± 0.2	0.5 ± 0.3	1.5 ± 0.3	-1.4 ± 0.1	0.7 ± 0.2	0.1 ± 0.1	-0.5 ± 0.2	0.2 ± 0.2	E Africa F	E Asia F
34	1.4 ± 0.3	-1.5 ± 0.1	1.1 ± 0.2	-1.0 ± 0.1	-0.3 ± 0.2	0.2 ± 0.3	1.0 ± 0.3	-1.4 ± 0.1	0.5 ± 0.2	0.1 ± 0.1	-0.2 ± 0.2	0.3 ± 0.2	E Africa F	E Asia F
35	1.7 ± 0.3	-1.6 ± 0.1	1.1 ± 0.2	-1.1 ± 0.1	-0.4 ± 0.2	-0.0 ± 0.3	1.3 ± 0.3	-1.2 ± 0.1	0.6 ± 0.2	0.1 ± 0.1	-0.4 ± 0.2	0.2 ± 0.3	E Africa F	E Asia F
36	1.5 ± 0.3	-1.5 ± 0.1	1.2 ± 0.2	-1.1 ± 0.1	-0.3 ± 0.2	0.3 ± 0.3	1.2 ± 0.3	-1.1 ± 0.1	0.8 ± 0.2	0.1 ± 0.1	-0.1 ± 0.3	0.2 ± 0.3	E Africa F	E Asia F
37	1.6 ± 0.3	-1.4 ± 0.1	1.4 ± 0.2	-0.9 ± 0.1	-0.2 ± 0.2	0.0 ± 0.4	1.1 ± 0.3	-1.1 ± 0.1	0.7 ± 0.2	0.1 ± 0.1	-0.3 ± 0.2	0.0 ± 0.2	E Africa F	E Asia F
38	1.7 ± 0.4	-1.5 ± 0.1	1.4 ± 0.2	-0.8 ± 0.1	-0.3 ± 0.2	0.1 ± 0.4	0.8 ± 0.3	-0.9 ± 0.1	0.8 ± 0.2	0.1 ± 0.1	0.2 ± 0.2	0.2 ± 0.3	E Africa F	E Asia F
39	1.4 ± 0.4	-1.4 ± 0.1	1.3 ± 0.2	-0.8 ± 0.1	-0.1 ± 0.2	0.2 ± 0.3	1.0 ± 0.3	-0.8 ± 0.1	1.0 ± 0.2	0.2 ± 0.1	0.1 ± 0.2	0.1 ± 0.3	E Africa F	E Asia F
40	1.4 ± 0.4	-1.3 ± 0.1	1.6 ± 0.2	-0.6 ± 0.1	-0.2 ± 0.2	-0.3 ± 0.4	0.7 ± 0.3	-0.7 ± 0.1	1.0 ± 0.2	0.1 ± 0.1	-0.0 ± 0.2	-0.2 ± 0.3	E Europe F	E Asia F
41	1.0 ± 0.4	-1.3 ± 0.1	1.5 ± 0.2	-0.7 ± 0.2	-0.3 ± 0.2	-0.6 ± 0.4	1.0 ± 0.3	-0.7 ± 0.1	1.0 ± 0.2	0.1 ± 0.1	-0.1 ± 0.2	-0.2 ± 0.3	E Europe F	E Asia F
42	1.4 ± 0.4	-1.1 ± 0.1	1.5 ± 0.2	-0.2 ± 0.2	-0.2 ± 0.2	-0.2 ± 0.4	0.9 ± 0.3	-0.6 ± 0.1	1.1 ± 0.2	0.0 ± 0.1	0.1 ± 0.2	-0.3 ± 0.3	E Europe F	E Asia F
43	1.6 ± 0.4	-1.2 ± 0.1	1.3 ± 0.2	-0.6 ± 0.2	-0.3 ± 0.2	-0.5 ± 0.4	0.8 ± 0.3	-0.5 ± 0.1	0.8 ± 0.2	0.0 ± 0.1	0.1 ± 0.2	-0.7 ± 0.3	E Africa F	E Asia F
44	1.4 ± 0.5	-1.4 ± 0.1	1.0 ± 0.2	-0.5 ± 0.2	-0.3 ± 0.2	-0.6 ± 0.4	0.4 ± 0.3	-0.6 ± 0.1	1.1 ± 0.2	0.0 ± 0.1	0.1 ± 0.2	-0.4 ± 0.3	E Africa F	E Asia F
45	1.1 ± 0.5	-1.3 ± 0.1	1.0 ± 0.2	-0.6 ± 0.2	-0.3 ± 0.2	-0.6 ± 0.4	0.3 ± 0.4	-0.7 ± 0.1	0.8 ± 0.2	0.1 ± 0.1	-0.2 ± 0.2	-0.8 ± 0.3	E Africa F	E Asia F
46	2.2 ± 0.5	-1.5 ± 0.1	0.9 ± 0.2	-0.5 ± 0.2	-0.6 ± 0.2	-0.5 ± 0.4	0.3 ± 0.4	-0.6 ± 0.1	0.8 ± 0.2	0.2 ± 0.2	-0.1 ± 0.2	-0.8 ± 0.3	E Africa F	E Asia F
47	1.9 ± 0.5	-1.4 ± 0.1	0.9 ± 0.2	-0.5 ± 0.2	-0.5 ± 0.2	-0.6 ± 0.4	0.8 ± 0.4	-0.7 ± 0.1	0.9 ± 0.2	0.2 ± 0.2	0.1 ± 0.3	-0.8 ± 0.3	E Africa F	E Asia F
48	1.1 ± 0.6	-1.4 ± 0.1	1.1 ± 0.2	-0.4 ± 0.2	-0.5 ± 0.2	-0.6 ± 0.4	0.3 ± 0.5	-0.7 ± 0.1	1.0 ± 0.3	0.4 ± 0.2	-0.0 ± 0.3	-1.1 ± 0.4	E Africa F	E Asia F
49	2.0 ± 0.6	-1.6 ± 0.1	0.8 ± 0.2	-0.4 ± 0.2	-0.3 ± 0.2	-0.5 ± 0.5	0.1 ± 0.5	-0.5 ± 0.1	0.9 ± 0.3	0.2 ± 0.2	0.1 ± 0.3	-0.8 ± 0.4	E Africa F	E Asia F
50	1.5 ± 0.6	-1.4 ± 0.1	1.0 ± 0.2	-0.4 ± 0.2	-0.3 ± 0.2	-0.5 ± 0.5	0.1 ± 0.5	-0.6 ± 0.1	0.9 ± 0.3	0.2 ± 0.2	0.4 ± 0.3	-1.2 ± 0.4	E Africa F	E Asia F
51	1.8 ± 0.6	-1.4 ± 0.1	0.7 ± 0.3	-0.2 ± 0.2	-0.2 ± 0.2	-0.2 ± 0.5	-0.3 ± 0.6	-0.5 ± 0.2	1.2 ± 0.3	0.5 ± 0.2	0.3 ± 0.3	-1.2 ± 0.4	E Africa F	E Asia F
52	1.7 ± 0.7	-1.3 ± 0.1	1.1 ± 0.3	-0.3 ± 0.2	0.2 ± 0.2	-0.8 ± 0.5	0.1 ± 0.6	-0.5 ± 0.2	1.2 ± 0.3	0.6 ± 0.2	0.4 ± 0.3	-1.0 ± 0.5	E Africa F	E Asia F

Table 23. *Mean raw error for Application-type images for algorithm neurotechnology-000. Values closer to zero are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Group	min Group
14	5.7 ± 0.5	5.4 ± 0.2	3.8 ± 0.3	3.8 ± 0.2	3.9 ± 0.4	9.3 ± 0.5	8.6 ± 0.4	6.3 ± 0.2	3.3 ± 0.3	4.7 ± 0.2	5.1 ± 0.4	11.1 ± 0.5	W Africa M	E Europe M
15	4.9 ± 0.5	5.7 ± 0.2	3.4 ± 0.3	3.9 ± 0.2	4.1 ± 0.4	8.4 ± 0.5	8.7 ± 0.5	6.7 ± 0.2	3.4 ± 0.3	5.1 ± 0.2	5.7 ± 0.4	10.4 ± 0.5	W Africa M	E Europe M
16	5.0 ± 0.5	5.0 ± 0.2	3.5 ± 0.3	3.4 ± 0.3	4.4 ± 0.4	8.3 ± 0.6	9.3 ± 0.3	6.4 ± 0.1	3.7 ± 0.3	5.2 ± 0.2	5.8 ± 0.3	9.8 ± 0.4	W Africa M	S Asia F
17	5.3 ± 0.5	4.5 ± 0.2	3.2 ± 0.4	3.0 ± 0.2	3.9 ± 0.4	8.2 ± 0.4	9.2 ± 0.4	5.9 ± 0.1	3.3 ± 0.2	5.0 ± 0.2	5.4 ± 0.3	9.8 ± 0.4	W Africa M	S Asia F
18	4.2 ± 0.4	3.4 ± 0.2	2.4 ± 0.3	2.3 ± 0.2	3.0 ± 0.3	7.1 ± 0.4	8.5 ± 0.3	5.1 ± 0.1	2.8 ± 0.2	4.4 ± 0.1	4.9 ± 0.2	8.9 ± 0.3	W Africa M	S Asia F
19	3.9 ± 0.4	2.6 ± 0.2	2.0 ± 0.3	2.0 ± 0.2	2.2 ± 0.2	6.8 ± 0.4	8.3 ± 0.3	4.5 ± 0.1	2.1 ± 0.2	4.3 ± 0.1	4.1 ± 0.2	8.4 ± 0.3	W Africa M	S Asia F
20	3.2 ± 0.4	1.9 ± 0.2	1.6 ± 0.2	1.3 ± 0.2	1.5 ± 0.2	6.1 ± 0.3	7.9 ± 0.3	3.8 ± 0.1	2.0 ± 0.2	4.0 ± 0.1	3.4 ± 0.2	8.1 ± 0.3	W Africa M	S Asia F
21	2.7 ± 0.4	1.1 ± 0.2	1.1 ± 0.2	0.6 ± 0.2	1.1 ± 0.2	5.6 ± 0.3	7.3 ± 0.3	3.02 ± 0.10	1.7 ± 0.2	3.4 ± 0.1	2.9 ± 0.2	7.6 ± 0.3	W Africa M	S Asia F
22	2.6 ± 0.3	0.2 ± 0.1	0.7 ± 0.2	-0.0 ± 0.1	0.2 ± 0.2	5.1 ± 0.3	7.2 ± 0.2	2.30 ± 0.10	1.3 ± 0.2	2.8 ± 0.1	2.2 ± 0.2	7.0 ± 0.3	E Africa M	S Asia F
23	1.9 ± 0.3	-0.3 ± 0.1	0.4 ± 0.2	-0.4 ± 0.1	-0.3 ± 0.2	4.3 ± 0.3	6.3 ± 0.2	1.7 ± 0.1	0.8 ± 0.2	2.4 ± 0.1	1.4 ± 0.2	6.3 ± 0.2	W Africa M	S Asia F
24	1.3 ± 0.3	-1.2 ± 0.1	-0.1 ± 0.2	-1.1 ± 0.1	-0.8 ± 0.1	3.7 ± 0.3	6.0 ± 0.2	1.0 ± 0.1	0.5 ± 0.2	1.9 ± 0.1	0.9 ± 0.1	5.7 ± 0.2	E Africa M	E Asia F
25	0.9 ± 0.3	-1.8 ± 0.1	-0.4 ± 0.2	-1.7 ± 0.1	-1.7 ± 0.1	3.0 ± 0.3	5.3 ± 0.2	0.3 ± 0.1	0.2 ± 0.2	1.3 ± 0.1	0.2 ± 0.1	5.2 ± 0.2	E Africa M	E Asia F
26	0.3 ± 0.3	-2.6 ± 0.1	-0.8 ± 0.2	-2.4 ± 0.1	-2.2 ± 0.1	2.4 ± 0.2	4.7 ± 0.2	-0.37 ± 0.09	-0.2 ± 0.2	0.7 ± 0.1	-0.3 ± 0.2	4.4 ± 0.2	E Africa M	E Asia F
27	0.1 ± 0.3	-3.16 ± 0.10	-1.2 ± 0.2	-3.0 ± 0.1	-2.7 ± 0.1	1.7 ± 0.2	4.0 ± 0.2	-0.99 ± 0.10	-0.4 ± 0.2	0.1 ± 0.1	-0.8 ± 0.2	3.7 ± 0.2	E Africa M	E Asia F
28	-0.5 ± 0.3	-3.77 ± 0.09	-1.6 ± 0.2	-3.6 ± 0.1	-3.3 ± 0.1	1.2 ± 0.2	3.3 ± 0.2	-1.61 ± 0.10	-0.5 ± 0.2	-0.6 ± 0.1	-1.5 ± 0.2	3.0 ± 0.2	E Africa M	E Asia F
29	-0.9 ± 0.3	-4.35 ± 0.09	-1.8 ± 0.2	-4.2 ± 0.1	-4.0 ± 0.1	0.5 ± 0.2	2.7 ± 0.2	-2.15 ± 0.09	-1.1 ± 0.2	-1.19 ± 0.10	-1.9 ± 0.2	2.6 ± 0.2	E Africa M	E Asia F
30	-1.5 ± 0.3	-4.94 ± 0.09	-2.2 ± 0.2	-4.8 ± 0.1	-4.4 ± 0.1	-0.1 ± 0.2	2.4 ± 0.2	-2.84 ± 0.09	-1.3 ± 0.2	-1.72 ± 0.09	-2.6 ± 0.2	1.9 ± 0.2	E Africa M	E Asia F
31	-1.9 ± 0.3	-5.49 ± 0.09	-2.4 ± 0.2	-5.4 ± 0.1	-4.9 ± 0.2	-0.8 ± 0.2	1.8 ± 0.2	-3.3 ± 0.1	-1.6 ± 0.2	-2.26 ± 0.10	-3.2 ± 0.2	1.1 ± 0.2	E Africa M	E Asia F
32	-1.9 ± 0.3	-6.12 ± 0.10	-2.6 ± 0.2	-6.0 ± 0.1	-5.4 ± 0.2	-1.3 ± 0.3	1.1 ± 0.2	-3.9 ± 0.1	-1.6 ± 0.2	-2.73 ± 0.10	-3.6 ± 0.2	0.5 ± 0.2	E Africa M	E Asia F
33	-2.7 ± 0.3	-6.63 ± 0.10	-2.9 ± 0.2	-6.4 ± 0.1	-6.0 ± 0.2	-1.7 ± 0.3	0.7 ± 0.2	-4.6 ± 0.1	-1.6 ± 0.2	-3.2 ± 0.1	-3.8 ± 0.2	-0.0 ± 0.2	E Africa M	E Asia F
34	-3.1 ± 0.3	-7.07 ± 0.10	-3.3 ± 0.2	-6.9 ± 0.1	-6.4 ± 0.2	-2.4 ± 0.3	-0.1 ± 0.2	-5.0 ± 0.1	-2.0 ± 0.2	-3.6 ± 0.1	-4.2 ± 0.3	-0.7 ± 0.2	E Africa M	E Asia F
35	-3.3 ± 0.4	-7.6 ± 0.1	-3.5 ± 0.2	-7.4 ± 0.1	-6.8 ± 0.2	-2.8 ± 0.3	-0.3 ± 0.2	-5.4 ± 0.1	-2.2 ± 0.2	-4.0 ± 0.1	-4.7 ± 0.3	-1.1 ± 0.2	E Africa M	E Asia F
36	-3.6 ± 0.4	-8.0 ± 0.1	-3.6 ± 0.3	-7.8 ± 0.1	-7.0 ± 0.2	-3.2 ± 0.3	-0.9 ± 0.3	-5.8 ± 0.1	-2.0 ± 0.3	-4.5 ± 0.1	-4.8 ± 0.3	-1.9 ± 0.2	E Africa M	E Asia F
37	-3.9 ± 0.4	-8.4 ± 0.1	-3.7 ± 0.3	-8.0 ± 0.2	-7.6 ± 0.2	-3.5 ± 0.3	-1.1 ± 0.3	-6.2 ± 0.1	-2.5 ± 0.3	-4.7 ± 0.1	-5.3 ± 0.3	-2.4 ± 0.2	E Africa M	E Asia F
38	-3.9 ± 0.4	-8.7 ± 0.1	-3.7 ± 0.3	-8.3 ± 0.2	-7.7 ± 0.2	-4.2 ± 0.4	-1.9 ± 0.3	-6.5 ± 0.1	-2.5 ± 0.3	-5.1 ± 0.1	-4.8 ± 0.3	-2.8 ± 0.2	E Africa M	E Asia F
39	-4.1 ± 0.4	-9.2 ± 0.1	-3.8 ± 0.3	-8.8 ± 0.2	-7.6 ± 0.2	-4.1 ± 0.4	-1.8 ± 0.3	-6.8 ± 0.2	-2.6 ± 0.3	-5.3 ± 0.1	-5.0 ± 0.3	-3.3 ± 0.2	E Africa M	E Asia F
40	-4.7 ± 0.5	-9.4 ± 0.1	-3.8 ± 0.3	-8.8 ± 0.2	-8.0 ± 0.3	-4.8 ± 0.4	-2.1 ± 0.4	-7.0 ± 0.2	-2.6 ± 0.3	-5.4 ± 0.2	-5.2 ± 0.3	-3.9 ± 0.3	E Africa M	E Asia F
41	-5.3 ± 0.5	-9.6 ± 0.1	-4.0 ± 0.3	-9.0 ± 0.2	-8.2 ± 0.3	-5.6 ± 0.4	-2.4 ± 0.4	-7.0 ± 0.2	-2.6 ± 0.3	-5.5 ± 0.2	-5.2 ± 0.4	-4.1 ± 0.3	E Africa M	E Asia F
42	-4.5 ± 0.5	-9.8 ± 0.1	-3.4 ± 0.4	-8.8 ± 0.3	-8.0 ± 0.3	-5.3 ± 0.4	-2.6 ± 0.4	-7.0 ± 0.2	-2.2 ± 0.3	-5.9 ± 0.2	-4.8 ± 0.4	-4.3 ± 0.3	E Europe M	E Asia F
43	-5.3 ± 0.6	-9.9 ± 0.2	-3.3 ± 0.4	-9.1 ± 0.3	-8.3 ± 0.3	-5.9 ± 0.5	-2.4 ± 0.4	-6.9 ± 0.2	-2.4 ± 0.4	-5.9 ± 0.2	-5.0 ± 0.4	-5.0 ± 0.3	E Europe M	E Asia F
44	-5.0 ± 0.6	-10.3 ± 0.2	-3.7 ± 0.4	-9.1 ± 0.3	-7.7 ± 0.3	-5.8 ± 0.5	-3.0 ± 0.4	-6.9 ± 0.2	-2.2 ± 0.4	-5.7 ± 0.2	-4.6 ± 0.4	-4.8 ± 0.3	E Europe M	E Asia F
45	-5.7 ± 0.6	-10.3 ± 0.2	-3.7 ± 0.4	-9.0 ± 0.3	-8.1 ± 0.3	-5.9 ± 0.5	-3.2 ± 0.5	-7.0 ± 0.2	-2.3 ± 0.4	-5.8 ± 0.2	-4.4 ± 0.4	-5.2 ± 0.4	E Europe M	E Asia F
46	-4.8 ± 0.7	-10.6 ± 0.2	-3.6 ± 0.4	-8.8 ± 0.3	-8.4 ± 0.4	-6.4 ± 0.5	-3.1 ± 0.5	-6.8 ± 0.2	-1.9 ± 0.4	-5.5 ± 0.2	-4.0 ± 0.4	-5.5 ± 0.4	E Europe M	E Asia F
47	-4.4 ± 0.7	-10.2 ± 0.2	-3.2 ± 0.4	-8.8 ± 0.3	-7.9 ± 0.4	-6.2 ± 0.5	-2.7 ± 0.5	-6.5 ± 0.3	-2.4 ± 0.4	-5.2 ± 0.3	-3.9 ± 0.4	-4.9 ± 0.5	E Europe M	E Asia F
48	-5.4 ± 0.7	-10.1 ± 0.2	-3.3 ± 0.4	-8.6 ± 0.4	-7.8 ± 0.4	-6.5 ± 0.6	-3.7 ± 0.6	-6.5 ± 0.3	-2.1 ± 0.4	-5.2 ± 0.3	-3.7 ± 0.5	-6.1 ± 0.5	E Europe M	E Asia F
49	-5.1 ± 0.8	-10.3 ± 0.2	-3.5 ± 0.4	-8.5 ± 0.3	-7.4 ± 0.4	-6.8 ± 0.6	-3.6 ± 0.6	-6.2 ± 0.3	-2.1 ± 0.4	-5.1 ± 0.3	-3.4 ± 0.5	-5.8 ± 0.5	E Europe M	E Asia F
50	-5.6 ± 0.9	-9.9 ± 0.2	-3.1 ± 0.4	-8.5 ± 0.3	-7.7 ± 0.4	-6.4 ± 0.6	-3.8 ± 0.7	-6.0 ± 0.3	-2.2 ± 0.4	-5.2 ± 0.3	-3.2 ± 0.5	-5.7 ± 0.5	E Europe M	E Asia F
51	-5.0 ± 0.7	-9.9 ± 0.2	-3.6 ± 0.4	-8.3 ± 0.3	-7.3 ± 0.4	-6.6 ± 0.6	-4.0 ± 0.7	-5.8 ± 0.3	-1.8 ± 0.4	-5.1 ± 0.3	-3.0 ± 0.5	-6.1 ± 0.6	E Europe M	E Asia F
52	-5.3 ± 0.8	-9.9 ± 0.3	-3.3 ± 0.4	-8.6 ± 0.3	-6.5 ± 0.4	-7.0 ± 0.6	-3.2 ± 0.7	-5.6 ± 0.3	-2.0 ± 0.4	-5.1 ± 0.3	-3.4 ± 0.5	-6.0 ± 0.6	E Europe M	E Asia F

Table 24. *Mean raw error for Application-type images for algorithm roc-000. Values closer to zero are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Group	min Group
14	5.1 ± 0.3	5.4 ± 0.1	3.7 ± 0.2	3.7 ± 0.1	4.5 ± 0.3	5.7 ± 0.3	4.2 ± 0.2	5.4 ± 0.1	2.7 ± 0.2	3.2 ± 0.1	4.5 ± 0.3	4.6 ± 0.3	W Africa F	E Europe M
15	4.8 ± 0.3	5.5 ± 0.1	3.2 ± 0.2	3.8 ± 0.2	4.7 ± 0.3	5.4 ± 0.4	4.1 ± 0.3	5.4 ± 0.1	2.6 ± 0.1	3.2 ± 0.1	4.6 ± 0.2	4.6 ± 0.3	E Asia F	E Europe M
16	4.7 ± 0.3	5.4 ± 0.2	2.8 ± 0.1	3.4 ± 0.2	4.9 ± 0.3	5.6 ± 0.4	4.2 ± 0.2	4.9 ± 0.1	2.3 ± 0.2	3.0 ± 0.1	4.4 ± 0.2	4.2 ± 0.3	W Africa F	E Europe M
17	4.8 ± 0.3	5.0 ± 0.1	2.3 ± 0.2	3.1 ± 0.2	4.5 ± 0.3	5.1 ± 0.3	3.7 ± 0.2	4.7 ± 0.1	1.58 ± 0.09	2.8 ± 0.1	4.2 ± 0.2	4.4 ± 0.4	W Africa F	E Europe M
18	3.9 ± 0.3	4.3 ± 0.1	1.4 ± 0.2	2.2 ± 0.1	4.2 ± 0.2	4.5 ± 0.3	3.4 ± 0.2	4.1 ± 0.1	0.8 ± 0.2	2.1 ± 0.1	3.8 ± 0.2	3.8 ± 0.3	W Africa F	E Europe M
19	3.9 ± 0.3	4.1 ± 0.1	1.1 ± 0.2	2.0 ± 0.1	4.0 ± 0.2	4.7 ± 0.3	3.7 ± 0.3	4.0 ± 0.1	0.3 ± 0.2	2.1 ± 0.1	3.5 ± 0.2	4.0 ± 0.3	W Africa F	E Europe M
20	3.6 ± 0.3	4.0 ± 0.1	0.5 ± 0.2	1.7 ± 0.2	3.7 ± 0.2	4.4 ± 0.3	3.5 ± 0.3	3.8 ± 0.1	0.1 ± 0.2	2.1 ± 0.1	3.6 ± 0.2	4.0 ± 0.3	W Africa F	E Europe M
21	3.2 ± 0.3	3.8 ± 0.1	0.2 ± 0.2	1.2 ± 0.1	3.5 ± 0.2	4.2 ± 0.3	3.6 ± 0.3	3.7 ± 0.1	-0.2 ± 0.2	2.1 ± 0.1	3.6 ± 0.2	4.0 ± 0.3	W Africa F	E Europe M
22	3.2 ± 0.3	3.3 ± 0.1	-0.0 ± 0.2	0.8 ± 0.1	3.4 ± 0.2	3.7 ± 0.3	4.2 ± 0.3	3.5 ± 0.1	-0.1 ± 0.2	2.1 ± 0.2	3.2 ± 0.2	3.7 ± 0.3	E Africa M	E Europe M
23	3.0 ± 0.3	3.2 ± 0.1	-0.2 ± 0.2	0.5 ± 0.1	3.2 ± 0.2	3.7 ± 0.3	3.8 ± 0.3	3.3 ± 0.1	-0.4 ± 0.2	2.1 ± 0.2	3.2 ± 0.2	3.9 ± 0.3	W Africa M	E Europe M
24	2.8 ± 0.3	2.8 ± 0.1	-0.3 ± 0.2	0.1 ± 0.1	2.9 ± 0.1	3.3 ± 0.3	3.9 ± 0.3	3.1 ± 0.1	-0.1 ± 0.2	2.1 ± 0.1	3.0 ± 0.2	3.7 ± 0.2	E Africa M	E Europe F
25	2.4 ± 0.3	2.69 ± 0.10	-0.3 ± 0.2	-0.3 ± 0.1	2.7 ± 0.1	3.2 ± 0.3	3.8 ± 0.3	2.9 ± 0.1	0.0 ± 0.2	1.9 ± 0.1	2.9 ± 0.2	3.6 ± 0.2	E Africa M	E Europe F
26	2.1 ± 0.3	2.35 ± 0.10	-0.3 ± 0.2	-0.6 ± 0.1	2.6 ± 0.1	2.9 ± 0.3	3.7 ± 0.2	2.7 ± 0.1	-0.1 ± 0.2	1.8 ± 0.1	2.7 ± 0.2	3.2 ± 0.2	E Africa M	S Asia F
27	2.3 ± 0.3	2.06 ± 0.09	-0.3 ± 0.2	-0.9 ± 0.1	2.2 ± 0.1	2.7 ± 0.2	3.3 ± 0.2	2.5 ± 0.1	0.2 ± 0.2	1.6 ± 0.1	2.7 ± 0.2	3.0 ± 0.2	E Africa M	S Asia F
28	1.9 ± 0.3	1.78 ± 0.09	-0.2 ± 0.2	-1.1 ± 0.1	2.0 ± 0.1	2.4 ± 0.2	3.2 ± 0.2	2.3 ± 0.1	0.4 ± 0.2	1.4 ± 0.1	2.3 ± 0.2	2.5 ± 0.2	E Africa M	S Asia F
29	2.0 ± 0.3	1.63 ± 0.09	-0.0 ± 0.2	-1.3 ± 0.1	1.8 ± 0.1	2.1 ± 0.2	3.1 ± 0.2	2.1 ± 0.1	0.5 ± 0.2	1.3 ± 0.1	2.1 ± 0.2	2.7 ± 0.2	E Africa M	S Asia F
30	1.6 ± 0.3	1.45 ± 0.09	-0.0 ± 0.2	-1.5 ± 0.1	1.8 ± 0.1	1.8 ± 0.3	3.0 ± 0.2	1.8 ± 0.1	0.5 ± 0.2	1.02 ± 0.10	2.0 ± 0.2	2.3 ± 0.2	E Africa M	S Asia F
31	1.6 ± 0.3	1.19 ± 0.09	0.1 ± 0.2	-1.7 ± 0.1	1.5 ± 0.1	1.6 ± 0.2	3.0 ± 0.2	1.6 ± 0.1	0.4 ± 0.2	0.84 ± 0.10	1.7 ± 0.2	2.2 ± 0.2	E Africa M	S Asia F
32	1.7 ± 0.3	1.00 ± 0.09	0.3 ± 0.2	-1.8 ± 0.1	1.3 ± 0.2	1.6 ± 0.3	2.6 ± 0.2	1.4 ± 0.1	0.5 ± 0.2	0.75 ± 0.10	1.6 ± 0.2	1.9 ± 0.2	E Africa M	S Asia F
33	1.4 ± 0.3	0.80 ± 0.09	0.3 ± 0.2	-1.9 ± 0.1	1.1 ± 0.2	1.2 ± 0.3	2.6 ± 0.3	1.1 ± 0.1	1.0 ± 0.2	0.51 ± 0.10	1.2 ± 0.2	1.7 ± 0.2	E Africa M	S Asia F
34	1.5 ± 0.3	0.66 ± 0.10	0.5 ± 0.2	-2.0 ± 0.1	1.0 ± 0.2	1.2 ± 0.3	2.2 ± 0.3	0.9 ± 0.1	0.7 ± 0.2	0.35 ± 0.10	1.2 ± 0.2	1.6 ± 0.2	E Africa M	S Asia F
35	1.6 ± 0.4	0.4 ± 0.1	0.4 ± 0.2	-2.1 ± 0.1	0.6 ± 0.2	0.7 ± 0.3	2.3 ± 0.3	0.8 ± 0.1	0.7 ± 0.2	0.3 ± 0.1	0.9 ± 0.2	1.2 ± 0.2	E Africa M	S Asia F
36	1.4 ± 0.4	0.4 ± 0.1	0.9 ± 0.2	-2.2 ± 0.1	0.6 ± 0.2	0.8 ± 0.3	2.0 ± 0.3	0.6 ± 0.1	0.9 ± 0.2	0.0 ± 0.1	1.1 ± 0.2	1.1 ± 0.2	E Africa M	S Asia F
37	1.4 ± 0.4	0.2 ± 0.1	1.0 ± 0.2	-2.0 ± 0.2	0.5 ± 0.2	0.8 ± 0.3	2.0 ± 0.3	0.5 ± 0.1	0.6 ± 0.2	-0.1 ± 0.1	0.7 ± 0.2	0.8 ± 0.2	E Africa M	S Asia F
38	1.8 ± 0.4	0.0 ± 0.1	1.3 ± 0.2	-2.0 ± 0.2	0.6 ± 0.2	0.4 ± 0.3	1.6 ± 0.3	0.4 ± 0.1	0.7 ± 0.2	-0.3 ± 0.1	1.0 ± 0.2	0.7 ± 0.2	E Africa F	S Asia F
39	1.5 ± 0.4	-0.0 ± 0.1	1.2 ± 0.2	-2.2 ± 0.2	0.5 ± 0.2	0.6 ± 0.3	1.9 ± 0.3	0.2 ± 0.1	0.7 ± 0.2	-0.3 ± 0.1	1.0 ± 0.2	0.6 ± 0.2	E Africa M	S Asia F
40	1.5 ± 0.4	-0.1 ± 0.1	1.7 ± 0.3	-2.0 ± 0.2	0.3 ± 0.2	0.1 ± 0.3	1.8 ± 0.3	0.1 ± 0.1	0.6 ± 0.2	-0.4 ± 0.1	0.8 ± 0.2	0.4 ± 0.2	E Africa M	S Asia F
41	1.1 ± 0.4	-0.2 ± 0.1	1.7 ± 0.3	-2.0 ± 0.2	0.3 ± 0.2	-0.1 ± 0.4	1.9 ± 0.3	0.1 ± 0.1	0.8 ± 0.2	-0.5 ± 0.1	0.6 ± 0.2	0.3 ± 0.3	E Africa M	S Asia F
42	1.6 ± 0.5	-0.1 ± 0.1	2.0 ± 0.3	-1.5 ± 0.2	0.4 ± 0.2	0.0 ± 0.4	1.8 ± 0.3	0.1 ± 0.1	1.0 ± 0.2	-0.7 ± 0.1	0.9 ± 0.2	0.2 ± 0.3	E Europe F	S Asia F
43	1.6 ± 0.5	-0.3 ± 0.1	2.2 ± 0.3	-1.7 ± 0.2	0.3 ± 0.2	-0.0 ± 0.4	1.9 ± 0.4	0.0 ± 0.1	0.8 ± 0.2	-0.6 ± 0.1	0.8 ± 0.3	-0.2 ± 0.3	E Europe F	S Asia F
44	1.5 ± 0.5	-0.4 ± 0.1	2.3 ± 0.3	-1.6 ± 0.2	0.6 ± 0.2	-0.2 ± 0.4	1.3 ± 0.3	-0.1 ± 0.1	1.0 ± 0.2	-0.7 ± 0.2	1.0 ± 0.3	-0.3 ± 0.3	E Europe F	S Asia F
45	1.3 ± 0.5	-0.3 ± 0.1	2.3 ± 0.3	-1.6 ± 0.2	0.4 ± 0.2	-0.1 ± 0.4	1.2 ± 0.4	-0.1 ± 0.1	0.9 ± 0.3	-0.7 ± 0.2	0.8 ± 0.3	-0.6 ± 0.3	E Europe F	S Asia F
46	2.3 ± 0.6	-0.5 ± 0.1	2.5 ± 0.3	-1.2 ± 0.2	0.3 ± 0.2	0.1 ± 0.4	1.2 ± 0.4	-0.2 ± 0.1	1.1 ± 0.3	-0.6 ± 0.2	0.8 ± 0.3	-0.7 ± 0.3	E Europe F	S Asia F
47	2.0 ± 0.6	-0.3 ± 0.1	2.9 ± 0.3	-1.2 ± 0.2	0.4 ± 0.3	-0.1 ± 0.4	1.5 ± 0.4	-0.1 ± 0.2	1.0 ± 0.3	-0.6 ± 0.2	1.0 ± 0.3	-0.5 ± 0.3	E Europe F	S Asia F
48	1.8 ± 0.6	-0.3 ± 0.1	3.1 ± 0.3	-1.0 ± 0.3	0.6 ± 0.3	-0.2 ± 0.5	0.9 ± 0.5	-0.2 ± 0.1	1.3 ± 0.3	-0.5 ± 0.2	0.9 ± 0.3	-1.0 ± 0.4	E Europe F	S Asia F
49	2.1 ± 0.6	-0.3 ± 0.2	3.0 ± 0.3	-0.9 ± 0.3	0.6 ± 0.3	-0.5 ± 0.5	0.6 ± 0.5	-0.1 ± 0.2	1.0 ± 0.3	-0.7 ± 0.2	1.0 ± 0.3	-0.9 ± 0.3	E Europe F	W Africa M
50	1.5 ± 0.7	-0.2 ± 0.2	3.5 ± 0.3	-0.8 ± 0.2	0.5 ± 0.3	-0.3 ± 0.5	0.5 ± 0.4	-0.0 ± 0.2	1.1 ± 0.3	-0.6 ± 0.2	1.3 ± 0.3	-1.3 ± 0.3	E Europe F	W Africa M
51	2.1 ± 0.6	-0.0 ± 0.2	3.4 ± 0.3	-0.8 ± 0.3	0.6 ± 0.3	-0.0 ± 0.5	0.2 ± 0.5	0.0 ± 0.2	1.3 ± 0.3	-0.6 ± 0.2	1.4 ± 0.3	-1.3 ± 0.4	E Europe F	W Africa M
52	1.5 ± 0.7	-0.0 ± 0.2	3.8 ± 0.3	-0.9 ± 0.3	0.9 ± 0.3	-0.5 ± 0.5	0.3 ± 0.5	0.0 ± 0.2	1.2 ± 0.3	-0.8 ± 0.2	0.9 ± 0.3	-1.4 ± 0.4	E Europe F	W Africa M

Table 25. *Mean raw error for Application-type images for algorithm unissey-001. Values closer to zero are better.*

Age	**F E Africa**	**F E Asia**	**F E Europe**	**F S Asia**	**F SE Asia**	**F W Africa**	**M E Africa**	**M E Asia**	**M E Europe**	**M S Asia**	**M SE Asia**	**M W Africa**	**max Group**	**min Group**
14	2.6 ± 0.3	3.8 ± 0.2	2.3 ± 0.3	2.2 ± 0.2	2.8 ± 0.3	4.1 ± 0.5	2.1 ± 0.3	3.0 ± 0.2	0.8 ± 0.3	1.7 ± 0.2	2.3 ± 0.3	2.6 ± 0.4	W Africa F	E Europe M
15	2.5 ± 0.4	4.1 ± 0.2	2.6 ± 0.3	2.5 ± 0.2	3.0 ± 0.4	3.9 ± 0.6	2.0 ± 0.3	3.6 ± 0.2	1.2 ± 0.3	2.4 ± 0.2	3.0 ± 0.4	2.6 ± 0.4	E Asia F	E Europe M
16	2.3 ± 0.4	4.0 ± 0.2	2.6 ± 0.3	2.4 ± 0.2	3.4 ± 0.4	4.0 ± 0.6	2.9 ± 0.4	3.8 ± 0.2	1.9 ± 0.3	2.8 ± 0.2	3.6 ± 0.4	2.5 ± 0.4	E Asia F	E Europe M
17	2.6 ± 0.4	3.9 ± 0.2	2.9 ± 0.4	2.3 ± 0.3	3.0 ± 0.4	4.2 ± 0.5	3.1 ± 0.4	3.9 ± 0.2	1.2 ± 0.3	3.0 ± 0.2	3.4 ± 0.4	3.1 ± 0.4	W Africa F	E Europe M
18	2.1 ± 0.4	3.4 ± 0.2	2.4 ± 0.4	1.8 ± 0.2	2.6 ± 0.3	3.6 ± 0.5	3.1 ± 0.4	3.4 ± 0.2	1.4 ± 0.3	3.0 ± 0.2	3.2 ± 0.3	2.8 ± 0.4	W Africa F	E Europe M
19	2.2 ± 0.4	3.2 ± 0.2	2.0 ± 0.4	2.0 ± 0.2	2.5 ± 0.3	3.8 ± 0.5	3.7 ± 0.4	3.3 ± 0.2	1.3 ± 0.3	3.3 ± 0.2	2.9 ± 0.3	2.6 ± 0.4	W Africa F	E Europe M
20	2.1 ± 0.4	3.1 ± 0.2	2.3 ± 0.3	1.5 ± 0.2	2.2 ± 0.2	4.0 ± 0.5	3.9 ± 0.4	3.2 ± 0.2	1.7 ± 0.3	3.4 ± 0.2	3.1 ± 0.3	2.8 ± 0.4	W Africa F	S Asia F
21	1.8 ± 0.4	2.8 ± 0.2	2.0 ± 0.3	1.3 ± 0.2	2.0 ± 0.2	3.6 ± 0.5	3.7 ± 0.3	3.1 ± 0.2	1.7 ± 0.3	3.2 ± 0.2	3.0 ± 0.3	2.6 ± 0.4	E Africa M	S Asia F
22	1.5 ± 0.4	2.3 ± 0.2	2.2 ± 0.3	0.9 ± 0.2	1.6 ± 0.2	3.5 ± 0.5	4.0 ± 0.3	2.8 ± 0.2	2.0 ± 0.3	3.1 ± 0.2	2.5 ± 0.3	2.1 ± 0.3	E Africa M	S Asia F
23	1.3 ± 0.3	2.1 ± 0.1	2.2 ± 0.3	0.7 ± 0.2	1.5 ± 0.2	3.1 ± 0.4	3.5 ± 0.3	2.8 ± 0.2	1.7 ± 0.3	2.9 ± 0.2	2.4 ± 0.3	1.8 ± 0.3	E Africa M	S Asia F
24	1.1 ± 0.3	1.6 ± 0.1	2.2 ± 0.2	0.4 ± 0.1	1.2 ± 0.2	2.7 ± 0.4	3.3 ± 0.3	2.4 ± 0.2	2.0 ± 0.3	2.7 ± 0.1	2.1 ± 0.2	1.6 ± 0.3	E Africa M	S Asia F
25	1.0 ± 0.3	1.3 ± 0.1	2.2 ± 0.2	-0.1 ± 0.1	0.6 ± 0.2	2.8 ± 0.4	3.3 ± 0.3	2.2 ± 0.2	2.1 ± 0.2	2.4 ± 0.1	2.0 ± 0.2	1.3 ± 0.3	E Africa M	S Asia F
26	1.1 ± 0.3	0.8 ± 0.1	2.3 ± 0.2	-0.6 ± 0.1	0.4 ± 0.2	2.3 ± 0.4	3.0 ± 0.3	1.8 ± 0.1	1.9 ± 0.2	2.0 ± 0.1	1.8 ± 0.2	0.7 ± 0.2	E Africa M	S Asia F
27	0.7 ± 0.3	0.48 ± 0.10	2.2 ± 0.2	-1.0 ± 0.1	0.0 ± 0.1	2.0 ± 0.3	2.5 ± 0.3	1.6 ± 0.1	2.1 ± 0.2	1.6 ± 0.1	1.6 ± 0.2	0.3 ± 0.2	E Africa M	S Asia F
28	0.2 ± 0.3	0.01 ± 0.10	2.2 ± 0.2	-1.4 ± 0.1	-0.3 ± 0.2	2.1 ± 0.3	2.0 ± 0.3	1.4 ± 0.2	2.1 ± 0.2	1.1 ± 0.1	1.4 ± 0.2	-0.4 ± 0.2	E Europe F	S Asia F
29	0.3 ± 0.3	-0.38 ± 0.09	2.3 ± 0.2	-1.5 ± 0.1	-0.7 ± 0.2	1.7 ± 0.3	1.9 ± 0.3	1.1 ± 0.1	1.8 ± 0.2	0.7 ± 0.1	0.9 ± 0.2	-0.3 ± 0.2	E Europe F	S Asia F
30	-0.1 ± 0.3	-0.81 ± 0.09	2.3 ± 0.2	-1.9 ± 0.1	-0.9 ± 0.2	1.2 ± 0.3	1.6 ± 0.3	0.7 ± 0.1	1.8 ± 0.2	0.2 ± 0.1	0.7 ± 0.2	-1.0 ± 0.2	E Europe F	S Asia F
31	-0.3 ± 0.3	-1.21 ± 0.10	2.6 ± 0.2	-2.3 ± 0.1	-1.3 ± 0.2	0.9 ± 0.3	1.3 ± 0.3	0.5 ± 0.1	1.7 ± 0.2	-0.2 ± 0.1	0.4 ± 0.3	-1.5 ± 0.2	E Europe F	S Asia F
32	-0.2 ± 0.3	-1.56 ± 0.10	2.4 ± 0.2	-2.5 ± 0.1	-1.6 ± 0.2	0.6 ± 0.3	0.9 ± 0.3	0.2 ± 0.1	1.8 ± 0.2	-0.5 ± 0.1	0.2 ± 0.2	-2.0 ± 0.2	E Europe F	S Asia F
33	-0.7 ± 0.4	-1.9 ± 0.1	2.5 ± 0.2	-2.7 ± 0.1	-2.0 ± 0.2	0.6 ± 0.4	0.5 ± 0.3	-0.3 ± 0.1	2.1 ± 0.2	-0.9 ± 0.1	-0.1 ± 0.3	-2.2 ± 0.2	E Europe F	S Asia F
34	-0.8 ± 0.4	-2.2 ± 0.1	2.5 ± 0.3	-2.9 ± 0.2	-2.3 ± 0.2	-0.1 ± 0.4	0.0 ± 0.3	-0.6 ± 0.1	1.9 ± 0.2	-1.1 ± 0.1	-0.6 ± 0.3	-2.7 ± 0.2	E Europe F	S Asia F
35	-0.9 ± 0.4	-2.6 ± 0.1	2.4 ± 0.3	-3.2 ± 0.2	-2.7 ± 0.2	-0.6 ± 0.4	-0.2 ± 0.3	-0.8 ± 0.1	1.5 ± 0.2	-1.4 ± 0.1	-0.7 ± 0.3	-2.9 ± 0.3	E Europe F	S Asia F
36	-1.2 ± 0.4	-2.8 ± 0.1	2.6 ± 0.3	-3.5 ± 0.2	-2.7 ± 0.2	-0.5 ± 0.4	-0.7 ± 0.3	-1.1 ± 0.1	1.6 ± 0.2	-1.7 ± 0.1	-1.0 ± 0.3	-3.5 ± 0.3	E Europe F	W Africa M
37	-1.2 ± 0.4	-3.1 ± 0.1	2.7 ± 0.3	-3.4 ± 0.2	-3.0 ± 0.2	-1.1 ± 0.4	-0.6 ± 0.3	-1.4 ± 0.1	1.3 ± 0.2	-1.9 ± 0.1	-1.3 ± 0.3	-3.8 ± 0.3	E Europe F	W Africa M
38	-1.2 ± 0.4	-3.4 ± 0.1	2.7 ± 0.3	-3.7 ± 0.2	-3.1 ± 0.2	-1.6 ± 0.4	-1.1 ± 0.3	-1.6 ± 0.1	1.2 ± 0.2	-2.2 ± 0.1	-0.9 ± 0.3	-4.2 ± 0.3	E Europe F	W Africa M
39	-1.3 ± 0.5	-3.7 ± 0.1	2.5 ± 0.3	-3.8 ± 0.2	-3.1 ± 0.2	-1.5 ± 0.4	-1.2 ± 0.3	-1.9 ± 0.1	1.0 ± 0.2	-2.3 ± 0.1	-1.1 ± 0.3	-4.7 ± 0.3	E Europe F	W Africa M
40	-1.8 ± 0.5	-3.9 ± 0.1	2.7 ± 0.3	-3.7 ± 0.2	-3.4 ± 0.2	-2.0 ± 0.4	-1.4 ± 0.4	-2.2 ± 0.1	1.1 ± 0.2	-2.5 ± 0.1	-1.3 ± 0.3	-5.0 ± 0.3	E Europe F	W Africa M
41	-2.4 ± 0.5	-4.1 ± 0.1	2.5 ± 0.3	-3.9 ± 0.2	-3.6 ± 0.2	-2.7 ± 0.4	-1.5 ± 0.4	-2.3 ± 0.1	0.8 ± 0.3	-2.7 ± 0.2	-1.5 ± 0.3	-5.2 ± 0.3	E Europe F	W Africa M
42	-2.1 ± 0.5	-4.1 ± 0.1	2.8 ± 0.3	-3.6 ± 0.2	-3.7 ± 0.3	-2.4 ± 0.4	-1.6 ± 0.4	-2.5 ± 0.1	0.8 ± 0.3	-3.0 ± 0.2	-1.4 ± 0.3	-5.5 ± 0.3	E Europe F	W Africa M
43	-2.0 ± 0.5	-4.4 ± 0.1	2.6 ± 0.3	-3.8 ± 0.2	-3.8 ± 0.3	-3.2 ± 0.5	-1.6 ± 0.4	-2.7 ± 0.1	0.6 ± 0.3	-2.9 ± 0.2	-1.7 ± 0.3	-5.9 ± 0.4	E Europe F	W Africa M
44	-1.9 ± 0.6	-4.6 ± 0.1	2.4 ± 0.3	-3.8 ± 0.3	-3.5 ± 0.3	-3.2 ± 0.5	-2.2 ± 0.4	-2.8 ± 0.2	0.8 ± 0.3	-3.1 ± 0.2	-1.6 ± 0.3	-5.9 ± 0.4	E Europe F	W Africa M
45	-2.4 ± 0.6	-4.6 ± 0.1	2.2 ± 0.3	-3.7 ± 0.3	-3.8 ± 0.3	-3.3 ± 0.5	-2.7 ± 0.5	-3.2 ± 0.2	0.6 ± 0.3	-3.0 ± 0.2	-1.9 ± 0.3	-6.2 ± 0.4	E Europe F	W Africa M
46	-1.6 ± 0.6	-4.9 ± 0.1	2.2 ± 0.3	-3.5 ± 0.3	-4.1 ± 0.3	-3.4 ± 0.5	-2.6 ± 0.5	-3.3 ± 0.2	0.7 ± 0.3	-2.9 ± 0.2	-1.9 ± 0.3	-6.6 ± 0.4	E Europe F	W Africa M
47	-1.6 ± 0.7	-4.8 ± 0.2	2.2 ± 0.3	-3.5 ± 0.3	-3.8 ± 0.3	-3.7 ± 0.5	-2.3 ± 0.5	-3.3 ± 0.2	0.3 ± 0.3	-2.8 ± 0.2	-1.8 ± 0.3	-6.1 ± 0.4	E Europe F	W Africa M
48	-2.5 ± 0.7	-4.9 ± 0.2	1.8 ± 0.3	-3.3 ± 0.3	-4.1 ± 0.3	-3.7 ± 0.5	-3.0 ± 0.6	-3.4 ± 0.2	0.4 ± 0.3	-2.8 ± 0.2	-2.2 ± 0.4	-6.8 ± 0.4	E Europe F	W Africa M
49	-2.3 ± 0.7	-5.0 ± 0.2	1.8 ± 0.3	-3.6 ± 0.3	-3.7 ± 0.3	-4.0 ± 0.5	-3.2 ± 0.6	-3.6 ± 0.2	0.3 ± 0.3	-3.0 ± 0.2	-2.0 ± 0.3	-6.9 ± 0.5	E Europe F	W Africa M
50	-2.9 ± 0.8	-5.1 ± 0.2	2.0 ± 0.3	-3.3 ± 0.3	-4.0 ± 0.3	-4.0 ± 0.5	-3.2 ± 0.6	-3.6 ± 0.2	-0.0 ± 0.3	-3.1 ± 0.3	-1.8 ± 0.4	-7.3 ± 0.5	E Europe F	W Africa M
51	-2.3 ± 0.7	-5.1 ± 0.2	1.6 ± 0.3	-3.5 ± 0.3	-4.3 ± 0.3	-4.5 ± 0.6	-3.5 ± 0.7	-3.6 ± 0.2	0.2 ± 0.3	-3.0 ± 0.3	-2.0 ± 0.4	-7.3 ± 0.5	E Europe F	W Africa M
52	-2.9 ± 0.8	-5.2 ± 0.2	1.5 ± 0.3	-3.6 ± 0.3	-3.7 ± 0.3	-5.0 ± 0.6	-2.9 ± 0.6	-3.9 ± 0.2	-0.1 ± 0.3	-3.1 ± 0.3	-2.3 ± 0.4	-7.3 ± 0.5	E Europe F	W Africa M

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Table 26. *Mean raw error for Application-type images for algorithm yoti-001. Values closer to zero are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Group	min Group
14	3.1 ± 0.3	2.0 ± 0.1	1.7 ± 0.3	1.8 ± 0.2	2.1 ± 0.3	3.9 ± 0.4	0.2 ± 0.3	0.59 ± 0.09	-0.0 ± 0.2	-0.5 ± 0.1	0.5 ± 0.2	1.1 ± 0.3	W Africa F	S Asia M
15	3.2 ± 0.4	2.2 ± 0.2	2.5 ± 0.4	2.3 ± 0.3	2.3 ± 0.4	4.1 ± 0.5	0.1 ± 0.3	0.6 ± 0.1	0.1 ± 0.2	-0.3 ± 0.1	0.4 ± 0.2	1.6 ± 0.4	W Africa F	S Asia M
16	3.3 ± 0.4	2.4 ± 0.2	2.7 ± 0.4	2.7 ± 0.3	3.1 ± 0.5	4.5 ± 0.6	1.2 ± 0.3	0.5 ± 0.1	0.4 ± 0.2	-0.3 ± 0.2	0.4 ± 0.2	1.7 ± 0.4	W Africa F	S Asia M
17	3.3 ± 0.5	2.6 ± 0.2	3.5 ± 0.5	3.1 ± 0.3	3.1 ± 0.5	4.2 ± 0.5	0.9 ± 0.3	0.7 ± 0.2	0.3 ± 0.2	-0.1 ± 0.2	0.3 ± 0.3	2.4 ± 0.4	W Africa F	S Asia M
18	3.1 ± 0.4	2.4 ± 0.2	3.2 ± 0.4	3.0 ± 0.2	3.6 ± 0.3	4.4 ± 0.5	1.1 ± 0.3	0.6 ± 0.1	0.2 ± 0.2	-0.1 ± 0.2	0.6 ± 0.3	2.0 ± 0.3	W Africa F	S Asia M
19	3.7 ± 0.4	2.8 ± 0.2	3.5 ± 0.4	3.6 ± 0.2	3.9 ± 0.3	4.7 ± 0.5	1.5 ± 0.3	1.1 ± 0.2	0.6 ± 0.3	0.4 ± 0.2	0.8 ± 0.3	2.5 ± 0.4	W Africa F	S Asia M
20	3.4 ± 0.4	3.2 ± 0.2	3.5 ± 0.3	3.4 ± 0.2	4.2 ± 0.3	4.6 ± 0.4	2.0 ± 0.3	1.5 ± 0.2	1.2 ± 0.3	1.0 ± 0.2	1.4 ± 0.3	2.7 ± 0.4	W Africa F	S Asia M
21	3.8 ± 0.4	3.5 ± 0.2	3.6 ± 0.3	3.8 ± 0.2	4.4 ± 0.3	4.8 ± 0.4	2.2 ± 0.3	1.8 ± 0.2	1.3 ± 0.2	1.5 ± 0.2	1.7 ± 0.3	2.8 ± 0.4	W Africa F	E Europe M
22	3.8 ± 0.4	3.6 ± 0.2	3.7 ± 0.2	3.7 ± 0.2	4.5 ± 0.2	4.5 ± 0.4	2.9 ± 0.3	2.0 ± 0.2	1.7 ± 0.2	1.8 ± 0.2	1.9 ± 0.2	2.7 ± 0.3	W Africa F	E Europe M
23	3.6 ± 0.3	3.7 ± 0.2	3.5 ± 0.2	3.8 ± 0.2	4.5 ± 0.2	4.7 ± 0.3	2.6 ± 0.3	2.0 ± 0.1	1.5 ± 0.2	2.1 ± 0.2	2.2 ± 0.2	3.3 ± 0.3	W Africa F	E Europe M
24	3.8 ± 0.4	3.7 ± 0.1	3.5 ± 0.2	3.7 ± 0.2	4.6 ± 0.2	4.4 ± 0.3	2.7 ± 0.3	2.1 ± 0.1	1.6 ± 0.1	2.3 ± 0.1	2.4 ± 0.2	2.9 ± 0.3	S E Asia F	E Europe M
25	3.6 ± 0.3	3.9 ± 0.1	3.2 ± 0.1	3.6 ± 0.1	4.7 ± 0.2	4.3 ± 0.3	2.6 ± 0.3	2.2 ± 0.1	1.4 ± 0.1	2.3 ± 0.1	2.5 ± 0.2	2.9 ± 0.3	S E Asia F	E Europe M
26	3.7 ± 0.3	3.8 ± 0.1	3.0 ± 0.1	3.4 ± 0.1	4.7 ± 0.2	4.1 ± 0.3	2.6 ± 0.2	2.1 ± 0.1	1.1 ± 0.1	2.3 ± 0.1	2.6 ± 0.2	2.7 ± 0.2	S E Asia F	E Europe M
27	3.9 ± 0.3	3.9 ± 0.1	2.9 ± 0.1	3.3 ± 0.1	4.5 ± 0.2	4.2 ± 0.3	2.4 ± 0.2	2.1 ± 0.1	1.0 ± 0.1	2.2 ± 0.1	2.7 ± 0.2	2.7 ± 0.2	S E Asia F	E Europe M
28	3.5 ± 0.3	3.8 ± 0.1	2.6 ± 0.1	3.2 ± 0.1	4.5 ± 0.2	3.8 ± 0.3	2.1 ± 0.2	2.2 ± 0.1	1.0 ± 0.1	2.1 ± 0.1	2.6 ± 0.2	2.4 ± 0.2	S E Asia F	E Europe M
29	3.9 ± 0.3	3.8 ± 0.1	2.5 ± 0.1	3.1 ± 0.1	4.6 ± 0.2	3.8 ± 0.3	2.2 ± 0.2	2.1 ± 0.1	0.7 ± 0.1	1.98 ± 0.10	2.4 ± 0.2	2.7 ± 0.2	S E Asia F	E Europe M
30	3.6 ± 0.3	3.8 ± 0.1	2.3 ± 0.1	2.9 ± 0.1	4.5 ± 0.2	3.5 ± 0.3	2.1 ± 0.2	2.1 ± 0.1	0.5 ± 0.1	1.98 ± 0.10	2.7 ± 0.2	2.4 ± 0.2	S E Asia F	E Europe M
31	3.4 ± 0.3	3.7 ± 0.1	2.2 ± 0.1	2.8 ± 0.1	4.5 ± 0.2	3.1 ± 0.3	2.2 ± 0.2	2.0 ± 0.1	0.4 ± 0.1	1.87 ± 0.09	2.5 ± 0.2	2.2 ± 0.2	S E Asia F	E Europe M
32	3.6 ± 0.3	3.6 ± 0.1	2.0 ± 0.1	2.7 ± 0.1	4.1 ± 0.2	3.3 ± 0.3	1.9 ± 0.2	2.1 ± 0.1	0.4 ± 0.2	1.87 ± 0.09	2.7 ± 0.2	2.2 ± 0.2	S E Asia F	E Europe M
33	3.4 ± 0.3	3.5 ± 0.1	1.8 ± 0.2	2.6 ± 0.1	4.2 ± 0.2	3.1 ± 0.3	2.0 ± 0.3	2.1 ± 0.1	0.5 ± 0.2	1.69 ± 0.09	2.4 ± 0.2	2.1 ± 0.2	S E Asia F	E Europe M
34	3.2 ± 0.3	3.4 ± 0.1	1.7 ± 0.2	2.5 ± 0.1	4.1 ± 0.2	2.8 ± 0.3	1.7 ± 0.3	2.1 ± 0.1	0.3 ± 0.2	1.68 ± 0.10	2.5 ± 0.2	2.1 ± 0.2	S E Asia F	E Europe M
35	3.7 ± 0.3	3.2 ± 0.1	1.7 ± 0.2	2.3 ± 0.1	3.7 ± 0.2	2.5 ± 0.3	2.1 ± 0.3	2.2 ± 0.1	0.4 ± 0.2	1.67 ± 0.10	2.6 ± 0.2	1.8 ± 0.2	S E Asia F	E Europe M
36	3.0 ± 0.3	3.1 ± 0.1	1.6 ± 0.2	2.2 ± 0.1	3.7 ± 0.2	2.8 ± 0.3	1.9 ± 0.3	2.2 ± 0.1	0.5 ± 0.2	1.57 ± 0.10	2.6 ± 0.2	1.7 ± 0.2	S E Asia F	E Europe M
37	2.9 ± 0.4	2.97 ± 0.10	1.7 ± 0.2	2.1 ± 0.1	3.4 ± 0.2	2.5 ± 0.3	2.0 ± 0.3	2.3 ± 0.1	0.3 ± 0.2	1.5 ± 0.1	2.3 ± 0.2	1.6 ± 0.2	S E Asia F	E Europe M
38	3.1 ± 0.4	2.79 ± 0.10	1.5 ± 0.2	2.0 ± 0.1	3.4 ± 0.2	2.3 ± 0.3	1.5 ± 0.3	2.1 ± 0.1	0.4 ± 0.2	1.4 ± 0.1	2.6 ± 0.2	1.6 ± 0.3	S E Asia F	E Europe M
39	2.6 ± 0.3	2.63 ± 0.10	1.4 ± 0.2	1.8 ± 0.1	3.3 ± 0.2	2.1 ± 0.4	1.8 ± 0.3	2.1 ± 0.1	0.5 ± 0.2	1.4 ± 0.1	2.6 ± 0.2	1.5 ± 0.3	S E Asia F	E Europe M
40	2.4 ± 0.4	2.47 ± 0.10	1.6 ± 0.2	1.7 ± 0.1	2.9 ± 0.2	2.0 ± 0.3	1.7 ± 0.3	2.1 ± 0.1	0.5 ± 0.2	1.3 ± 0.1	2.5 ± 0.2	1.3 ± 0.3	S E Asia F	E Europe M
41	2.0 ± 0.4	2.18 ± 0.10	1.4 ± 0.2	1.5 ± 0.1	2.7 ± 0.2	1.1 ± 0.4	1.7 ± 0.3	2.0 ± 0.1	0.6 ± 0.2	1.3 ± 0.1	2.3 ± 0.2	1.3 ± 0.3	S E Asia F	E Europe M
42	2.4 ± 0.4	2.19 ± 0.10	1.5 ± 0.2	1.6 ± 0.2	2.5 ± 0.2	1.6 ± 0.4	1.7 ± 0.3	1.9 ± 0.1	0.8 ± 0.2	1.2 ± 0.1	2.4 ± 0.2	0.9 ± 0.3	S E Asia F	E Europe M
43	2.2 ± 0.4	1.91 ± 0.09	1.3 ± 0.2	1.2 ± 0.2	2.3 ± 0.2	0.9 ± 0.4	1.6 ± 0.3	1.8 ± 0.1	0.6 ± 0.2	1.2 ± 0.1	2.4 ± 0.2	0.6 ± 0.3	S E Asia M	E Europe M
44	1.9 ± 0.5	1.63 ± 0.09	1.0 ± 0.2	1.1 ± 0.2	2.3 ± 0.2	0.9 ± 0.4	1.2 ± 0.3	1.7 ± 0.1	0.9 ± 0.2	1.0 ± 0.1	2.4 ± 0.2	0.7 ± 0.3	S E Asia M	W Africa M
45	1.4 ± 0.4	1.61 ± 0.10	1.2 ± 0.2	0.9 ± 0.2	2.1 ± 0.2	0.7 ± 0.4	1.1 ± 0.4	1.6 ± 0.1	0.8 ± 0.2	1.1 ± 0.1	1.9 ± 0.2	0.2 ± 0.3	S E Asia F	W Africa M
46	1.9 ± 0.4	1.3 ± 0.1	1.2 ± 0.2	0.9 ± 0.2	1.8 ± 0.2	0.4 ± 0.4	1.0 ± 0.4	1.5 ± 0.1	0.9 ± 0.3	1.2 ± 0.2	2.0 ± 0.2	-0.0 ± 0.3	S E Asia M	W Africa M
47	1.6 ± 0.5	1.3 ± 0.1	1.3 ± 0.3	0.8 ± 0.2	1.8 ± 0.2	0.3 ± 0.4	1.2 ± 0.4	1.3 ± 0.1	1.2 ± 0.2	1.2 ± 0.2	2.1 ± 0.2	0.2 ± 0.3	S E Asia M	W Africa M
48	0.6 ± 0.5	1.1 ± 0.1	1.3 ± 0.2	0.8 ± 0.2	1.7 ± 0.2	0.2 ± 0.4	0.6 ± 0.4	1.2 ± 0.1	1.2 ± 0.3	1.1 ± 0.2	1.8 ± 0.2	-0.3 ± 0.3	S E Asia M	W Africa M
49	0.8 ± 0.5	0.9 ± 0.1	1.1 ± 0.2	0.5 ± 0.2	1.8 ± 0.2	-0.0 ± 0.4	0.4 ± 0.5	1.0 ± 0.1	1.1 ± 0.3	1.1 ± 0.2	1.8 ± 0.2	-0.3 ± 0.3	S E Asia M	W Africa M
50	0.9 ± 0.6	0.9 ± 0.1	1.4 ± 0.2	0.4 ± 0.2	1.5 ± 0.2	-0.1 ± 0.5	0.4 ± 0.4	0.9 ± 0.1	0.9 ± 0.3	0.9 ± 0.2	1.9 ± 0.2	-0.9 ± 0.3	S E Asia M	W Africa M
51	0.3 ± 0.5	0.6 ± 0.1	1.2 ± 0.3	0.2 ± 0.2	1.4 ± 0.2	-0.4 ± 0.5	-0.3 ± 0.5	0.7 ± 0.1	1.2 ± 0.3	0.9 ± 0.2	1.7 ± 0.2	-1.1 ± 0.4	S E Asia M	W Africa M
52	0.5 ± 0.6	0.6 ± 0.1	1.3 ± 0.3	-0.1 ± 0.2	1.5 ± 0.2	-1.0 ± 0.5	-0.1 ± 0.5	0.5 ± 0.1	1.1 ± 0.3	0.6 ± 0.2	1.4 ± 0.3	-1.3 ± 0.4	S E Asia F	W Africa M

Table 27. *Mean absolute error for Application-type images for algorithm dermalog-001. Values closer to zero are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Group	min Group
14	3.4 ± 0.3	4.7 ± 0.1	5.1 ± 0.3	4.8 ± 0.2	5.3 ± 0.3	3.4 ± 0.3	2.4 ± 0.2	3.7 ± 0.1	2.9 ± 0.3	3.6 ± 0.2	3.6 ± 0.2	2.7 ± 0.3	S E Asia F	E Africa M
15	4.0 ± 0.3	4.6 ± 0.2	5.4 ± 0.3	5.4 ± 0.2	5.2 ± 0.4	3.4 ± 0.3	2.4 ± 0.2	3.9 ± 0.1	3.0 ± 0.3	4.1 ± 0.2	4.0 ± 0.2	3.0 ± 0.3	S Asia F	E Africa M
16	4.0 ± 0.3	4.6 ± 0.1	5.3 ± 0.3	5.2 ± 0.2	5.3 ± 0.3	3.4 ± 0.4	3.0 ± 0.3	3.8 ± 0.1	3.3 ± 0.3	4.3 ± 0.2	4.2 ± 0.3	3.3 ± 0.3	E Europe F	E Africa M
17	4.2 ± 0.3	4.2 ± 0.1	5.6 ± 0.3	5.1 ± 0.2	4.9 ± 0.3	3.2 ± 0.3	3.1 ± 0.3	3.4 ± 0.1	2.8 ± 0.2	4.2 ± 0.2	3.8 ± 0.3	3.6 ± 0.4	E Europe F	E Europe M
18	3.8 ± 0.2	3.7 ± 0.1	4.8 ± 0.3	4.5 ± 0.1	4.1 ± 0.2	3.1 ± 0.2	3.4 ± 0.2	2.88 ± 0.09	2.7 ± 0.2	4.1 ± 0.1	3.3 ± 0.2	3.4 ± 0.3	E Europe F	E Europe M
19	4.2 ± 0.3	3.3 ± 0.1	4.6 ± 0.3	4.4 ± 0.1	3.7 ± 0.2	3.2 ± 0.2	3.8 ± 0.3	2.52 ± 0.09	2.6 ± 0.2	3.9 ± 0.1	3.0 ± 0.2	3.6 ± 0.3	E Europe F	E Asia M
20	4.4 ± 0.3	3.1 ± 0.1	4.3 ± 0.2	4.0 ± 0.2	3.5 ± 0.2	3.0 ± 0.2	3.8 ± 0.3	2.32 ± 0.09	2.5 ± 0.2	3.8 ± 0.1	2.8 ± 0.2	3.3 ± 0.3	E Africa F	E Asia M
21	4.3 ± 0.2	2.8 ± 0.1	4.1 ± 0.2	3.9 ± 0.1	3.3 ± 0.2	3.3 ± 0.2	3.8 ± 0.3	2.06 ± 0.08	2.3 ± 0.2	3.5 ± 0.1	2.6 ± 0.2	3.5 ± 0.3	E Africa F	E Asia M
22	4.3 ± 0.2	2.59 ± 0.09	3.8 ± 0.2	3.7 ± 0.1	2.9 ± 0.1	3.3 ± 0.2	4.5 ± 0.3	2.14 ± 0.08	2.5 ± 0.2	3.4 ± 0.1	2.3 ± 0.1	3.4 ± 0.2	E Africa M	E Asia M
23	4.2 ± 0.2	2.68 ± 0.08	3.7 ± 0.1	3.6 ± 0.1	2.9 ± 0.1	3.3 ± 0.2	4.4 ± 0.3	2.22 ± 0.08	2.4 ± 0.1	3.2 ± 0.1	2.3 ± 0.1	3.6 ± 0.2	E Africa M	E Asia M
24	4.5 ± 0.2	2.82 ± 0.07	3.5 ± 0.1	3.52 ± 0.09	2.89 ± 0.09	3.7 ± 0.2	4.3 ± 0.2	2.36 ± 0.08	2.6 ± 0.1	3.1 ± 0.1	2.4 ± 0.1	3.4 ± 0.2	E Africa F	S E Asia M
25	4.6 ± 0.2	3.02 ± 0.07	3.5 ± 0.1	3.48 ± 0.08	2.97 ± 0.09	4.1 ± 0.2	4.5 ± 0.2	2.66 ± 0.08	2.6 ± 0.1	2.96 ± 0.09	2.7 ± 0.1	3.5 ± 0.2	E Africa F	E Europe M
26	4.6 ± 0.2	3.15 ± 0.06	3.52 ± 0.10	3.42 ± 0.07	3.19 ± 0.08	4.3 ± 0.2	4.1 ± 0.2	2.73 ± 0.07	2.8 ± 0.1	2.95 ± 0.08	2.8 ± 0.1	3.4 ± 0.2	E Africa F	E Asia M
27	4.8 ± 0.2	3.29 ± 0.06	3.43 ± 0.09	3.36 ± 0.06	3.30 ± 0.08	4.8 ± 0.2	4.3 ± 0.2	2.97 ± 0.08	2.8 ± 0.1	2.94 ± 0.08	3.0 ± 0.1	3.6 ± 0.2	E Africa F	E Europe M
28	5.0 ± 0.2	3.51 ± 0.06	3.34 ± 0.09	3.37 ± 0.06	3.40 ± 0.09	4.9 ± 0.2	3.9 ± 0.2	3.16 ± 0.09	3.0 ± 0.1	2.91 ± 0.07	3.0 ± 0.1	3.5 ± 0.1	E Africa F	S Asia M
29	5.0 ± 0.2	3.57 ± 0.06	3.34 ± 0.09	3.36 ± 0.06	3.52 ± 0.09	5.2 ± 0.2	4.1 ± 0.2	3.28 ± 0.08	3.2 ± 0.1	2.88 ± 0.06	3.2 ± 0.1	3.7 ± 0.1	W Africa F	S Asia M
30	5.1 ± 0.2	3.71 ± 0.07	3.37 ± 0.10	3.37 ± 0.07	3.6 ± 0.1	5.4 ± 0.2	4.0 ± 0.2	3.41 ± 0.09	3.1 ± 0.1	2.93 ± 0.06	3.2 ± 0.1	3.7 ± 0.1	W Africa F	S Asia M
31	5.3 ± 0.2	3.77 ± 0.07	3.3 ± 0.1	3.38 ± 0.07	3.7 ± 0.1	5.7 ± 0.2	4.1 ± 0.2	3.57 ± 0.09	3.4 ± 0.1	2.98 ± 0.06	3.5 ± 0.2	3.8 ± 0.1	W Africa F	S Asia M
32	5.4 ± 0.2	3.87 ± 0.08	3.3 ± 0.1	3.44 ± 0.07	3.8 ± 0.1	5.7 ± 0.2	4.1 ± 0.2	3.70 ± 0.09	3.5 ± 0.1	3.11 ± 0.06	3.6 ± 0.2	3.9 ± 0.2	W Africa F	S Asia M
33	5.7 ± 0.2	3.89 ± 0.08	3.3 ± 0.1	3.51 ± 0.08	3.9 ± 0.1	5.9 ± 0.2	4.2 ± 0.2	3.9 ± 0.1	3.5 ± 0.1	3.24 ± 0.06	3.6 ± 0.2	4.1 ± 0.2	W Africa F	S Asia M
34	5.7 ± 0.3	3.94 ± 0.08	3.4 ± 0.1	3.63 ± 0.08	3.9 ± 0.1	6.0 ± 0.2	4.2 ± 0.2	4.0 ± 0.1	3.6 ± 0.2	3.39 ± 0.07	3.9 ± 0.2	4.1 ± 0.2	W Africa F	E Europe F
35	6.0 ± 0.3	4.07 ± 0.09	3.5 ± 0.1	3.77 ± 0.09	3.9 ± 0.1	6.1 ± 0.2	4.3 ± 0.2	4.2 ± 0.1	3.8 ± 0.2	3.64 ± 0.08	4.2 ± 0.2	4.5 ± 0.2	W Africa F	E Europe F
36	6.0 ± 0.3	4.14 ± 0.09	3.5 ± 0.1	3.98 ± 0.09	4.2 ± 0.1	6.3 ± 0.3	4.5 ± 0.2	4.3 ± 0.1	4.0 ± 0.2	3.85 ± 0.08	4.3 ± 0.2	4.4 ± 0.2	W Africa F	E Europe F
37	6.2 ± 0.3	4.26 ± 0.09	3.7 ± 0.1	4.28 ± 0.10	4.2 ± 0.1	6.6 ± 0.3	4.4 ± 0.2	4.5 ± 0.1	4.2 ± 0.2	4.14 ± 0.08	4.3 ± 0.2	4.7 ± 0.2	W Africa F	E Europe F
38	6.1 ± 0.3	4.48 ± 0.09	3.7 ± 0.1	4.41 ± 0.10	4.3 ± 0.1	6.8 ± 0.3	4.6 ± 0.2	4.7 ± 0.1	4.2 ± 0.2	4.40 ± 0.08	4.4 ± 0.2	4.8 ± 0.2	W Africa F	E Europe F
39	6.2 ± 0.3	4.53 ± 0.09	3.9 ± 0.1	4.6 ± 0.1	4.3 ± 0.1	6.5 ± 0.3	4.6 ± 0.2	4.8 ± 0.1	4.3 ± 0.2	4.46 ± 0.08	4.5 ± 0.2	5.1 ± 0.2	W Africa F	E Europe F
40	6.0 ± 0.3	4.70 ± 0.09	3.8 ± 0.1	4.7 ± 0.1	4.5 ± 0.2	6.8 ± 0.3	4.6 ± 0.2	4.9 ± 0.1	4.5 ± 0.2	4.72 ± 0.09	4.5 ± 0.2	5.2 ± 0.2	W Africa F	E Europe F
41	6.5 ± 0.4	4.69 ± 0.10	3.8 ± 0.1	5.0 ± 0.1	4.5 ± 0.2	6.9 ± 0.3	4.9 ± 0.2	4.9 ± 0.1	4.6 ± 0.2	4.7 ± 0.1	4.6 ± 0.2	5.4 ± 0.2	W Africa F	E Europe F
42	5.9 ± 0.4	4.73 ± 0.09	3.7 ± 0.2	4.8 ± 0.1	4.5 ± 0.2	6.8 ± 0.3	4.7 ± 0.3	5.0 ± 0.1	4.2 ± 0.2	4.8 ± 0.1	4.5 ± 0.2	5.2 ± 0.2	W Africa F	E Europe F
43	5.9 ± 0.4	4.86 ± 0.10	4.0 ± 0.2	5.1 ± 0.2	4.7 ± 0.2	6.8 ± 0.4	4.6 ± 0.3	4.8 ± 0.1	4.5 ± 0.2	4.9 ± 0.1	4.2 ± 0.2	5.5 ± 0.2	W Africa F	E Europe F
44	6.1 ± 0.4	5.0 ± 0.1	4.0 ± 0.2	5.0 ± 0.2	4.5 ± 0.2	6.9 ± 0.4	4.3 ± 0.3	4.7 ± 0.1	4.1 ± 0.2	4.8 ± 0.1	4.2 ± 0.2	5.2 ± 0.3	W Africa F	E Europe F
45	6.0 ± 0.4	4.9 ± 0.1	3.8 ± 0.2	5.1 ± 0.2	4.4 ± 0.2	7.0 ± 0.4	4.5 ± 0.3	4.7 ± 0.1	4.2 ± 0.2	4.8 ± 0.1	4.1 ± 0.2	5.3 ± 0.3	W Africa F	E Europe F
46	5.7 ± 0.4	5.1 ± 0.1	3.9 ± 0.2	4.9 ± 0.2	4.7 ± 0.2	6.5 ± 0.4	4.3 ± 0.3	4.5 ± 0.1	4.1 ± 0.2	4.5 ± 0.1	3.9 ± 0.2	5.6 ± 0.3	W Africa F	E Europe F
47	5.7 ± 0.5	5.0 ± 0.1	3.8 ± 0.2	4.8 ± 0.2	4.4 ± 0.2	6.5 ± 0.4	4.4 ± 0.3	4.4 ± 0.1	3.7 ± 0.2	4.7 ± 0.2	3.7 ± 0.2	5.3 ± 0.3	W Africa F	E Europe M
48	5.6 ± 0.5	5.0 ± 0.1	3.8 ± 0.2	5.0 ± 0.2	4.5 ± 0.2	6.6 ± 0.4	4.5 ± 0.3	4.3 ± 0.1	3.9 ± 0.3	4.6 ± 0.2	3.9 ± 0.2	5.5 ± 0.3	W Africa F	E Europe F
49	5.7 ± 0.5	5.1 ± 0.1	3.8 ± 0.2	4.9 ± 0.2	4.3 ± 0.2	6.9 ± 0.4	4.7 ± 0.4	4.3 ± 0.1	3.8 ± 0.2	4.5 ± 0.2	3.8 ± 0.2	5.4 ± 0.3	W Africa F	E Europe F
50	5.9 ± 0.6	5.1 ± 0.1	3.7 ± 0.2	4.8 ± 0.2	4.6 ± 0.2	6.7 ± 0.4	4.3 ± 0.4	4.2 ± 0.1	3.9 ± 0.2	4.6 ± 0.2	3.8 ± 0.2	5.3 ± 0.3	W Africa F	E Europe F
51	5.2 ± 0.4	5.3 ± 0.1	3.6 ± 0.2	4.9 ± 0.2	4.5 ± 0.2	6.7 ± 0.4	4.7 ± 0.4	4.2 ± 0.1	3.6 ± 0.2	4.6 ± 0.2	3.7 ± 0.2	5.7 ± 0.3	W Africa F	E Europe M
52	5.6 ± 0.5	5.2 ± 0.1	3.9 ± 0.2	5.1 ± 0.2	4.4 ± 0.2	7.0 ± 0.5	4.7 ± 0.4	4.1 ± 0.1	3.9 ± 0.2	4.6 ± 0.2	3.9 ± 0.2	5.8 ± 0.4	W Africa F	E Europe F

Table 28. Mean absolute error for Application-type images for algorithm incode-000. Values closer to zero are better.

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Group	min Group
14	2.7 ± 0.2	2.39 ± 0.09	2.4 ± 0.2	2.3 ± 0.1	2.6 ± 0.2	2.9 ± 0.3	2.6 ± 0.2	1.67 ± 0.07	1.6 ± 0.1	1.81 ± 0.07	1.8 ± 0.1	2.2 ± 0.2	W Africa F	E Europe M
15	2.8 ± 0.3	2.5 ± 0.1	2.2 ± 0.2	2.6 ± 0.2	2.9 ± 0.3	2.7 ± 0.3	2.5 ± 0.2	1.74 ± 0.06	1.4 ± 0.1	1.81 ± 0.08	2.0 ± 0.1	2.2 ± 0.2	S E Asia F	E Europe M
16	2.9 ± 0.3	2.5 ± 0.1	2.6 ± 0.3	2.5 ± 0.2	2.8 ± 0.3	3.0 ± 0.5	2.5 ± 0.2	1.60 ± 0.06	1.5 ± 0.2	1.71 ± 0.09	1.8 ± 0.1	2.0 ± 0.2	W Africa F	E Europe M
17	3.4 ± 0.4	2.6 ± 0.1	2.5 ± 0.3	2.6 ± 0.2	2.8 ± 0.2	2.9 ± 0.3	2.1 ± 0.2	1.50 ± 0.09	1.3 ± 0.1	1.7 ± 0.1	1.6 ± 0.2	2.0 ± 0.3	E Africa F	E Europe M
18	3.4 ± 0.3	2.7 ± 0.1	2.7 ± 0.3	2.5 ± 0.1	2.9 ± 0.2	3.0 ± 0.3	2.1 ± 0.2	1.67 ± 0.08	1.6 ± 0.2	1.80 ± 0.10	1.7 ± 0.2	2.0 ± 0.2	E Africa F	E Europe M
19	4.1 ± 0.3	2.9 ± 0.1	3.1 ± 0.2	2.9 ± 0.1	3.0 ± 0.2	3.3 ± 0.3	2.8 ± 0.2	2.01 ± 0.08	1.9 ± 0.2	2.07 ± 0.10	2.0 ± 0.1	2.6 ± 0.3	E Africa F	E Europe M
20	4.6 ± 0.3	3.1 ± 0.1	3.4 ± 0.2	3.2 ± 0.1	3.1 ± 0.1	3.7 ± 0.2	3.2 ± 0.2	2.28 ± 0.08	2.2 ± 0.1	2.54 ± 0.09	2.2 ± 0.1	3.1 ± 0.2	E Africa F	E Europe M
21	4.6 ± 0.2	3.18 ± 0.09	3.6 ± 0.2	3.32 ± 0.10	3.3 ± 0.1	4.3 ± 0.3	3.5 ± 0.2	2.47 ± 0.07	2.4 ± 0.1	2.64 ± 0.09	2.5 ± 0.1	3.4 ± 0.2	E Africa F	E Europe M
22	5.0 ± 0.2	3.10 ± 0.08	3.5 ± 0.1	3.36 ± 0.09	3.2 ± 0.1	4.3 ± 0.2	4.0 ± 0.2	2.58 ± 0.08	2.5 ± 0.1	2.75 ± 0.10	2.5 ± 0.1	3.4 ± 0.2	E Africa F	S E Asia M
23	4.9 ± 0.2	2.94 ± 0.08	3.5 ± 0.1	3.36 ± 0.08	3.0 ± 0.1	4.3 ± 0.2	4.0 ± 0.2	2.58 ± 0.08	2.3 ± 0.1	2.80 ± 0.10	2.4 ± 0.1	3.7 ± 0.2	E Africa F	E Europe M
24	5.0 ± 0.2	2.87 ± 0.07	3.3 ± 0.1	3.32 ± 0.08	2.84 ± 0.09	4.3 ± 0.2	3.8 ± 0.2	2.48 ± 0.09	2.3 ± 0.1	2.79 ± 0.09	2.3 ± 0.1	3.4 ± 0.2	E Africa F	S E Asia M
25	4.9 ± 0.2	2.74 ± 0.07	3.1 ± 0.1	3.31 ± 0.07	2.80 ± 0.09	4.3 ± 0.2	3.9 ± 0.2	2.52 ± 0.08	2.3 ± 0.1	2.74 ± 0.08	2.3 ± 0.1	3.6 ± 0.2	E Africa F	S E Asia M
26	4.8 ± 0.2	2.75 ± 0.07	3.06 ± 0.10	3.17 ± 0.07	2.80 ± 0.09	4.2 ± 0.2	3.7 ± 0.2	2.43 ± 0.08	2.3 ± 0.1	2.75 ± 0.08	2.3 ± 0.1	3.4 ± 0.2	E Africa F	S E Asia M
27	4.7 ± 0.2	2.74 ± 0.06	3.1 ± 0.1	3.19 ± 0.07	2.77 ± 0.09	4.3 ± 0.2	3.8 ± 0.2	2.52 ± 0.08	2.3 ± 0.1	2.77 ± 0.07	2.4 ± 0.1	3.5 ± 0.2	E Africa F	E Europe M
28	4.6 ± 0.2	2.81 ± 0.06	2.97 ± 0.09	3.25 ± 0.07	2.77 ± 0.09	4.2 ± 0.2	3.6 ± 0.2	2.57 ± 0.08	2.4 ± 0.1	2.83 ± 0.07	2.5 ± 0.1	3.6 ± 0.2	E Africa F	E Europe M
29	4.6 ± 0.2	2.83 ± 0.06	3.01 ± 0.10	3.32 ± 0.07	2.85 ± 0.09	4.3 ± 0.2	3.6 ± 0.2	2.67 ± 0.08	2.5 ± 0.1	2.89 ± 0.07	2.6 ± 0.1	3.7 ± 0.2	E Africa F	E Europe M
30	4.6 ± 0.2	3.02 ± 0.06	3.11 ± 0.10	3.38 ± 0.07	2.92 ± 0.09	4.3 ± 0.2	3.8 ± 0.2	2.80 ± 0.08	2.4 ± 0.1	2.96 ± 0.06	2.8 ± 0.1	3.7 ± 0.1	E Africa F	E Europe M
31	4.7 ± 0.2	3.15 ± 0.06	3.2 ± 0.1	3.46 ± 0.07	3.02 ± 0.09	4.3 ± 0.2	3.8 ± 0.2	2.89 ± 0.08	2.5 ± 0.1	3.11 ± 0.06	2.9 ± 0.1	3.8 ± 0.1	E Africa F	E Europe M
32	4.8 ± 0.2	3.29 ± 0.06	3.2 ± 0.1	3.69 ± 0.07	3.2 ± 0.1	4.4 ± 0.2	3.8 ± 0.2	3.05 ± 0.08	2.6 ± 0.1	3.24 ± 0.06	2.9 ± 0.1	3.9 ± 0.1	E Africa F	E Europe M
33	4.7 ± 0.2	3.44 ± 0.07	3.4 ± 0.1	3.70 ± 0.07	3.29 ± 0.10	4.5 ± 0.2	4.1 ± 0.2	3.24 ± 0.08	2.7 ± 0.1	3.26 ± 0.06	3.0 ± 0.1	3.9 ± 0.1	E Africa F	E Europe M
34	4.6 ± 0.2	3.52 ± 0.07	3.4 ± 0.1	3.70 ± 0.08	3.25 ± 0.10	4.4 ± 0.2	3.8 ± 0.2	3.33 ± 0.08	2.8 ± 0.1	3.40 ± 0.06	3.0 ± 0.1	3.9 ± 0.1	E Africa F	E Europe M
35	4.9 ± 0.2	3.65 ± 0.07	3.6 ± 0.1	3.79 ± 0.08	3.4 ± 0.1	4.4 ± 0.2	4.0 ± 0.2	3.40 ± 0.09	2.8 ± 0.1	3.46 ± 0.07	3.2 ± 0.1	4.1 ± 0.2	E Africa F	E Europe M
36	4.7 ± 0.2	3.66 ± 0.07	3.4 ± 0.1	3.78 ± 0.08	3.4 ± 0.1	4.4 ± 0.2	4.1 ± 0.2	3.32 ± 0.09	2.9 ± 0.1	3.39 ± 0.07	3.2 ± 0.2	4.1 ± 0.2	E Africa F	E Europe M
37	4.7 ± 0.2	3.56 ± 0.07	3.6 ± 0.1	3.74 ± 0.08	3.3 ± 0.1	4.7 ± 0.2	4.0 ± 0.2	3.27 ± 0.09	2.9 ± 0.1	3.44 ± 0.07	3.1 ± 0.1	3.9 ± 0.1	W Africa F	E Europe M
38	4.5 ± 0.2	3.55 ± 0.07	3.4 ± 0.1	3.63 ± 0.08	3.3 ± 0.1	4.5 ± 0.2	3.7 ± 0.2	3.32 ± 0.09	2.7 ± 0.1	3.28 ± 0.07	3.0 ± 0.1	4.0 ± 0.2	E Africa F	E Europe M
39	4.4 ± 0.2	3.48 ± 0.07	3.2 ± 0.1	3.56 ± 0.09	3.1 ± 0.1	4.3 ± 0.2	3.6 ± 0.2	3.14 ± 0.09	2.7 ± 0.1	3.15 ± 0.07	2.9 ± 0.1	3.7 ± 0.2	E Africa F	E Europe M
40	4.2 ± 0.2	3.33 ± 0.08	3.2 ± 0.1	3.36 ± 0.09	3.0 ± 0.1	4.4 ± 0.2	3.5 ± 0.2	2.96 ± 0.08	2.7 ± 0.1	3.12 ± 0.08	2.7 ± 0.1	3.7 ± 0.2	W Africa F	E Europe M
41	4.1 ± 0.3	3.17 ± 0.08	3.0 ± 0.1	3.3 ± 0.1	2.9 ± 0.1	4.2 ± 0.2	3.4 ± 0.2	2.88 ± 0.08	2.6 ± 0.1	2.92 ± 0.08	2.6 ± 0.1	3.8 ± 0.2	W Africa F	E Europe M
42	4.3 ± 0.3	3.00 ± 0.07	3.1 ± 0.1	3.1 ± 0.1	2.7 ± 0.1	4.2 ± 0.2	3.3 ± 0.2	2.76 ± 0.08	2.5 ± 0.1	2.79 ± 0.08	2.5 ± 0.1	3.6 ± 0.2	E Africa F	S E Asia M
43	4.2 ± 0.3	3.02 ± 0.07	3.0 ± 0.1	3.1 ± 0.1	2.8 ± 0.1	4.1 ± 0.2	3.3 ± 0.2	2.72 ± 0.08	2.4 ± 0.1	2.84 ± 0.09	2.7 ± 0.1	3.9 ± 0.2	E Africa F	E Europe M
44	4.5 ± 0.3	3.05 ± 0.07	2.8 ± 0.1	3.1 ± 0.1	2.9 ± 0.1	4.4 ± 0.3	3.4 ± 0.2	2.66 ± 0.08	2.6 ± 0.1	2.86 ± 0.09	2.7 ± 0.2	3.6 ± 0.2	E Africa F	E Europe M
45	4.3 ± 0.3	3.01 ± 0.07	2.7 ± 0.1	3.1 ± 0.1	2.8 ± 0.1	3.9 ± 0.2	3.5 ± 0.2	2.78 ± 0.08	2.7 ± 0.2	2.92 ± 0.09	2.7 ± 0.1	3.9 ± 0.2	E Africa F	S E Asia M
46	4.7 ± 0.4	3.12 ± 0.08	2.9 ± 0.1	3.1 ± 0.1	2.9 ± 0.1	4.0 ± 0.3	3.8 ± 0.3	2.83 ± 0.08	2.8 ± 0.1	2.90 ± 0.10	2.8 ± 0.2	4.1 ± 0.2	E Africa F	E Europe M
47	4.4 ± 0.4	3.04 ± 0.08	2.9 ± 0.1	3.1 ± 0.1	2.9 ± 0.1	4.2 ± 0.3	4.0 ± 0.3	2.82 ± 0.08	2.7 ± 0.2	3.2 ± 0.1	3.0 ± 0.2	4.1 ± 0.2	E Africa F	E Europe M
48	4.5 ± 0.4	3.04 ± 0.08	3.0 ± 0.1	3.2 ± 0.1	2.9 ± 0.1	4.3 ± 0.3	4.3 ± 0.3	2.85 ± 0.08	3.0 ± 0.2	3.1 ± 0.1	2.9 ± 0.2	4.3 ± 0.3	E Africa F	E Asia M
49	4.8 ± 0.4	3.14 ± 0.09	2.8 ± 0.2	3.2 ± 0.1	3.0 ± 0.1	4.3 ± 0.3	4.0 ± 0.3	2.93 ± 0.09	2.9 ± 0.2	3.2 ± 0.1	3.0 ± 0.2	4.1 ± 0.2	E Africa F	E Europe F
50	4.8 ± 0.4	3.15 ± 0.09	2.9 ± 0.2	3.2 ± 0.1	3.1 ± 0.1	4.5 ± 0.3	3.9 ± 0.3	3.02 ± 0.09	3.0 ± 0.2	3.3 ± 0.1	3.2 ± 0.2	4.3 ± 0.2	E Africa F	E Europe F
51	5.0 ± 0.4	3.17 ± 0.09	3.0 ± 0.2	3.3 ± 0.1	3.2 ± 0.2	4.6 ± 0.3	4.3 ± 0.4	3.14 ± 0.10	3.1 ± 0.2	3.6 ± 0.2	3.3 ± 0.2	4.4 ± 0.3	E Africa F	E Europe F
52	5.1 ± 0.4	3.24 ± 0.09	3.3 ± 0.2	3.5 ± 0.1	3.4 ± 0.2	4.6 ± 0.3	4.2 ± 0.3	3.14 ± 0.10	3.4 ± 0.2	3.7 ± 0.1	3.5 ± 0.2	4.7 ± 0.3	E Africa F	E Asia M

Table 29. *Mean absolute error for Application-type images for algorithm neurotechnology-000. Values closer to zero are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Group	min Group
14	6.3 ± 0.4	6.0 ± 0.2	4.3 ± 0.2	4.5 ± 0.2	5.1 ± 0.3	9.5 ± 0.5	8.9 ± 0.4	6.7 ± 0.1	4.0 ± 0.2	5.3 ± 0.1	5.8 ± 0.3	11.1 ± 0.5	W Africa M	E Europe M
15	5.7 ± 0.4	6.2 ± 0.2	3.8 ± 0.2	4.5 ± 0.2	5.2 ± 0.3	8.6 ± 0.5	9.0 ± 0.4	6.8 ± 0.1	3.8 ± 0.2	5.4 ± 0.2	6.2 ± 0.3	10.4 ± 0.4	W Africa M	E Europe F
16	6.1 ± 0.4	5.5 ± 0.2	3.9 ± 0.3	4.2 ± 0.2	5.2 ± 0.3	8.6 ± 0.5	9.3 ± 0.3	6.5 ± 0.1	3.9 ± 0.2	5.3 ± 0.2	6.0 ± 0.3	9.9 ± 0.4	W Africa M	E Europe F
17	6.1 ± 0.4	5.2 ± 0.1	3.7 ± 0.3	3.9 ± 0.2	4.8 ± 0.3	8.4 ± 0.4	9.2 ± 0.4	5.9 ± 0.1	3.3 ± 0.2	5.1 ± 0.2	5.6 ± 0.2	9.8 ± 0.4	W Africa M	E Europe M
18	5.3 ± 0.3	4.5 ± 0.1	3.2 ± 0.2	3.4 ± 0.1	4.2 ± 0.2	7.4 ± 0.3	8.6 ± 0.3	5.34 ± 0.10	3.1 ± 0.2	4.7 ± 0.1	5.1 ± 0.2	9.0 ± 0.3	W Africa M	E Europe M
19	5.2 ± 0.3	3.93 ± 0.10	3.0 ± 0.2	3.3 ± 0.1	3.7 ± 0.2	7.1 ± 0.3	8.4 ± 0.3	4.69 ± 0.10	2.5 ± 0.2	4.4 ± 0.1	4.4 ± 0.2	8.5 ± 0.3	W Africa M	E Europe M
20	4.8 ± 0.2	3.4 ± 0.1	2.8 ± 0.2	3.0 ± 0.1	3.3 ± 0.1	6.4 ± 0.3	7.9 ± 0.3	4.06 ± 0.09	2.4 ± 0.2	4.1 ± 0.1	3.7 ± 0.1	8.2 ± 0.2	W Africa M	E Europe M
21	4.6 ± 0.2	3.11 ± 0.09	2.7 ± 0.2	2.90 ± 0.09	3.0 ± 0.1	6.1 ± 0.3	7.4 ± 0.3	3.33 ± 0.08	2.5 ± 0.2	3.6 ± 0.1	3.3 ± 0.1	7.6 ± 0.3	W Africa M	E Europe M
22	4.6 ± 0.2	2.86 ± 0.09	2.8 ± 0.1	2.83 ± 0.09	2.7 ± 0.1	5.5 ± 0.2	7.2 ± 0.2	2.75 ± 0.08	2.5 ± 0.2	3.2 ± 0.1	2.7 ± 0.1	7.0 ± 0.3	E Africa M	E Europe M
23	4.1 ± 0.2	2.72 ± 0.08	3.0 ± 0.1	2.95 ± 0.08	2.7 ± 0.1	4.8 ± 0.2	6.4 ± 0.2	2.43 ± 0.07	2.3 ± 0.1	3.0 ± 0.1	2.3 ± 0.1	6.3 ± 0.2	E Africa M	S E Asia M
24	3.9 ± 0.2	2.82 ± 0.09	3.0 ± 0.1	3.05 ± 0.08	2.61 ± 0.09	4.5 ± 0.2	6.1 ± 0.2	2.09 ± 0.07	2.4 ± 0.1	2.80 ± 0.09	1.94 ± 0.10	5.7 ± 0.2	E Africa M	S E Asia M
25	3.9 ± 0.2	2.98 ± 0.08	3.27 ± 0.10	3.32 ± 0.07	3.0 ± 0.1	4.1 ± 0.2	5.5 ± 0.2	1.90 ± 0.07	2.5 ± 0.1	2.65 ± 0.08	1.99 ± 0.10	5.2 ± 0.2	E Africa M	E Asia M
26	3.9 ± 0.2	3.33 ± 0.08	3.44 ± 0.09	3.70 ± 0.07	3.18 ± 0.10	3.7 ± 0.2	5.0 ± 0.2	1.86 ± 0.07	2.8 ± 0.1	2.64 ± 0.07	2.1 ± 0.1	4.6 ± 0.2	E Africa M	E Asia M
27	4.0 ± 0.2	3.76 ± 0.08	3.62 ± 0.09	4.11 ± 0.07	3.5 ± 0.1	3.4 ± 0.2	4.3 ± 0.2	2.08 ± 0.07	2.9 ± 0.1	2.68 ± 0.06	2.3 ± 0.1	4.0 ± 0.1	E Africa M	E Asia M
28	4.0 ± 0.2	4.16 ± 0.08	3.87 ± 0.09	4.61 ± 0.08	4.0 ± 0.1	3.4 ± 0.2	3.9 ± 0.2	2.46 ± 0.07	3.0 ± 0.1	2.86 ± 0.06	2.7 ± 0.1	3.5 ± 0.1	S Asia F	E Asia M
29	4.0 ± 0.2	4.66 ± 0.08	4.1 ± 0.1	4.98 ± 0.08	4.6 ± 0.1	3.4 ± 0.1	3.6 ± 0.2	2.82 ± 0.07	3.3 ± 0.1	3.09 ± 0.06	3.1 ± 0.1	3.2 ± 0.1	S Asia F	E Asia M
30	4.4 ± 0.2	5.18 ± 0.08	4.4 ± 0.1	5.50 ± 0.08	4.9 ± 0.1	3.5 ± 0.2	3.5 ± 0.2	3.35 ± 0.07	3.3 ± 0.1	3.37 ± 0.06	3.5 ± 0.1	2.9 ± 0.1	S Asia F	W Africa M
31	4.6 ± 0.2	5.72 ± 0.08	4.7 ± 0.1	6.01 ± 0.09	5.4 ± 0.1	3.7 ± 0.2	3.2 ± 0.1	3.89 ± 0.08	3.6 ± 0.1	3.68 ± 0.06	4.1 ± 0.1	2.7 ± 0.1	S Asia F	W Africa M
32	4.7 ± 0.2	6.29 ± 0.09	4.8 ± 0.1	6.49 ± 0.10	5.9 ± 0.1	4.1 ± 0.2	3.1 ± 0.1	4.40 ± 0.08	3.7 ± 0.1	4.01 ± 0.07	4.4 ± 0.1	2.6 ± 0.1	S Asia F	W Africa M
33	5.1 ± 0.2	6.81 ± 0.09	5.1 ± 0.1	7.0 ± 0.1	6.4 ± 0.1	4.2 ± 0.2	3.3 ± 0.2	5.03 ± 0.09	3.6 ± 0.1	4.39 ± 0.07	4.7 ± 0.2	2.7 ± 0.1	S Asia F	W Africa M
34	5.2 ± 0.2	7.27 ± 0.09	5.3 ± 0.2	7.4 ± 0.1	6.8 ± 0.2	4.7 ± 0.2	3.2 ± 0.1	5.47 ± 0.09	3.8 ± 0.2	4.69 ± 0.08	5.3 ± 0.2	2.8 ± 0.1	S Asia F	W Africa M
35	5.5 ± 0.2	7.79 ± 0.10	5.5 ± 0.2	7.9 ± 0.1	7.3 ± 0.2	4.8 ± 0.2	3.4 ± 0.2	5.96 ± 0.10	3.9 ± 0.2	5.10 ± 0.09	5.6 ± 0.2	3.2 ± 0.1	S Asia F	W Africa M
36	6.1 ± 0.3	8.2 ± 0.1	5.6 ± 0.2	8.3 ± 0.1	7.4 ± 0.2	5.2 ± 0.2	3.8 ± 0.2	6.3 ± 0.1	4.1 ± 0.2	5.41 ± 0.09	5.9 ± 0.2	3.6 ± 0.1	S Asia F	W Africa M
37	5.9 ± 0.3	8.6 ± 0.1	5.8 ± 0.2	8.5 ± 0.1	8.0 ± 0.2	5.7 ± 0.2	3.9 ± 0.2	6.6 ± 0.1	4.3 ± 0.2	5.76 ± 0.10	6.2 ± 0.2	3.8 ± 0.1	E Asia F	W Africa M
38	6.2 ± 0.3	9.0 ± 0.1	5.7 ± 0.2	8.8 ± 0.2	8.2 ± 0.2	6.3 ± 0.2	4.2 ± 0.2	7.0 ± 0.1	4.3 ± 0.2	6.1 ± 0.1	6.2 ± 0.2	4.2 ± 0.1	E Asia F	E Africa M
39	6.3 ± 0.3	9.5 ± 0.1	5.9 ± 0.2	9.3 ± 0.2	8.2 ± 0.2	6.1 ± 0.2	4.4 ± 0.2	7.4 ± 0.1	4.4 ± 0.2	6.2 ± 0.1	6.5 ± 0.2	4.7 ± 0.2	E Asia F	E Africa M
40	6.6 ± 0.3	9.7 ± 0.1	5.9 ± 0.2	9.4 ± 0.2	8.7 ± 0.2	6.5 ± 0.2	4.6 ± 0.2	7.6 ± 0.1	4.6 ± 0.2	6.4 ± 0.1	6.5 ± 0.2	5.2 ± 0.2	E Asia F	E Europe M
41	7.2 ± 0.3	9.9 ± 0.1	6.1 ± 0.2	9.6 ± 0.2	9.0 ± 0.2	7.3 ± 0.3	5.0 ± 0.2	7.7 ± 0.1	4.7 ± 0.2	6.6 ± 0.1	6.9 ± 0.3	5.8 ± 0.2	E Asia F	E Europe M
42	6.7 ± 0.3	10.2 ± 0.1	6.1 ± 0.3	9.5 ± 0.2	8.9 ± 0.2	7.1 ± 0.3	5.1 ± 0.3	7.9 ± 0.1	4.5 ± 0.2	6.7 ± 0.1	6.8 ± 0.2	5.8 ± 0.2	E Asia F	E Europe M
43	7.6 ± 0.4	10.3 ± 0.1	6.0 ± 0.3	9.8 ± 0.2	9.2 ± 0.2	7.5 ± 0.3	5.2 ± 0.3	7.9 ± 0.2	4.7 ± 0.2	6.8 ± 0.2	6.9 ± 0.3	6.5 ± 0.2	E Asia F	E Europe M
44	7.6 ± 0.4	10.7 ± 0.1	6.1 ± 0.3	9.8 ± 0.3	8.9 ± 0.3	7.7 ± 0.3	5.4 ± 0.3	8.0 ± 0.2	4.6 ± 0.2	6.8 ± 0.2	6.8 ± 0.3	6.4 ± 0.2	E Asia F	E Europe M
45	7.9 ± 0.4	10.8 ± 0.2	6.1 ± 0.3	9.7 ± 0.3	9.1 ± 0.3	7.6 ± 0.4	5.5 ± 0.3	8.2 ± 0.2	4.6 ± 0.2	6.8 ± 0.2	6.7 ± 0.3	6.9 ± 0.2	E Asia F	E Europe M
46	7.4 ± 0.5	11.1 ± 0.2	5.9 ± 0.3	9.5 ± 0.3	9.3 ± 0.3	8.0 ± 0.4	5.5 ± 0.3	8.1 ± 0.2	4.9 ± 0.3	6.6 ± 0.2	6.3 ± 0.3	7.1 ± 0.3	E Asia F	E Europe M
47	7.2 ± 0.5	10.8 ± 0.2	5.9 ± 0.3	9.6 ± 0.3	8.9 ± 0.3	7.9 ± 0.4	5.6 ± 0.3	8.0 ± 0.2	5.0 ± 0.3	6.5 ± 0.2	6.4 ± 0.3	7.2 ± 0.3	E Asia F	E Europe M
48	7.5 ± 0.5	10.7 ± 0.2	5.7 ± 0.3	9.5 ± 0.3	9.0 ± 0.3	8.0 ± 0.4	6.2 ± 0.4	8.0 ± 0.2	5.0 ± 0.3	6.6 ± 0.2	6.6 ± 0.3	7.9 ± 0.3	E Asia F	E Europe M
49	7.3 ± 0.5	10.9 ± 0.2	6.0 ± 0.3	9.3 ± 0.3	8.5 ± 0.3	8.4 ± 0.5	6.1 ± 0.4	7.9 ± 0.2	5.2 ± 0.3	6.4 ± 0.2	6.0 ± 0.3	7.8 ± 0.3	E Asia F	E Europe M
50	7.8 ± 0.7	10.6 ± 0.2	5.5 ± 0.3	9.1 ± 0.3	8.7 ± 0.3	7.9 ± 0.5	6.3 ± 0.4	7.7 ± 0.2	5.0 ± 0.3	6.6 ± 0.2	6.1 ± 0.3	7.6 ± 0.3	E Asia F	E Europe M
51	7.1 ± 0.5	10.6 ± 0.2	5.7 ± 0.3	8.9 ± 0.3	8.5 ± 0.3	8.2 ± 0.5	6.6 ± 0.5	7.6 ± 0.2	4.8 ± 0.2	6.6 ± 0.2	6.0 ± 0.3	8.2 ± 0.4	E Asia F	E Europe M
52	7.2 ± 0.6	10.5 ± 0.2	5.4 ± 0.3	9.1 ± 0.3	7.7 ± 0.3	8.1 ± 0.5	6.0 ± 0.4	7.3 ± 0.2	4.9 ± 0.3	6.4 ± 0.2	5.9 ± 0.3	8.0 ± 0.4	E Asia F	E Europe M

Table 30. *Mean absolute error for Application-type images for algorithm roc-000. Values closer to zero are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Group	min Group
14	5.3 ± 0.2	5.5 ± 0.1	3.8 ± 0.1	4.0 ± 0.1	4.8 ± 0.2	5.7 ± 0.3	4.4 ± 0.2	5.5 ± 0.1	3.0 ± 0.1	3.62 ± 0.09	4.8 ± 0.2	4.7 ± 0.2	W Africa F	E Europe M
15	4.9 ± 0.3	5.5 ± 0.1	3.3 ± 0.1	3.9 ± 0.2	5.0 ± 0.3	5.5 ± 0.3	4.3 ± 0.2	5.4 ± 0.1	2.74 ± 0.10	3.4 ± 0.1	4.7 ± 0.2	4.7 ± 0.3	E Asia F	E Europe M
16	4.8 ± 0.3	5.4 ± 0.1	2.8 ± 0.1	3.5 ± 0.1	4.9 ± 0.3	5.7 ± 0.4	4.2 ± 0.2	4.9 ± 0.1	2.4 ± 0.1	3.1 ± 0.1	4.4 ± 0.2	4.3 ± 0.3	W Africa F	E Europe M
17	5.0 ± 0.3	5.1 ± 0.1	2.3 ± 0.2	3.2 ± 0.2	4.6 ± 0.3	5.2 ± 0.3	3.7 ± 0.2	4.7 ± 0.1	1.59 ± 0.09	2.9 ± 0.1	4.2 ± 0.2	4.5 ± 0.4	W Africa F	E Europe M
18	4.2 ± 0.2	4.6 ± 0.1	1.9 ± 0.2	2.5 ± 0.1	4.4 ± 0.2	4.8 ± 0.3	3.6 ± 0.2	4.3 ± 0.1	1.3 ± 0.1	2.4 ± 0.1	4.0 ± 0.2	4.0 ± 0.3	W Africa F	E Europe M
19	4.2 ± 0.3	4.3 ± 0.1	1.8 ± 0.2	2.4 ± 0.1	4.2 ± 0.2	4.8 ± 0.3	3.8 ± 0.2	4.2 ± 0.1	1.1 ± 0.1	2.4 ± 0.1	3.8 ± 0.2	4.2 ± 0.3	W Africa F	E Europe M
20	4.1 ± 0.3	4.1 ± 0.1	1.9 ± 0.1	2.5 ± 0.1	4.0 ± 0.2	4.5 ± 0.3	3.8 ± 0.3	4.0 ± 0.1	1.4 ± 0.1	2.7 ± 0.1	3.8 ± 0.2	4.2 ± 0.3	W Africa F	E Europe M
21	3.9 ± 0.2	4.0 ± 0.1	2.3 ± 0.1	2.6 ± 0.1	3.8 ± 0.1	4.5 ± 0.3	4.0 ± 0.3	3.88 ± 0.10	1.7 ± 0.1	2.9 ± 0.1	3.9 ± 0.2	4.3 ± 0.3	W Africa F	E Europe M
22	4.2 ± 0.3	3.7 ± 0.1	2.6 ± 0.1	2.79 ± 0.09	3.9 ± 0.1	4.2 ± 0.3	4.6 ± 0.3	3.7 ± 0.1	2.2 ± 0.1	3.1 ± 0.1	3.5 ± 0.2	4.1 ± 0.3	E Africa M	E Europe M
23	4.2 ± 0.2	3.67 ± 0.09	3.1 ± 0.1	3.08 ± 0.08	3.8 ± 0.1	4.4 ± 0.2	4.5 ± 0.3	3.6 ± 0.1	2.4 ± 0.1	3.2 ± 0.1	3.6 ± 0.2	4.3 ± 0.2	E Africa M	E Europe M
24	4.3 ± 0.2	3.48 ± 0.08	3.12 ± 0.09	3.21 ± 0.07	3.7 ± 0.1	4.3 ± 0.2	4.4 ± 0.2	3.41 ± 0.10	2.7 ± 0.1	3.3 ± 0.1	3.4 ± 0.1	4.2 ± 0.2	E Africa M	E Europe M
25	4.4 ± 0.2	3.46 ± 0.07	3.41 ± 0.09	3.35 ± 0.07	3.6 ± 0.1	4.2 ± 0.2	4.5 ± 0.2	3.34 ± 0.09	2.8 ± 0.1	3.25 ± 0.09	3.4 ± 0.1	4.2 ± 0.2	E Africa M	E Europe M
26	4.4 ± 0.2	3.33 ± 0.07	3.56 ± 0.09	3.49 ± 0.06	3.57 ± 0.10	4.2 ± 0.2	4.6 ± 0.2	3.15 ± 0.09	2.9 ± 0.1	3.29 ± 0.08	3.3 ± 0.1	3.9 ± 0.2	E Africa M	E Europe M
27	4.8 ± 0.2	3.13 ± 0.06	3.53 ± 0.09	3.66 ± 0.07	3.42 ± 0.09	4.3 ± 0.2	4.3 ± 0.2	3.09 ± 0.09	2.9 ± 0.1	3.21 ± 0.08	3.3 ± 0.1	3.8 ± 0.2	E Africa F	E Europe M
28	4.5 ± 0.2	3.07 ± 0.06	3.61 ± 0.10	3.87 ± 0.07	3.38 ± 0.09	4.1 ± 0.2	4.3 ± 0.2	2.96 ± 0.09	2.8 ± 0.1	3.13 ± 0.07	3.1 ± 0.1	3.5 ± 0.2	E Africa F	E Europe M
29	4.7 ± 0.2	2.99 ± 0.06	3.6 ± 0.1	3.94 ± 0.07	3.34 ± 0.09	4.1 ± 0.2	4.2 ± 0.2	2.87 ± 0.08	2.9 ± 0.1	3.09 ± 0.07	3.0 ± 0.1	3.8 ± 0.2	E Africa F	E Asia M
30	4.5 ± 0.2	2.96 ± 0.06	3.7 ± 0.1	4.04 ± 0.07	3.3 ± 0.1	4.1 ± 0.2	4.3 ± 0.2	2.74 ± 0.07	2.8 ± 0.1	3.09 ± 0.06	3.0 ± 0.1	3.5 ± 0.1	E Africa F	E Asia M
31	4.6 ± 0.2	2.96 ± 0.06	3.7 ± 0.1	4.15 ± 0.08	3.21 ± 0.09	4.1 ± 0.2	4.3 ± 0.2	2.65 ± 0.08	2.9 ± 0.1	3.03 ± 0.06	2.9 ± 0.1	3.6 ± 0.1	E Africa F	E Asia M
32	4.8 ± 0.2	2.97 ± 0.06	3.7 ± 0.1	4.29 ± 0.08	3.3 ± 0.1	4.3 ± 0.2	4.1 ± 0.2	2.69 ± 0.07	2.9 ± 0.1	3.07 ± 0.06	2.9 ± 0.1	3.5 ± 0.1	E Africa F	E Asia M
33	4.8 ± 0.2	2.93 ± 0.06	3.8 ± 0.1	4.31 ± 0.08	3.2 ± 0.1	4.1 ± 0.2	4.3 ± 0.2	2.59 ± 0.07	2.9 ± 0.1	3.05 ± 0.06	2.7 ± 0.1	3.5 ± 0.1	E Africa F	E Asia M
34	4.8 ± 0.2	2.98 ± 0.06	3.8 ± 0.1	4.34 ± 0.09	3.2 ± 0.1	4.0 ± 0.2	4.0 ± 0.2	2.60 ± 0.07	2.9 ± 0.1	3.08 ± 0.06	3.0 ± 0.1	3.5 ± 0.1	E Africa F	E Asia M
35	5.1 ± 0.2	3.01 ± 0.06	4.0 ± 0.1	4.41 ± 0.09	3.2 ± 0.1	4.2 ± 0.2	4.1 ± 0.2	2.66 ± 0.08	2.8 ± 0.1	3.07 ± 0.06	2.9 ± 0.1	3.6 ± 0.1	E Africa F	E Asia M
36	5.0 ± 0.2	3.10 ± 0.07	3.9 ± 0.1	4.36 ± 0.09	3.3 ± 0.1	4.1 ± 0.2	4.2 ± 0.2	2.66 ± 0.07	3.0 ± 0.1	3.10 ± 0.07	3.1 ± 0.2	3.5 ± 0.1	E Africa F	E Asia M
37	5.0 ± 0.2	3.08 ± 0.07	4.0 ± 0.1	4.5 ± 0.1	3.3 ± 0.1	4.4 ± 0.2	4.0 ± 0.2	2.70 ± 0.07	2.9 ± 0.1	3.13 ± 0.07	2.9 ± 0.1	3.5 ± 0.1	E Africa F	E Asia M
38	4.9 ± 0.3	3.20 ± 0.07	4.1 ± 0.2	4.4 ± 0.1	3.4 ± 0.1	4.4 ± 0.2	3.9 ± 0.2	2.71 ± 0.08	2.7 ± 0.1	3.08 ± 0.07	3.2 ± 0.2	3.4 ± 0.1	E Africa F	E Asia M
39	4.8 ± 0.3	3.22 ± 0.07	3.9 ± 0.2	4.5 ± 0.1	3.4 ± 0.1	4.1 ± 0.2	3.8 ± 0.2	2.76 ± 0.08	2.9 ± 0.1	3.10 ± 0.07	3.3 ± 0.1	3.5 ± 0.1	E Africa F	E Asia M
40	4.9 ± 0.3	3.30 ± 0.07	4.1 ± 0.2	4.4 ± 0.1	3.5 ± 0.1	4.3 ± 0.2	3.9 ± 0.2	2.74 ± 0.08	2.9 ± 0.1	3.20 ± 0.07	3.1 ± 0.1	3.5 ± 0.2	E Africa F	E Asia M
41	4.8 ± 0.3	3.34 ± 0.07	4.2 ± 0.2	4.4 ± 0.1	3.5 ± 0.1	4.3 ± 0.2	4.0 ± 0.2	2.89 ± 0.08	2.9 ± 0.1	3.20 ± 0.08	3.2 ± 0.2	3.6 ± 0.2	E Africa F	E Asia M
42	5.2 ± 0.3	3.44 ± 0.07	4.3 ± 0.2	4.3 ± 0.1	3.5 ± 0.1	4.6 ± 0.2	3.8 ± 0.2	2.96 ± 0.08	2.9 ± 0.2	3.20 ± 0.08	3.1 ± 0.2	3.6 ± 0.2	E Africa F	E Europe M
43	5.1 ± 0.3	3.55 ± 0.08	4.4 ± 0.2	4.3 ± 0.1	3.7 ± 0.1	4.4 ± 0.2	4.0 ± 0.2	3.00 ± 0.08	2.9 ± 0.2	3.21 ± 0.09	3.4 ± 0.2	3.8 ± 0.2	E Africa F	E Europe M
44	5.3 ± 0.4	3.58 ± 0.08	4.4 ± 0.2	4.5 ± 0.2	3.8 ± 0.1	4.5 ± 0.3	3.7 ± 0.2	3.11 ± 0.08	3.0 ± 0.2	3.30 ± 0.10	3.4 ± 0.2	3.5 ± 0.2	E Africa F	E Europe M
45	5.0 ± 0.3	3.62 ± 0.08	4.3 ± 0.2	4.4 ± 0.2	3.6 ± 0.1	4.4 ± 0.2	3.8 ± 0.2	3.10 ± 0.08	3.0 ± 0.2	3.3 ± 0.1	3.4 ± 0.2	3.8 ± 0.2	E Africa F	E Europe M
46	5.5 ± 0.4	3.61 ± 0.08	4.6 ± 0.2	4.1 ± 0.2	3.7 ± 0.2	4.4 ± 0.2	3.8 ± 0.2	3.11 ± 0.09	3.4 ± 0.2	3.2 ± 0.1	3.5 ± 0.2	3.7 ± 0.2	E Africa F	E Asia M
47	5.2 ± 0.4	3.76 ± 0.09	4.7 ± 0.2	4.2 ± 0.2	3.7 ± 0.2	4.4 ± 0.3	4.0 ± 0.3	3.21 ± 0.09	3.2 ± 0.2	3.5 ± 0.1	3.5 ± 0.2	3.9 ± 0.2	E Africa F	E Europe M
48	5.1 ± 0.4	3.80 ± 0.09	4.7 ± 0.2	4.3 ± 0.2	3.7 ± 0.2	4.5 ± 0.3	3.9 ± 0.3	3.26 ± 0.09	3.5 ± 0.2	3.5 ± 0.1	3.7 ± 0.2	4.0 ± 0.2	E Africa F	E Asia M
49	5.2 ± 0.4	3.82 ± 0.09	4.7 ± 0.2	4.1 ± 0.2	3.8 ± 0.2	4.8 ± 0.3	3.8 ± 0.3	3.34 ± 0.10	3.3 ± 0.2	3.4 ± 0.1	3.6 ± 0.2	3.7 ± 0.2	E Africa F	E Europe M
50	4.9 ± 0.4	3.91 ± 0.10	5.0 ± 0.2	4.1 ± 0.2	3.7 ± 0.2	4.4 ± 0.3	3.6 ± 0.3	3.32 ± 0.10	3.6 ± 0.2	3.6 ± 0.1	3.7 ± 0.2	3.9 ± 0.2	E Europe F	E Asia M
51	5.1 ± 0.4	3.9 ± 0.1	5.0 ± 0.2	4.2 ± 0.2	3.8 ± 0.2	4.4 ± 0.3	3.8 ± 0.3	3.5 ± 0.1	3.5 ± 0.2	3.7 ± 0.1	3.8 ± 0.2	4.0 ± 0.2	E Africa F	E Asia M
52	5.1 ± 0.4	4.0 ± 0.1	5.0 ± 0.2	4.1 ± 0.2	3.9 ± 0.2	4.5 ± 0.3	3.6 ± 0.3	3.5 ± 0.1	3.5 ± 0.2	3.6 ± 0.1	3.7 ± 0.2	4.1 ± 0.3	E Africa F	E Asia M

Table 31. *Mean absolute error for Application-type images for algorithm unissey-001. Values closer to zero are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Group	min Group
14	3.1 ± 0.3	4.1 ± 0.2	2.8 ± 0.2	2.8 ± 0.1	3.4 ± 0.3	4.4 ± 0.5	3.0 ± 0.2	3.7 ± 0.2	2.1 ± 0.2	2.6 ± 0.1	3.2 ± 0.3	3.1 ± 0.3	W Africa F	E Europe M
15	3.2 ± 0.3	4.3 ± 0.2	3.0 ± 0.3	3.1 ± 0.2	3.6 ± 0.3	4.3 ± 0.5	3.0 ± 0.3	3.9 ± 0.2	2.2 ± 0.2	3.0 ± 0.2	3.6 ± 0.3	3.1 ± 0.3	E Asia F	E Europe M
16	3.3 ± 0.3	4.4 ± 0.2	3.1 ± 0.3	3.2 ± 0.2	4.0 ± 0.3	4.5 ± 0.6	3.6 ± 0.3	4.2 ± 0.2	2.7 ± 0.3	3.3 ± 0.2	4.1 ± 0.3	3.0 ± 0.3	W Africa F	E Europe M
17	3.6 ± 0.4	4.3 ± 0.2	3.7 ± 0.4	3.3 ± 0.2	3.7 ± 0.3	4.9 ± 0.5	3.7 ± 0.3	4.3 ± 0.2	2.2 ± 0.2	3.5 ± 0.2	3.8 ± 0.3	3.5 ± 0.4	W Africa F	E Europe M
18	3.7 ± 0.3	4.2 ± 0.1	3.5 ± 0.3	3.2 ± 0.1	3.6 ± 0.2	4.8 ± 0.4	4.1 ± 0.3	4.3 ± 0.1	2.7 ± 0.2	3.8 ± 0.1	3.9 ± 0.3	3.6 ± 0.3	W Africa F	E Europe M
19	4.0 ± 0.3	4.2 ± 0.1	3.4 ± 0.3	3.5 ± 0.1	3.7 ± 0.2	4.9 ± 0.4	4.4 ± 0.3	4.3 ± 0.1	3.0 ± 0.2	3.9 ± 0.2	3.9 ± 0.2	3.5 ± 0.3	W Africa F	E Europe M
20	4.4 ± 0.3	4.2 ± 0.1	4.0 ± 0.2	3.6 ± 0.1	3.8 ± 0.2	5.4 ± 0.4	4.7 ± 0.3	4.3 ± 0.1	3.1 ± 0.2	4.1 ± 0.1	4.2 ± 0.2	3.9 ± 0.3	W Africa F	E Europe M
21	4.4 ± 0.2	4.1 ± 0.1	4.0 ± 0.2	3.8 ± 0.1	3.8 ± 0.1	5.5 ± 0.4	4.7 ± 0.3	4.3 ± 0.1	3.5 ± 0.2	4.0 ± 0.1	4.4 ± 0.2	4.0 ± 0.3	W Africa F	E Europe M
22	4.7 ± 0.2	3.83 ± 0.09	4.5 ± 0.2	3.82 ± 0.10	3.7 ± 0.1	5.7 ± 0.3	4.9 ± 0.2	4.2 ± 0.1	3.9 ± 0.2	4.0 ± 0.1	4.1 ± 0.2	3.8 ± 0.2	W Africa F	S E Asia F
23	4.6 ± 0.2	3.72 ± 0.08	4.5 ± 0.2	3.93 ± 0.09	3.7 ± 0.1	5.4 ± 0.3	4.7 ± 0.2	4.1 ± 0.1	3.7 ± 0.2	4.0 ± 0.1	4.1 ± 0.2	3.7 ± 0.2	W Africa F	S E Asia F
24	4.7 ± 0.2	3.48 ± 0.08	4.5 ± 0.1	3.86 ± 0.09	3.54 ± 0.09	5.5 ± 0.3	4.7 ± 0.2	3.9 ± 0.1	3.8 ± 0.2	3.7 ± 0.1	3.8 ± 0.1	3.6 ± 0.2	W Africa F	E Asia F
25	4.8 ± 0.2	3.23 ± 0.07	4.7 ± 0.1	3.97 ± 0.08	3.36 ± 0.09	5.5 ± 0.2	4.6 ± 0.2	3.8 ± 0.1	3.7 ± 0.2	3.6 ± 0.1	3.8 ± 0.1	3.7 ± 0.2	W Africa F	E Asia F
26	4.7 ± 0.2	3.08 ± 0.07	4.6 ± 0.1	3.92 ± 0.08	3.33 ± 0.09	5.4 ± 0.2	4.6 ± 0.2	3.48 ± 0.09	3.8 ± 0.2	3.55 ± 0.09	3.6 ± 0.1	3.4 ± 0.2	W Africa F	E Asia F
27	4.9 ± 0.2	2.86 ± 0.06	4.6 ± 0.1	3.99 ± 0.08	3.17 ± 0.09	5.3 ± 0.2	4.3 ± 0.2	3.28 ± 0.09	3.8 ± 0.2	3.35 ± 0.09	3.6 ± 0.2	3.5 ± 0.2	W Africa F	E Asia F
28	4.8 ± 0.2	2.72 ± 0.06	4.6 ± 0.1	4.13 ± 0.08	3.12 ± 0.10	5.3 ± 0.2	4.1 ± 0.2	3.2 ± 0.1	3.7 ± 0.2	3.17 ± 0.08	3.4 ± 0.2	3.4 ± 0.1	W Africa F	E Asia F
29	4.7 ± 0.2	2.68 ± 0.06	4.6 ± 0.1	4.18 ± 0.09	3.2 ± 0.1	5.0 ± 0.2	4.1 ± 0.2	2.97 ± 0.09	3.7 ± 0.2	3.19 ± 0.08	3.2 ± 0.2	3.5 ± 0.1	W Africa F	E Asia F
30	4.8 ± 0.2	2.83 ± 0.06	4.8 ± 0.1	4.40 ± 0.09	3.2 ± 0.1	5.2 ± 0.2	4.2 ± 0.2	2.89 ± 0.09	3.6 ± 0.2	3.26 ± 0.07	3.2 ± 0.2	3.7 ± 0.1	W Africa F	E Asia F
31	4.9 ± 0.2	3.06 ± 0.07	4.9 ± 0.1	4.56 ± 0.09	3.5 ± 0.1	5.4 ± 0.2	4.2 ± 0.2	2.99 ± 0.09	3.7 ± 0.1	3.43 ± 0.07	3.3 ± 0.2	3.9 ± 0.1	W Africa F	E Asia M
32	5.2 ± 0.2	3.31 ± 0.07	5.0 ± 0.1	4.80 ± 0.09	3.8 ± 0.1	5.3 ± 0.2	4.2 ± 0.2	3.14 ± 0.09	3.8 ± 0.1	3.58 ± 0.06	3.4 ± 0.2	4.2 ± 0.1	W Africa F	E Asia M
33	5.3 ± 0.2	3.66 ± 0.06	5.3 ± 0.1	5.01 ± 0.09	4.0 ± 0.1	5.4 ± 0.2	4.5 ± 0.2	3.26 ± 0.08	4.0 ± 0.1	3.79 ± 0.06	3.5 ± 0.1	4.4 ± 0.1	W Africa F	E Asia M
34	5.3 ± 0.2	3.93 ± 0.06	5.3 ± 0.2	5.22 ± 0.09	4.2 ± 0.1	5.4 ± 0.2	4.3 ± 0.2	3.44 ± 0.07	3.9 ± 0.1	3.99 ± 0.06	3.8 ± 0.2	4.8 ± 0.1	W Africa F	E Asia M
35	5.5 ± 0.2	4.25 ± 0.07	5.2 ± 0.2	5.31 ± 0.10	4.5 ± 0.1	5.4 ± 0.2	4.4 ± 0.2	3.43 ± 0.08	3.8 ± 0.1	4.10 ± 0.07	3.8 ± 0.2	5.0 ± 0.2	E Africa F	E Asia M
36	5.6 ± 0.2	4.34 ± 0.08	5.1 ± 0.2	5.5 ± 0.1	4.5 ± 0.1	5.5 ± 0.2	4.5 ± 0.2	3.40 ± 0.09	3.8 ± 0.1	4.14 ± 0.07	3.8 ± 0.2	5.2 ± 0.2	E Africa F	E Asia M
37	5.2 ± 0.3	4.35 ± 0.09	5.0 ± 0.2	5.4 ± 0.1	4.5 ± 0.1	5.4 ± 0.2	4.1 ± 0.2	3.32 ± 0.09	3.3 ± 0.1	4.03 ± 0.09	3.6 ± 0.2	5.2 ± 0.2	S Asia F	E Europe M
38	5.0 ± 0.3	4.51 ± 0.09	5.0 ± 0.2	5.5 ± 0.1	4.5 ± 0.2	5.6 ± 0.3	4.3 ± 0.2	3.3 ± 0.1	3.1 ± 0.2	4.07 ± 0.09	3.5 ± 0.2	5.5 ± 0.2	W Africa F	E Europe M
39	5.3 ± 0.3	4.68 ± 0.10	4.8 ± 0.2	5.6 ± 0.1	4.6 ± 0.2	5.3 ± 0.3	4.1 ± 0.2	3.4 ± 0.1	3.1 ± 0.2	4.09 ± 0.10	3.6 ± 0.2	5.9 ± 0.2	W Africa M	E Europe M
40	5.2 ± 0.3	4.88 ± 0.10	5.0 ± 0.2	5.5 ± 0.1	4.9 ± 0.2	5.5 ± 0.3	4.4 ± 0.2	3.5 ± 0.1	3.3 ± 0.2	4.3 ± 0.1	3.5 ± 0.2	6.2 ± 0.2	W Africa M	E Europe M
41	5.9 ± 0.3	5.03 ± 0.10	5.0 ± 0.2	5.8 ± 0.2	5.2 ± 0.2	5.6 ± 0.3	4.6 ± 0.3	3.65 ± 0.10	3.3 ± 0.2	4.4 ± 0.1	3.9 ± 0.2	6.4 ± 0.3	W Africa M	E Europe M
42	5.5 ± 0.3	5.17 ± 0.10	5.1 ± 0.2	5.7 ± 0.2	5.1 ± 0.2	5.4 ± 0.3	4.7 ± 0.2	3.92 ± 0.10	3.3 ± 0.2	4.6 ± 0.1	3.9 ± 0.2	6.6 ± 0.3	W Africa M	E Europe M
43	5.7 ± 0.3	5.4 ± 0.1	4.9 ± 0.2	5.8 ± 0.2	5.4 ± 0.2	5.9 ± 0.3	4.8 ± 0.3	4.0 ± 0.1	3.5 ± 0.2	4.7 ± 0.1	4.1 ± 0.2	6.9 ± 0.3	W Africa M	E Europe M
44	5.9 ± 0.4	5.7 ± 0.1	4.9 ± 0.2	5.9 ± 0.2	5.4 ± 0.2	6.1 ± 0.3	4.8 ± 0.3	4.3 ± 0.1	3.5 ± 0.2	4.8 ± 0.1	4.4 ± 0.2	7.0 ± 0.3	W Africa M	E Europe M
45	5.9 ± 0.4	5.7 ± 0.1	4.6 ± 0.2	6.0 ± 0.2	5.4 ± 0.2	6.1 ± 0.3	5.0 ± 0.3	4.6 ± 0.1	3.4 ± 0.2	4.7 ± 0.1	4.4 ± 0.2	7.3 ± 0.3	W Africa M	E Europe M
46	6.0 ± 0.4	5.9 ± 0.1	4.6 ± 0.2	5.6 ± 0.2	5.8 ± 0.2	5.9 ± 0.3	5.0 ± 0.3	4.6 ± 0.1	3.5 ± 0.2	4.7 ± 0.1	4.3 ± 0.2	7.7 ± 0.3	W Africa M	E Europe M
47	5.8 ± 0.4	5.8 ± 0.1	4.6 ± 0.2	5.6 ± 0.2	5.5 ± 0.2	5.9 ± 0.4	5.0 ± 0.3	4.6 ± 0.1	3.4 ± 0.2	4.8 ± 0.2	4.2 ± 0.2	7.3 ± 0.3	W Africa M	E Europe M
48	5.9 ± 0.4	5.9 ± 0.1	4.4 ± 0.2	5.7 ± 0.2	5.5 ± 0.2	5.6 ± 0.4	5.6 ± 0.4	4.6 ± 0.1	3.3 ± 0.2	4.7 ± 0.2	4.4 ± 0.2	7.7 ± 0.4	W Africa M	E Europe M
49	5.8 ± 0.4	6.0 ± 0.1	4.2 ± 0.2	5.6 ± 0.2	5.3 ± 0.2	6.1 ± 0.4	5.3 ± 0.4	4.8 ± 0.1	3.4 ± 0.2	4.7 ± 0.2	4.2 ± 0.2	7.8 ± 0.4	W Africa M	E Europe M
50	6.1 ± 0.6	6.0 ± 0.1	4.3 ± 0.2	5.3 ± 0.2	5.6 ± 0.2	5.8 ± 0.4	5.4 ± 0.4	4.8 ± 0.1	3.3 ± 0.2	4.8 ± 0.2	4.2 ± 0.2	8.0 ± 0.4	W Africa M	E Europe M
51	5.4 ± 0.5	6.0 ± 0.1	4.1 ± 0.2	5.4 ± 0.2	5.6 ± 0.2	6.2 ± 0.4	5.6 ± 0.4	4.9 ± 0.1	3.3 ± 0.2	4.7 ± 0.2	4.4 ± 0.2	8.2 ± 0.4	W Africa M	E Europe M
52	6.2 ± 0.5	6.0 ± 0.2	4.1 ± 0.2	5.5 ± 0.2	5.2 ± 0.2	6.4 ± 0.4	5.1 ± 0.4	5.0 ± 0.1	3.6 ± 0.2	4.8 ± 0.2	4.3 ± 0.2	8.2 ± 0.4	W Africa M	E Europe M

Table 32. *Mean absolute error for Application-type images for algorithm yoti-001. Values closer to zero are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Group	min Group
14	4.0 ± 0.2	2.4 ± 0.1	2.6 ± 0.2	2.9 ± 0.1	2.5 ± 0.3	4.4 ± 0.4	2.4 ± 0.2	1.22 ± 0.08	1.47 ± 0.10	1.56 ± 0.07	1.0 ± 0.1	2.3 ± 0.2	W Africa F	S E Asia M
15	4.1 ± 0.3	2.7 ± 0.2	3.2 ± 0.3	3.4 ± 0.2	3.0 ± 0.3	4.6 ± 0.4	2.4 ± 0.2	1.40 ± 0.08	1.4 ± 0.1	1.7 ± 0.1	1.3 ± 0.1	2.4 ± 0.3	W Africa F	S E Asia M
16	4.3 ± 0.3	3.1 ± 0.2	3.4 ± 0.3	3.9 ± 0.2	3.9 ± 0.4	5.1 ± 0.5	2.5 ± 0.2	1.65 ± 0.08	1.5 ± 0.2	1.8 ± 0.1	1.6 ± 0.2	2.6 ± 0.3	W Africa F	E Europe M
17	4.5 ± 0.4	3.6 ± 0.2	4.1 ± 0.4	4.2 ± 0.2	4.2 ± 0.4	4.9 ± 0.4	2.4 ± 0.2	2.2 ± 0.1	1.4 ± 0.2	2.0 ± 0.1	2.0 ± 0.2	2.9 ± 0.3	W Africa F	E Europe M
18	4.3 ± 0.3	3.8 ± 0.1	4.3 ± 0.3	4.4 ± 0.2	4.6 ± 0.3	5.5 ± 0.4	2.7 ± 0.2	2.50 ± 0.09	2.0 ± 0.2	2.4 ± 0.1	2.6 ± 0.2	2.9 ± 0.2	W Africa F	E Europe M
19	4.7 ± 0.3	4.3 ± 0.1	4.7 ± 0.3	4.7 ± 0.2	5.0 ± 0.2	5.5 ± 0.4	2.8 ± 0.2	2.97 ± 0.10	2.3 ± 0.2	2.8 ± 0.1	2.9 ± 0.2	3.3 ± 0.3	W Africa F	E Europe M
20	4.9 ± 0.3	4.6 ± 0.1	4.7 ± 0.2	4.9 ± 0.2	5.2 ± 0.2	5.4 ± 0.3	3.2 ± 0.2	3.22 ± 0.10	2.6 ± 0.2	3.1 ± 0.1	3.3 ± 0.2	3.6 ± 0.3	W Africa F	E Europe M
21	5.1 ± 0.3	4.7 ± 0.1	4.6 ± 0.2	5.1 ± 0.1	5.4 ± 0.2	5.8 ± 0.3	3.2 ± 0.2	3.34 ± 0.09	2.7 ± 0.2	3.3 ± 0.1	3.5 ± 0.2	3.7 ± 0.3	W Africa F	E Europe M
22	5.2 ± 0.3	4.8 ± 0.1	4.5 ± 0.2	5.0 ± 0.1	5.5 ± 0.2	5.5 ± 0.3	3.9 ± 0.2	3.44 ± 0.10	2.6 ± 0.1	3.3 ± 0.1	3.4 ± 0.1	3.7 ± 0.2	S E Asia F	E Europe M
23	5.2 ± 0.2	4.8 ± 0.1	4.2 ± 0.1	5.1 ± 0.1	5.4 ± 0.2	5.6 ± 0.3	3.9 ± 0.2	3.38 ± 0.10	2.4 ± 0.1	3.4 ± 0.1	3.5 ± 0.1	4.1 ± 0.2	W Africa F	E Europe M
24	5.5 ± 0.3	4.7 ± 0.1	4.0 ± 0.1	5.1 ± 0.1	5.4 ± 0.1	5.5 ± 0.3	3.7 ± 0.2	3.27 ± 0.09	2.28 ± 0.10	3.4 ± 0.1	3.5 ± 0.1	3.7 ± 0.2	W Africa F	E Europe M
25	5.3 ± 0.2	4.7 ± 0.1	3.8 ± 0.1	4.9 ± 0.1	5.4 ± 0.1	5.3 ± 0.3	3.8 ± 0.2	3.17 ± 0.09	2.1 ± 0.1	3.29 ± 0.10	3.5 ± 0.2	3.9 ± 0.2	S E Asia F	E Europe M
26	5.4 ± 0.2	4.68 ± 0.10	3.5 ± 0.1	4.78 ± 0.10	5.4 ± 0.1	5.3 ± 0.2	3.8 ± 0.2	2.93 ± 0.09	1.9 ± 0.1	3.29 ± 0.09	3.4 ± 0.1	3.8 ± 0.2	S E Asia F	E Europe M
27	5.7 ± 0.2	4.67 ± 0.09	3.4 ± 0.1	4.62 ± 0.09	5.1 ± 0.1	5.5 ± 0.2	3.7 ± 0.2	2.94 ± 0.09	1.93 ± 0.09	3.09 ± 0.08	3.5 ± 0.2	3.8 ± 0.2	E Africa F	E Europe M
28	5.4 ± 0.2	4.54 ± 0.09	3.2 ± 0.1	4.63 ± 0.09	5.2 ± 0.1	5.2 ± 0.2	3.5 ± 0.2	3.0 ± 0.1	1.99 ± 0.09	3.14 ± 0.08	3.4 ± 0.2	3.6 ± 0.2	E Africa F	E Europe M
29	5.7 ± 0.2	4.57 ± 0.09	3.2 ± 0.1	4.50 ± 0.09	5.2 ± 0.1	5.4 ± 0.2	3.7 ± 0.2	2.90 ± 0.09	2.00 ± 0.09	3.09 ± 0.07	3.3 ± 0.2	3.9 ± 0.2	E Africa F	E Europe M
30	5.5 ± 0.2	4.59 ± 0.08	3.2 ± 0.1	4.46 ± 0.09	5.2 ± 0.1	5.3 ± 0.2	3.8 ± 0.2	3.06 ± 0.09	2.03 ± 0.09	3.18 ± 0.07	3.5 ± 0.2	3.9 ± 0.2	E Africa F	E Europe M
31	5.5 ± 0.2	4.55 ± 0.08	3.2 ± 0.1	4.34 ± 0.09	5.2 ± 0.1	5.2 ± 0.2	3.8 ± 0.2	3.02 ± 0.09	2.20 ± 0.09	3.16 ± 0.07	3.5 ± 0.2	3.9 ± 0.2	E Africa F	E Europe M
32	5.7 ± 0.2	4.46 ± 0.08	3.2 ± 0.1	4.26 ± 0.08	4.9 ± 0.1	5.5 ± 0.2	3.9 ± 0.2	3.25 ± 0.09	2.32 ± 0.10	3.21 ± 0.06	3.7 ± 0.2	3.9 ± 0.2	E Africa F	E Europe M
33	5.5 ± 0.2	4.40 ± 0.08	3.2 ± 0.1	4.21 ± 0.09	4.9 ± 0.1	5.2 ± 0.2	4.0 ± 0.2	3.33 ± 0.09	2.41 ± 0.10	3.19 ± 0.07	3.4 ± 0.2	4.0 ± 0.1	E Africa F	E Europe M
34	5.5 ± 0.2	4.28 ± 0.08	3.2 ± 0.1	4.00 ± 0.08	4.8 ± 0.1	5.3 ± 0.2	3.9 ± 0.2	3.38 ± 0.09	2.40 ± 0.10	3.26 ± 0.07	3.6 ± 0.2	4.0 ± 0.2	E Africa F	E Europe M
35	5.7 ± 0.2	4.12 ± 0.08	3.2 ± 0.1	3.84 ± 0.08	4.5 ± 0.1	5.0 ± 0.2	4.1 ± 0.2	3.44 ± 0.09	2.4 ± 0.1	3.25 ± 0.07	3.7 ± 0.2	4.0 ± 0.2	E Africa F	E Europe M
36	5.3 ± 0.2	4.00 ± 0.08	3.1 ± 0.1	3.75 ± 0.08	4.4 ± 0.1	5.1 ± 0.2	4.1 ± 0.2	3.43 ± 0.09	2.5 ± 0.1	3.21 ± 0.06	3.8 ± 0.2	4.0 ± 0.2	E Africa F	E Europe M
37	5.3 ± 0.2	3.84 ± 0.07	3.2 ± 0.1	3.75 ± 0.08	4.2 ± 0.1	5.1 ± 0.2	4.1 ± 0.2	3.36 ± 0.09	2.5 ± 0.1	3.23 ± 0.07	3.5 ± 0.2	4.1 ± 0.2	E Africa F	E Europe M
38	5.0 ± 0.2	3.71 ± 0.07	3.0 ± 0.1	3.62 ± 0.09	4.1 ± 0.1	4.9 ± 0.2	3.9 ± 0.2	3.30 ± 0.09	2.5 ± 0.1	3.10 ± 0.07	3.6 ± 0.2	3.9 ± 0.2	E Africa F	E Europe M
39	4.7 ± 0.2	3.54 ± 0.07	3.0 ± 0.1	3.43 ± 0.09	3.9 ± 0.1	4.8 ± 0.2	3.9 ± 0.2	3.24 ± 0.09	2.6 ± 0.1	3.06 ± 0.07	3.6 ± 0.2	3.9 ± 0.2	W Africa F	E Europe M
40	4.5 ± 0.2	3.42 ± 0.07	3.0 ± 0.1	3.30 ± 0.09	3.8 ± 0.1	4.6 ± 0.2	3.8 ± 0.2	3.11 ± 0.08	2.6 ± 0.1	3.09 ± 0.07	3.4 ± 0.2	3.8 ± 0.2	W Africa F	E Europe M
41	4.5 ± 0.3	3.26 ± 0.07	3.0 ± 0.1	3.22 ± 0.10	3.6 ± 0.1	4.5 ± 0.2	3.8 ± 0.2	3.06 ± 0.08	2.5 ± 0.1	2.97 ± 0.07	3.4 ± 0.2	4.0 ± 0.2	W Africa F	E Europe M
42	4.8 ± 0.3	3.24 ± 0.07	3.1 ± 0.1	3.4 ± 0.1	3.3 ± 0.1	4.4 ± 0.2	3.7 ± 0.2	2.97 ± 0.08	2.7 ± 0.1	3.04 ± 0.08	3.3 ± 0.1	3.8 ± 0.2	E Africa F	E Europe M
43	4.5 ± 0.3	3.13 ± 0.07	3.0 ± 0.1	3.2 ± 0.1	3.4 ± 0.1	4.4 ± 0.2	3.8 ± 0.2	2.99 ± 0.08	2.7 ± 0.1	3.03 ± 0.09	3.4 ± 0.2	3.9 ± 0.2	E Africa F	E Europe M
44	4.6 ± 0.3	2.99 ± 0.06	3.0 ± 0.2	3.3 ± 0.1	3.3 ± 0.1	4.4 ± 0.3	3.6 ± 0.2	2.95 ± 0.08	2.9 ± 0.2	3.05 ± 0.09	3.4 ± 0.2	3.7 ± 0.2	E Africa F	E Europe M
45	4.2 ± 0.3	2.97 ± 0.07	2.9 ± 0.1	3.2 ± 0.1	3.2 ± 0.1	4.3 ± 0.2	3.7 ± 0.2	2.84 ± 0.08	2.9 ± 0.2	3.08 ± 0.09	3.2 ± 0.1	3.9 ± 0.2	W Africa F	E Asia M
46	4.3 ± 0.3	2.91 ± 0.06	3.2 ± 0.2	3.2 ± 0.1	3.2 ± 0.1	4.2 ± 0.3	3.6 ± 0.2	2.72 ± 0.07	3.0 ± 0.2	3.05 ± 0.10	3.3 ± 0.2	3.7 ± 0.2	E Africa F	E Asia M
47	4.1 ± 0.3	2.83 ± 0.07	3.3 ± 0.2	3.1 ± 0.1	3.1 ± 0.1	4.3 ± 0.3	3.6 ± 0.2	2.65 ± 0.08	2.9 ± 0.2	3.2 ± 0.1	3.3 ± 0.2	3.9 ± 0.2	W Africa F	E Asia M
48	4.3 ± 0.3	2.69 ± 0.07	3.1 ± 0.1	3.2 ± 0.1	3.0 ± 0.1	4.2 ± 0.3	3.9 ± 0.3	2.54 ± 0.07	3.1 ± 0.2	3.0 ± 0.1	3.0 ± 0.2	3.9 ± 0.2	E Africa F	E Asia M
49	4.1 ± 0.3	2.69 ± 0.07	3.1 ± 0.2	3.1 ± 0.1	3.0 ± 0.1	4.1 ± 0.3	3.7 ± 0.3	2.59 ± 0.08	3.0 ± 0.2	3.0 ± 0.1	3.0 ± 0.2	3.5 ± 0.2	W Africa F	E Asia M
50	4.4 ± 0.4	2.68 ± 0.07	3.1 ± 0.2	3.1 ± 0.1	3.0 ± 0.1	4.2 ± 0.3	3.3 ± 0.3	2.52 ± 0.08	3.0 ± 0.2	3.0 ± 0.1	3.1 ± 0.2	3.6 ± 0.2	E Africa F	E Asia M
51	4.2 ± 0.3	2.65 ± 0.07	3.2 ± 0.2	3.1 ± 0.1	3.0 ± 0.1	4.6 ± 0.3	3.7 ± 0.3	2.43 ± 0.08	3.0 ± 0.2	3.1 ± 0.1	3.0 ± 0.2	3.9 ± 0.2	W Africa F	E Asia M
52	4.4 ± 0.4	2.59 ± 0.07	3.2 ± 0.2	3.3 ± 0.1	3.1 ± 0.1	4.5 ± 0.3	3.5 ± 0.3	2.46 ± 0.08	3.2 ± 0.2	3.0 ± 0.1	3.0 ± 0.2	3.9 ± 0.2	W Africa F	E Asia M

Appendix A.3. Challenge Age

The following pages include two tables for each algorithm, one for *Visa* images and another for lower quality *Border* images. The values are Challenge-25 accept rates - the proportion of people of the given age who are judged to have age 25 or over. For an application with a legal age (LA) of 18, these rates would be properly termed false positive rates (FPR) for everyone below 18, and true positive rates for those 18 or over. The vocabulary would change depending on the LA. For this reason we use the generic term “accept rates”.

Table 33. *For algorithm dermalog-001 with Application images, Challenge-25 accept rate by age, sex and region of birth. The final columns give groups that give the highest and lowest accept rate and the Gini summary of variability. Gini is computed over the 12 accept-rate values to its left; lower values are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Accept	min Accept	Gini
14	0.04 ± 0.02	0.05 ± 0.01	0.08 ± 0.03	0.06 ± 0.01	0.09 ± 0.02	0.02 ± 0.01	0.019 ± 0.010	0.017 ± 0.006	0.016 ± 0.009	0.04 ± 0.01	0.02 ± 0.01	0.02 ± 0.01	S E Asia F	E Europe M	0.38
15	0.08 ± 0.03	0.07 ± 0.01	0.14 ± 0.03	0.13 ± 0.02	0.11 ± 0.03	0.02 ± 0.02	0.01 ± 0.01	0.032 ± 0.010	0.04 ± 0.02	0.05 ± 0.01	0.03 ± 0.01	0.01 ± 0.01	E Europe F	E Africa M	0.43
16	0.10 ± 0.03	0.10 ± 0.02	0.21 ± 0.04	0.16 ± 0.02	0.16 ± 0.04	0.06 ± 0.03	0.05 ± 0.02	0.05 ± 0.01	0.04 ± 0.02	0.10 ± 0.02	0.08 ± 0.03	0.04 ± 0.02	E Europe F	W Africa M	0.32
17	0.13 ± 0.03	0.14 ± 0.02	0.31 ± 0.05	0.24 ± 0.03	0.20 ± 0.04	0.07 ± 0.02	0.10 ± 0.03	0.07 ± 0.01	0.04 ± 0.02	0.12 ± 0.02	0.10 ± 0.03	0.09 ± 0.03	E Europe F	E Europe M	0.33
18	0.13 ± 0.03	0.16 ± 0.02	0.27 ± 0.04	0.25 ± 0.02	0.20 ± 0.03	0.12 ± 0.03	0.13 ± 0.03	0.072 ± 0.010	0.05 ± 0.02	0.18 ± 0.02	0.10 ± 0.02	0.14 ± 0.04	E Europe F	E Europe M	0.26
19	0.23 ± 0.03	0.20 ± 0.02	0.41 ± 0.04	0.34 ± 0.02	0.24 ± 0.03	0.17 ± 0.03	0.26 ± 0.04	0.11 ± 0.01	0.11 ± 0.03	0.27 ± 0.02	0.15 ± 0.02	0.24 ± 0.04	E Europe F	E Asia M	0.23
20	0.28 ± 0.03	0.26 ± 0.02	0.43 ± 0.03	0.39 ± 0.02	0.32 ± 0.03	0.18 ± 0.03	0.34 ± 0.04	0.15 ± 0.02	0.17 ± 0.03	0.38 ± 0.02	0.22 ± 0.03	0.28 ± 0.04	E Europe F	E Asia M	0.19
21	0.31 ± 0.03	0.30 ± 0.02	0.51 ± 0.03	0.49 ± 0.02	0.38 ± 0.02	0.22 ± 0.03	0.40 ± 0.03	0.19 ± 0.02	0.20 ± 0.03	0.46 ± 0.02	0.29 ± 0.03	0.39 ± 0.04	E Europe F	E Asia M	0.19
22	0.38 ± 0.03	0.35 ± 0.02	0.59 ± 0.03	0.56 ± 0.02	0.42 ± 0.02	0.27 ± 0.03	0.55 ± 0.04	0.26 ± 0.02	0.33 ± 0.04	0.58 ± 0.02	0.35 ± 0.03	0.49 ± 0.04	E Europe F	E Asia M	0.17
23	0.42 ± 0.03	0.42 ± 0.02	0.67 ± 0.02	0.63 ± 0.02	0.50 ± 0.02	0.30 ± 0.03	0.61 ± 0.03	0.32 ± 0.02	0.40 ± 0.03	0.66 ± 0.02	0.42 ± 0.03	0.59 ± 0.03	E Europe F	W Africa F	0.15
24	0.48 ± 0.03	0.48 ± 0.02	0.73 ± 0.02	0.69 ± 0.02	0.57 ± 0.02	0.33 ± 0.03	0.70 ± 0.03	0.42 ± 0.02	0.50 ± 0.03	0.74 ± 0.02	0.49 ± 0.03	0.66 ± 0.03	S Asia M	W Africa F	0.14
25	0.49 ± 0.03	0.55 ± 0.01	0.77 ± 0.02	0.75 ± 0.01	0.61 ± 0.02	0.38 ± 0.03	0.77 ± 0.03	0.46 ± 0.02	0.58 ± 0.03	0.80 ± 0.01	0.62 ± 0.03	0.69 ± 0.03	S Asia M	W Africa F	0.13
26	0.57 ± 0.03	0.62 ± 0.01	0.81 ± 0.01	0.78 ± 0.01	0.69 ± 0.02	0.45 ± 0.03	0.81 ± 0.02	0.58 ± 0.02	0.67 ± 0.02	0.85 ± 0.01	0.67 ± 0.03	0.75 ± 0.03	S Asia M	W Africa F	0.10
27	0.60 ± 0.03	0.69 ± 0.01	0.87 ± 0.01	0.817 ± 0.009	0.73 ± 0.02	0.49 ± 0.02	0.85 ± 0.02	0.66 ± 0.02	0.80 ± 0.02	0.88 ± 0.01	0.75 ± 0.02	0.80 ± 0.02	S Asia M	W Africa F	0.09
28	0.67 ± 0.02	0.72 ± 0.01	0.90 ± 0.01	0.855 ± 0.009	0.78 ± 0.01	0.54 ± 0.03	0.89 ± 0.02	0.73 ± 0.02	0.84 ± 0.02	0.919 ± 0.009	0.82 ± 0.02	0.85 ± 0.02	S Asia M	W Africa F	0.08
29	0.70 ± 0.02	0.790 ± 0.010	0.92 ± 0.01	0.884 ± 0.008	0.83 ± 0.01	0.61 ± 0.03	0.91 ± 0.02	0.80 ± 0.01	0.85 ± 0.02	0.944 ± 0.006	0.85 ± 0.02	0.87 ± 0.02	S Asia M	W Africa F	0.07
30	0.74 ± 0.02	0.833 ± 0.010	0.93 ± 0.01	0.912 ± 0.007	0.86 ± 0.01	0.65 ± 0.03	0.95 ± 0.01	0.84 ± 0.01	0.92 ± 0.01	0.955 ± 0.005	0.89 ± 0.02	0.90 ± 0.01	S Asia M	W Africa F	0.06
31	0.76 ± 0.02	0.873 ± 0.008	0.950 ± 0.009	0.923 ± 0.007	0.89 ± 0.01	0.69 ± 0.02	0.95 ± 0.01	0.90 ± 0.01	0.93 ± 0.01	0.967 ± 0.005	0.92 ± 0.02	0.93 ± 0.01	S Asia M	W Africa F	0.05
32	0.80 ± 0.02	0.903 ± 0.007	0.970 ± 0.007	0.941 ± 0.006	0.92 ± 0.01	0.74 ± 0.02	0.95 ± 0.01	0.92 ± 0.01	0.96 ± 0.01	0.977 ± 0.004	0.94 ± 0.01	0.94 ± 0.01	S Asia M	W Africa F	0.04
33	0.81 ± 0.02	0.928 ± 0.007	0.978 ± 0.006	0.957 ± 0.006	0.93 ± 0.01	0.78 ± 0.02	0.968 ± 0.010	0.943 ± 0.008	0.978 ± 0.008	0.982 ± 0.003	0.96 ± 0.01	0.961 ± 0.010	S Asia M	W Africa F	0.04
34	0.86 ± 0.02	0.949 ± 0.006	0.981 ± 0.006	0.967 ± 0.005	0.952 ± 0.009	0.81 ± 0.02	0.979 ± 0.009	0.955 ± 0.007	0.981 ± 0.008	0.986 ± 0.003	0.97 ± 0.01	0.969 ± 0.008	S Asia M	W Africa F	0.03

Table 34. *For algorithm dermalog-001 with Border images, Challenge-25 accept rate by age, sex and region of birth. The final columns give groups that give the highest and lowest accept rate and the Gini summary of variability. Gini is computed over the 12 accept-rate values to its left; lower values are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Accept	min Accept	Gini
14	0.21 ± 0.06	0.16 ± 0.02	0.15 ± 0.03	0.21 ± 0.03	0.19 ± 0.03	0.13 ± 0.05	0.15 ± 0.06	0.064 ± 0.010	0.06 ± 0.02	0.10 ± 0.02	0.07 ± 0.02	0.15 ± 0.06	E Africa F	E Europe M	0.24
15	0.24 ± 0.06	0.20 ± 0.02	0.22 ± 0.04	0.32 ± 0.03	0.22 ± 0.04	0.24 ± 0.06	0.26 ± 0.07	0.10 ± 0.01	0.08 ± 0.02	0.16 ± 0.02	0.10 ± 0.02	0.21 ± 0.06	S Asia F	E Europe M	0.21
16	0.35 ± 0.06	0.27 ± 0.02	0.27 ± 0.03	0.38 ± 0.03	0.34 ± 0.04	0.23 ± 0.06	0.30 ± 0.06	0.15 ± 0.01	0.10 ± 0.02	0.22 ± 0.02	0.15 ± 0.03	0.31 ± 0.06	S Asia F	E Europe M	0.20
17	0.37 ± 0.06	0.34 ± 0.01	0.34 ± 0.03	0.44 ± 0.02	0.37 ± 0.03	0.31 ± 0.05	0.43 ± 0.07	0.22 ± 0.01	0.12 ± 0.03	0.35 ± 0.02	0.22 ± 0.03	0.46 ± 0.06	W Africa M	E Europe M	0.17
18	0.43 ± 0.05	0.42 ± 0.01	0.44 ± 0.03	0.52 ± 0.02	0.45 ± 0.02	0.35 ± 0.05	0.54 ± 0.06	0.30 ± 0.01	0.23 ± 0.03	0.45 ± 0.02	0.32 ± 0.03	0.55 ± 0.05	W Africa M	E Europe M	0.14
19	0.50 ± 0.05	0.49 ± 0.01	0.51 ± 0.02	0.60 ± 0.02	0.50 ± 0.03	0.43 ± 0.04	0.63 ± 0.05	0.38 ± 0.01	0.30 ± 0.03	0.56 ± 0.02	0.38 ± 0.03	0.60 ± 0.04	E Africa M	E Europe M	0.12
20	0.58 ± 0.04	0.57 ± 0.01	0.55 ± 0.02	0.66 ± 0.02	0.58 ± 0.02	0.50 ± 0.04	0.73 ± 0.04	0.47 ± 0.01	0.36 ± 0.03	0.68 ± 0.02	0.49 ± 0.02	0.71 ± 0.04	E Africa M	E Europe M	0.11
21	0.66 ± 0.04	0.63 ± 0.01	0.61 ± 0.02	0.71 ± 0.01	0.62 ± 0.02	0.57 ± 0.04	0.80 ± 0.03	0.56 ± 0.01	0.47 ± 0.03	0.76 ± 0.01	0.60 ± 0.02	0.76 ± 0.03	E Africa M	E Europe M	0.09
22	0.66 ± 0.03	0.689 ± 0.010	0.66 ± 0.02	0.77 ± 0.01	0.69 ± 0.02	0.63 ± 0.03	0.86 ± 0.03	0.64 ± 0.01	0.56 ± 0.03	0.82 ± 0.01	0.67 ± 0.03	0.82 ± 0.03	E Africa M	E Europe M	0.07
23	0.73 ± 0.03	0.738 ± 0.008	0.72 ± 0.01	0.811 ± 0.010	0.75 ± 0.01	0.65 ± 0.03	0.91 ± 0.02	0.72 ± 0.01	0.66 ± 0.02	0.866 ± 0.010	0.72 ± 0.02	0.88 ± 0.02	E Africa M	W Africa F	0.06
24	0.78 ± 0.03	0.780 ± 0.007	0.76 ± 0.01	0.845 ± 0.008	0.80 ± 0.01	0.71 ± 0.03	0.91 ± 0.02	0.773 ± 0.009	0.74 ± 0.02	0.909 ± 0.008	0.78 ± 0.02	0.90 ± 0.02	E Africa M	W Africa F	0.05
25	0.79 ± 0.02	0.829 ± 0.006	0.81 ± 0.01	0.863 ± 0.007	0.84 ± 0.01	0.77 ± 0.02	0.94 ± 0.02	0.842 ± 0.009	0.80 ± 0.02	0.934 ± 0.006	0.84 ± 0.02	0.95 ± 0.01	W Africa M	W Africa F	0.04
26	0.83 ± 0.02	0.864 ± 0.005	0.834 ± 0.009	0.883 ± 0.006	0.87 ± 0.01	0.80 ± 0.02	0.96 ± 0.01	0.874 ± 0.007	0.85 ± 0.01	0.947 ± 0.004	0.88 ± 0.02	0.95 ± 0.01	E Africa M	W Africa F	0.03
27	0.85 ± 0.02	0.888 ± 0.004	0.868 ± 0.008	0.904 ± 0.005	0.897 ± 0.010	0.83 ± 0.02	0.974 ± 0.010	0.901 ± 0.006	0.90 ± 0.01	0.963 ± 0.004	0.91 ± 0.01	0.966 ± 0.009	E Africa M	W Africa F	0.03
28	0.88 ± 0.02	0.915 ± 0.004	0.907 ± 0.007	0.921 ± 0.004	0.914 ± 0.009	0.83 ± 0.02	0.984 ± 0.008	0.928 ± 0.006	0.935 ± 0.008	0.973 ± 0.003	0.94 ± 0.01	0.974 ± 0.007	E Africa M	W Africa F	0.03
29	0.91 ± 0.02	0.932 ± 0.004	0.925 ± 0.006	0.932 ± 0.004	0.932 ± 0.008	0.88 ± 0.01	0.990 ± 0.006	0.951 ± 0.005	0.946 ± 0.007	0.979 ± 0.003	0.94 ± 0.01	0.981 ± 0.005	E Africa M	W Africa F	0.02
30	0.91 ± 0.02	0.951 ± 0.003	0.939 ± 0.005	0.946 ± 0.004	0.949 ± 0.007	0.90 ± 0.01	0.993 ± 0.005	0.964 ± 0.004	0.963 ± 0.006	0.983 ± 0.002	0.962 ± 0.009	0.984 ± 0.005	E Africa M	W Africa F	0.02
31	0.94 ± 0.01	0.963 ± 0.003	0.959 ± 0.005	0.959 ± 0.003	0.959 ± 0.006	0.92 ± 0.01	0.996 ± 0.004	0.975 ± 0.003	0.975 ± 0.005	0.987 ± 0.002	0.974 ± 0.008	0.991 ± 0.004	E Africa M	W Africa F	0.01
32	0.94 ± 0.01	0.971 ± 0.002	0.975 ± 0.004	0.966 ± 0.003	0.963 ± 0.006	0.93 ± 0.01	0.992 ± 0.005	0.982 ± 0.003	0.985 ± 0.004	0.990 ± 0.002	0.980 ± 0.006	0.992 ± 0.004	W Africa M	W Africa F	0.01
33	0.95 ± 0.01	0.979 ± 0.002	0.978 ± 0.004	0.972 ± 0.003	0.969 ± 0.005	0.96 ± 0.01	0.998 ± 0.003	0.986 ± 0.002	0.989 ± 0.003	0.992 ± 0.001	0.984 ± 0.006	0.995 ± 0.003	E Africa M	E Africa F	0.01
34	0.96 ± 0.01	0.984 ± 0.002	0.982 ± 0.004	0.981 ± 0.002	0.982 ± 0.004	0.968 ± 0.008	0.998 ± 0.003	0.990 ± 0.002	0.993 ± 0.002	0.994 ± 0.001	0.991 ± 0.004	0.994 ± 0.003	E Africa M	E Africa F	0.01

Table 35. *For algorithm incode-000 with Application images, Challenge-25 accept rate by age, sex and region of birth. The final columns give groups that give the highest and lowest accept rate and the Gini summary of variability. Gini is computed over the 12 accept-rate values to its left; lower values are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Accept	min Accept	Gini
14	0.02 ± 0.01	0.007 ± 0.004	0.02 ± 0.01	0.008 ± 0.005	0.013 ± 0.009	0.008 ± 0.008	0.010 ± 0.008	0.002 ± 0.002	0.002 ± 0.002	0.003 ± 0.002	0.000 ± 0.000	0.004 ± 0.004	E Africa F	S E Asia M	0.47
15	0.03 ± 0.01	0.010 ± 0.005	0.02 ± 0.01	0.018 ± 0.009	0.02 ± 0.01	0.02 ± 0.02	0.008 ± 0.008	0.001 ± 0.001	0.000 ± 0.000	0.004 ± 0.003	0.000 ± 0.000	0.01 ± 0.01	E Africa F	E Europe M	0.47
16	0.08 ± 0.03	0.026 ± 0.009	0.04 ± 0.02	0.03 ± 0.01	0.05 ± 0.02	0.09 ± 0.03	0.03 ± 0.02	0.002 ± 0.002	0.006 ± 0.006	0.004 ± 0.003	0.006 ± 0.006	0.01 ± 0.01	W Africa F	E Asia M	0.52
17	0.11 ± 0.03	0.05 ± 0.01	0.07 ± 0.03	0.06 ± 0.02	0.06 ± 0.02	0.11 ± 0.03	0.02 ± 0.01	0.006 ± 0.004	0.003 ± 0.003	0.017 ± 0.007	0.01 ± 0.01	0.05 ± 0.02	E Africa F	E Europe M	0.46
18	0.15 ± 0.03	0.07 ± 0.01	0.08 ± 0.02	0.08 ± 0.01	0.09 ± 0.02	0.13 ± 0.03	0.04 ± 0.01	0.013 ± 0.004	0.013 ± 0.007	0.023 ± 0.006	0.015 ± 0.008	0.06 ± 0.02	E Africa F	E Europe M	0.42
19	0.24 ± 0.03	0.11 ± 0.01	0.14 ± 0.03	0.13 ± 0.01	0.14 ± 0.02	0.19 ± 0.04	0.12 ± 0.03	0.032 ± 0.007	0.03 ± 0.01	0.06 ± 0.01	0.03 ± 0.01	0.11 ± 0.03	E Africa F	E Europe M	0.34
20	0.30 ± 0.03	0.17 ± 0.02	0.22 ± 0.03	0.20 ± 0.02	0.22 ± 0.02	0.26 ± 0.04	0.20 ± 0.03	0.044 ± 0.009	0.07 ± 0.02	0.13 ± 0.02	0.09 ± 0.02	0.17 ± 0.03	E Africa F	E Asia M	0.27
21	0.39 ± 0.04	0.24 ± 0.02	0.29 ± 0.03	0.26 ± 0.02	0.31 ± 0.02	0.36 ± 0.04	0.30 ± 0.03	0.10 ± 0.01	0.12 ± 0.02	0.20 ± 0.02	0.16 ± 0.02	0.24 ± 0.04	E Africa F	E Asia M	0.22
22	0.47 ± 0.03	0.32 ± 0.02	0.40 ± 0.03	0.34 ± 0.02	0.38 ± 0.02	0.39 ± 0.04	0.46 ± 0.04	0.18 ± 0.01	0.23 ± 0.03	0.31 ± 0.02	0.21 ± 0.03	0.31 ± 0.04	E Africa F	E Asia M	0.17
23	0.56 ± 0.03	0.41 ± 0.02	0.50 ± 0.03	0.45 ± 0.02	0.49 ± 0.02	0.50 ± 0.03	0.51 ± 0.04	0.28 ± 0.02	0.34 ± 0.03	0.45 ± 0.02	0.35 ± 0.03	0.46 ± 0.03	E Africa F	E Asia M	0.11
24	0.63 ± 0.03	0.49 ± 0.02	0.61 ± 0.02	0.54 ± 0.02	0.57 ± 0.02	0.54 ± 0.03	0.64 ± 0.03	0.38 ± 0.02	0.50 ± 0.03	0.59 ± 0.02	0.46 ± 0.03	0.53 ± 0.03	E Africa M	E Asia M	0.08
25	0.69 ± 0.03	0.60 ± 0.02	0.70 ± 0.02	0.61 ± 0.01	0.67 ± 0.02	0.64 ± 0.03	0.74 ± 0.03	0.52 ± 0.02	0.65 ± 0.03	0.71 ± 0.02	0.61 ± 0.03	0.62 ± 0.03	E Africa M	E Asia M	0.05
26	0.77 ± 0.02	0.68 ± 0.01	0.79 ± 0.02	0.69 ± 0.01	0.75 ± 0.02	0.71 ± 0.03	0.80 ± 0.02	0.64 ± 0.02	0.75 ± 0.02	0.79 ± 0.01	0.72 ± 0.02	0.70 ± 0.03	E Africa M	E Asia M	0.04
27	0.81 ± 0.02	0.75 ± 0.01	0.85 ± 0.01	0.75 ± 0.01	0.82 ± 0.01	0.77 ± 0.02	0.86 ± 0.02	0.74 ± 0.02	0.86 ± 0.02	0.85 ± 0.01	0.81 ± 0.02	0.76 ± 0.02	E Africa M	E Asia M	0.04
28	0.85 ± 0.02	0.81 ± 0.01	0.91 ± 0.01	0.81 ± 0.01	0.86 ± 0.01	0.83 ± 0.02	0.90 ± 0.02	0.82 ± 0.01	0.91 ± 0.01	0.902 ± 0.009	0.87 ± 0.02	0.83 ± 0.02	E Europe F	S Asia F	0.03
29	0.90 ± 0.02	0.866 ± 0.009	0.946 ± 0.009	0.853 ± 0.008	0.91 ± 0.01	0.85 ± 0.02	0.94 ± 0.01	0.88 ± 0.01	0.95 ± 0.01	0.934 ± 0.006	0.91 ± 0.02	0.89 ± 0.02	E Europe M	S Asia F	0.02
30	0.92 ± 0.02	0.911 ± 0.007	0.963 ± 0.008	0.895 ± 0.008	0.942 ± 0.010	0.87 ± 0.02	0.95 ± 0.01	0.919 ± 0.010	0.973 ± 0.009	0.955 ± 0.005	0.96 ± 0.01	0.92 ± 0.01	E Europe M	W Africa F	0.02
31	0.93 ± 0.01	0.940 ± 0.006	0.984 ± 0.005	0.926 ± 0.007	0.962 ± 0.007	0.92 ± 0.01	0.968 ± 0.009	0.955 ± 0.007	0.984 ± 0.007	0.966 ± 0.004	0.96 ± 0.01	0.95 ± 0.01	E Europe F	W Africa F	0.01
32	0.96 ± 0.01	0.958 ± 0.005	0.990 ± 0.005	0.939 ± 0.006	0.971 ± 0.008	0.94 ± 0.01	0.976 ± 0.009	0.968 ± 0.006	0.994 ± 0.004	0.978 ± 0.004	0.986 ± 0.007	0.96 ± 0.01	E Europe M	W Africa F	0.01
33	0.974 ± 0.009	0.971 ± 0.005	0.993 ± 0.004	0.966 ± 0.005	0.984 ± 0.005	0.95 ± 0.01	0.989 ± 0.006	0.981 ± 0.005	0.997 ± 0.003	0.989 ± 0.003	0.991 ± 0.006	0.973 ± 0.008	E Europe M	W Africa F	0.01
34	0.97 ± 0.01	0.985 ± 0.003	0.996 ± 0.003	0.980 ± 0.004	0.990 ± 0.005	0.96 ± 0.01	0.993 ± 0.005	0.988 ± 0.004	0.997 ± 0.003	0.992 ± 0.002	0.992 ± 0.006	0.987 ± 0.006	E Europe M	W Africa F	0.01

Table 36. *For algorithm incode-000 with Border images, Challenge-25 accept rate by age, sex and region of birth. The final columns give groups that give the highest and lowest accept rate and the Gini summary of variability. Gini is computed over the 12 accept-rate values to its left; lower values are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Accept	min Accept	Gini
14	0.33 ± 0.07	0.06 ± 0.01	0.22 ± 0.04	0.20 ± 0.02	0.06 ± 0.02	0.20 ± 0.06	0.27 ± 0.07	0.012 ± 0.004	0.06 ± 0.02	0.05 ± 0.01	0.02 ± 0.01	0.22 ± 0.06	E Africa F	E Asia M	0.44
15	0.33 ± 0.07	0.063 ± 0.009	0.27 ± 0.04	0.25 ± 0.03	0.10 ± 0.02	0.34 ± 0.06	0.37 ± 0.07	0.017 ± 0.005	0.06 ± 0.02	0.06 ± 0.01	0.02 ± 0.01	0.23 ± 0.06	E Africa M	E Asia M	0.45
16	0.43 ± 0.06	0.080 ± 0.009	0.32 ± 0.04	0.30 ± 0.03	0.13 ± 0.02	0.35 ± 0.06	0.34 ± 0.07	0.024 ± 0.005	0.11 ± 0.02	0.08 ± 0.01	0.03 ± 0.01	0.20 ± 0.05	E Africa F	E Asia M	0.42
17	0.48 ± 0.06	0.12 ± 0.01	0.40 ± 0.03	0.33 ± 0.02	0.14 ± 0.02	0.42 ± 0.06	0.43 ± 0.07	0.038 ± 0.006	0.12 ± 0.03	0.15 ± 0.02	0.05 ± 0.02	0.36 ± 0.06	E Africa F	E Asia M	0.38
18	0.55 ± 0.05	0.139 ± 0.009	0.45 ± 0.03	0.36 ± 0.02	0.20 ± 0.02	0.42 ± 0.05	0.46 ± 0.06	0.053 ± 0.006	0.19 ± 0.03	0.20 ± 0.02	0.07 ± 0.02	0.36 ± 0.05	E Africa F	E Asia M	0.34
19	0.58 ± 0.05	0.179 ± 0.009	0.50 ± 0.02	0.42 ± 0.02	0.23 ± 0.02	0.53 ± 0.05	0.52 ± 0.05	0.077 ± 0.007	0.24 ± 0.03	0.28 ± 0.02	0.13 ± 0.02	0.45 ± 0.05	E Africa F	E Asia M	0.30
20	0.65 ± 0.04	0.224 ± 0.009	0.56 ± 0.02	0.49 ± 0.02	0.29 ± 0.02	0.57 ± 0.04	0.60 ± 0.05	0.111 ± 0.008	0.35 ± 0.03	0.40 ± 0.02	0.16 ± 0.02	0.50 ± 0.04	E Africa F	E Asia M	0.26
21	0.69 ± 0.04	0.262 ± 0.009	0.62 ± 0.02	0.55 ± 0.02	0.37 ± 0.02	0.64 ± 0.03	0.69 ± 0.04	0.160 ± 0.009	0.44 ± 0.03	0.50 ± 0.02	0.23 ± 0.02	0.60 ± 0.04	E Africa M	E Asia M	0.23
22	0.78 ± 0.03	0.319 ± 0.009	0.68 ± 0.02	0.60 ± 0.01	0.41 ± 0.02	0.70 ± 0.03	0.76 ± 0.04	0.222 ± 0.009	0.56 ± 0.03	0.59 ± 0.02	0.34 ± 0.02	0.65 ± 0.03	E Africa F	E Asia M	0.20
23	0.79 ± 0.03	0.370 ± 0.009	0.74 ± 0.01	0.66 ± 0.01	0.52 ± 0.02	0.73 ± 0.03	0.82 ± 0.03	0.30 ± 0.01	0.67 ± 0.02	0.67 ± 0.01	0.42 ± 0.03	0.71 ± 0.03	E Africa M	E Asia M	0.16
24	0.84 ± 0.02	0.436 ± 0.009	0.80 ± 0.01	0.71 ± 0.01	0.56 ± 0.02	0.77 ± 0.02	0.86 ± 0.03	0.38 ± 0.01	0.75 ± 0.02	0.76 ± 0.01	0.49 ± 0.02	0.76 ± 0.03	E Africa M	E Asia M	0.14
25	0.83 ± 0.02	0.502 ± 0.009	0.849 ± 0.009	0.747 ± 0.008	0.64 ± 0.02	0.82 ± 0.02	0.89 ± 0.02	0.46 ± 0.01	0.82 ± 0.02	0.815 ± 0.010	0.59 ± 0.02	0.83 ± 0.02	E Africa M	E Asia M	0.11
26	0.89 ± 0.02	0.561 ± 0.007	0.874 ± 0.008	0.795 ± 0.008	0.69 ± 0.01	0.84 ± 0.02	0.92 ± 0.02	0.55 ± 0.01	0.88 ± 0.01	0.852 ± 0.008	0.67 ± 0.02	0.86 ± 0.02	E Africa M	E Asia M	0.09
27	0.90 ± 0.02	0.622 ± 0.007	0.906 ± 0.007	0.828 ± 0.007	0.75 ± 0.01	0.87 ± 0.02	0.95 ± 0.01	0.61 ± 0.01	0.91 ± 0.01	0.887 ± 0.007	0.76 ± 0.02	0.89 ± 0.01	E Africa M	E Asia M	0.08
28	0.93 ± 0.01	0.688 ± 0.007	0.935 ± 0.006	0.858 ± 0.006	0.80 ± 0.01	0.88 ± 0.02	0.96 ± 0.01	0.698 ± 0.010	0.947 ± 0.008	0.920 ± 0.005	0.81 ± 0.02	0.92 ± 0.01	E Africa M	E Asia F	0.06
29	0.94 ± 0.01	0.737 ± 0.006	0.954 ± 0.005	0.886 ± 0.005	0.83 ± 0.01	0.91 ± 0.01	0.979 ± 0.008	0.767 ± 0.008	0.953 ± 0.007	0.940 ± 0.004	0.87 ± 0.02	0.94 ± 0.01	E Africa M	E Asia F	0.05
30	0.94 ± 0.01	0.787 ± 0.006	0.970 ± 0.004	0.907 ± 0.004	0.88 ± 0.01	0.93 ± 0.01	0.979 ± 0.009	0.821 ± 0.008	0.975 ± 0.005	0.957 ± 0.003	0.89 ± 0.01	0.957 ± 0.008	E Africa M	E Asia F	0.04
31	0.97 ± 0.01	0.829 ± 0.006	0.978 ± 0.004	0.929 ± 0.004	0.905 ± 0.009	0.95 ± 0.01	0.983 ± 0.007	0.867 ± 0.007	0.987 ± 0.004	0.969 ± 0.003	0.91 ± 0.01	0.960 ± 0.008	E Europe M	E Asia F	0.03
32	0.976 ± 0.009	0.867 ± 0.005	0.986 ± 0.003	0.947 ± 0.004	0.929 ± 0.007	0.957 ± 0.010	0.991 ± 0.005	0.901 ± 0.006	0.992 ± 0.003	0.977 ± 0.002	0.94 ± 0.01	0.970 ± 0.006	E Europe M	E Asia F	0.02
33	0.978 ± 0.009	0.896 ± 0.004	0.989 ± 0.003	0.956 ± 0.004	0.934 ± 0.008	0.966 ± 0.009	0.991 ± 0.005	0.926 ± 0.005	0.992 ± 0.002	0.983 ± 0.002	0.95 ± 0.01	0.980 ± 0.006	E Europe M	E Asia F	0.02
34	0.980 ± 0.009	0.918 ± 0.004	0.991 ± 0.002	0.973 ± 0.003	0.958 ± 0.007	0.979 ± 0.008	0.993 ± 0.005	0.943 ± 0.005	0.997 ± 0.002	0.988 ± 0.002	0.971 ± 0.007	0.983 ± 0.005	E Europe M	E Asia F	0.01

__Table 37.__ For algorithm neurotechnology-000 with Application images, Challenge-25 accept rate by age, sex and region of birth. The final columns give groups that give the highest and lowest accept rate and the Gini summary of variability. Gini is computed over the 12 accept-rate values to its left; lower values are better.

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Accept	min Accept	Gini
14	0.21 ± 0.04	0.12 ± 0.01	0.03 ± 0.02	0.040 ± 0.009	0.06 ± 0.02	0.53 ± 0.06	0.42 ± 0.04	0.16 ± 0.02	0.013 ± 0.009	0.05 ± 0.01	0.12 ± 0.03	0.65 ± 0.06	W Africa M	E Europe M	0.57
15	0.20 ± 0.04	0.19 ± 0.02	0.04 ± 0.02	0.07 ± 0.02	0.12 ± 0.03	0.49 ± 0.06	0.49 ± 0.05	0.22 ± 0.02	0.02 ± 0.01	0.10 ± 0.02	0.16 ± 0.04	0.67 ± 0.07	W Africa M	E Europe M	0.49
16	0.31 ± 0.05	0.20 ± 0.02	0.08 ± 0.03	0.10 ± 0.02	0.16 ± 0.04	0.59 ± 0.06	0.66 ± 0.05	0.29 ± 0.02	0.03 ± 0.01	0.14 ± 0.02	0.19 ± 0.04	0.76 ± 0.06	W Africa M	E Europe M	0.47
17	0.39 ± 0.05	0.24 ± 0.02	0.12 ± 0.03	0.13 ± 0.02	0.21 ± 0.04	0.64 ± 0.05	0.76 ± 0.05	0.36 ± 0.02	0.06 ± 0.02	0.20 ± 0.02	0.28 ± 0.05	0.84 ± 0.04	W Africa M	E Europe M	0.41
18	0.40 ± 0.04	0.26 ± 0.02	0.13 ± 0.03	0.14 ± 0.02	0.23 ± 0.03	0.66 ± 0.04	0.77 ± 0.04	0.41 ± 0.02	0.10 ± 0.02	0.27 ± 0.02	0.34 ± 0.04	0.85 ± 0.03	W Africa M	E Europe M	0.38
19	0.43 ± 0.04	0.28 ± 0.02	0.16 ± 0.03	0.18 ± 0.02	0.23 ± 0.03	0.74 ± 0.04	0.86 ± 0.03	0.46 ± 0.02	0.11 ± 0.03	0.36 ± 0.02	0.37 ± 0.04	0.91 ± 0.03	W Africa M	E Europe M	0.37
20	0.47 ± 0.04	0.30 ± 0.02	0.20 ± 0.03	0.22 ± 0.02	0.26 ± 0.02	0.75 ± 0.03	0.88 ± 0.03	0.51 ± 0.02	0.19 ± 0.03	0.44 ± 0.02	0.42 ± 0.03	0.95 ± 0.02	W Africa M	E Europe M	0.33
21	0.51 ± 0.04	0.33 ± 0.02	0.26 ± 0.03	0.26 ± 0.02	0.31 ± 0.02	0.79 ± 0.03	0.91 ± 0.02	0.55 ± 0.02	0.28 ± 0.04	0.51 ± 0.02	0.49 ± 0.03	0.95 ± 0.02	W Africa M	S Asia F	0.28
22	0.59 ± 0.03	0.35 ± 0.02	0.32 ± 0.03	0.28 ± 0.02	0.31 ± 0.02	0.83 ± 0.03	0.94 ± 0.02	0.59 ± 0.02	0.38 ± 0.04	0.58 ± 0.02	0.54 ± 0.03	0.96 ± 0.01	W Africa M	S Asia F	0.25
23	0.61 ± 0.03	0.40 ± 0.02	0.38 ± 0.02	0.34 ± 0.02	0.38 ± 0.02	0.84 ± 0.02	0.94 ± 0.02	0.66 ± 0.02	0.41 ± 0.03	0.64 ± 0.02	0.59 ± 0.03	0.98 ± 0.01	W Africa M	S Asia F	0.22
24	0.63 ± 0.03	0.42 ± 0.02	0.44 ± 0.02	0.38 ± 0.02	0.42 ± 0.02	0.86 ± 0.02	0.96 ± 0.01	0.69 ± 0.02	0.52 ± 0.03	0.71 ± 0.02	0.65 ± 0.03	0.987 ± 0.008	W Africa M	S Asia F	0.19
25	0.66 ± 0.03	0.47 ± 0.02	0.51 ± 0.02	0.42 ± 0.01	0.45 ± 0.02	0.85 ± 0.02	0.97 ± 0.01	0.73 ± 0.02	0.61 ± 0.03	0.76 ± 0.02	0.68 ± 0.02	0.986 ± 0.008	W Africa M	S Asia F	0.17
26	0.69 ± 0.03	0.50 ± 0.01	0.57 ± 0.02	0.45 ± 0.01	0.51 ± 0.02	0.89 ± 0.02	0.977 ± 0.009	0.78 ± 0.02	0.68 ± 0.03	0.79 ± 0.01	0.74 ± 0.02	0.991 ± 0.006	W Africa M	S Asia F	0.15
27	0.75 ± 0.02	0.53 ± 0.01	0.62 ± 0.02	0.48 ± 0.01	0.56 ± 0.02	0.91 ± 0.02	0.984 ± 0.007	0.81 ± 0.01	0.75 ± 0.02	0.82 ± 0.01	0.79 ± 0.02	0.990 ± 0.006	W Africa M	S Asia F	0.13
28	0.75 ± 0.02	0.59 ± 0.01	0.68 ± 0.02	0.52 ± 0.01	0.60 ± 0.02	0.92 ± 0.02	0.986 ± 0.007	0.85 ± 0.01	0.82 ± 0.02	0.83 ± 0.01	0.82 ± 0.02	0.991 ± 0.005	W Africa M	S Asia F	0.12
29	0.80 ± 0.02	0.63 ± 0.01	0.73 ± 0.02	0.56 ± 0.01	0.64 ± 0.02	0.93 ± 0.01	0.989 ± 0.006	0.90 ± 0.01	0.84 ± 0.02	0.857 ± 0.009	0.87 ± 0.02	0.997 ± 0.003	W Africa M	S Asia F	0.10
30	0.82 ± 0.02	0.68 ± 0.01	0.77 ± 0.02	0.59 ± 0.01	0.69 ± 0.02	0.93 ± 0.01	0.994 ± 0.004	0.924 ± 0.010	0.90 ± 0.01	0.878 ± 0.009	0.89 ± 0.02	0.996 ± 0.003	W Africa M	S Asia F	0.09
31	0.84 ± 0.02	0.71 ± 0.01	0.81 ± 0.02	0.63 ± 0.01	0.73 ± 0.02	0.95 ± 0.01	0.996 ± 0.004	0.937 ± 0.008	0.91 ± 0.01	0.899 ± 0.007	0.91 ± 0.02	0.995 ± 0.003	E Africa M	S Asia F	0.08
32	0.89 ± 0.02	0.76 ± 0.01	0.85 ± 0.01	0.66 ± 0.01	0.76 ± 0.02	0.94 ± 0.01	0.993 ± 0.004	0.947 ± 0.008	0.93 ± 0.01	0.917 ± 0.007	0.92 ± 0.02	0.999 ± 0.002	W Africa M	S Asia F	0.07
33	0.88 ± 0.02	0.78 ± 0.01	0.87 ± 0.01	0.69 ± 0.01	0.79 ± 0.02	0.95 ± 0.01	0.993 ± 0.005	0.964 ± 0.006	0.968 ± 0.010	0.936 ± 0.007	0.95 ± 0.01	0.999 ± 0.001	W Africa M	S Asia F	0.06
34	0.90 ± 0.02	0.827 ± 0.009	0.89 ± 0.01	0.73 ± 0.01	0.83 ± 0.02	0.96 ± 0.01	0.997 ± 0.004	0.970 ± 0.006	0.968 ± 0.009	0.948 ± 0.006	0.96 ± 0.01	0.999 ± 0.002	W Africa M	S Asia F	0.05

__Table 38.__ For algorithm neurotechnology-000 with Border images, Challenge-25 accept rate by age, sex and region of birth. The final columns give groups that give the highest and lowest accept rate and the Gini summary of variability. Gini is computed over the 12 accept-rate values to its left; lower values are better.

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Accept	min Accept	Gini
14	0.26 ± 0.06	0.061 ± 0.010	0.07 ± 0.02	0.09 ± 0.02	0.05 ± 0.02	0.47 ± 0.08	0.36 ± 0.07	0.10 ± 0.01	0.04 ± 0.02	0.08 ± 0.01	0.08 ± 0.02	0.52 ± 0.08	W Africa M	E Europe M	0.51
15	0.24 ± 0.06	0.08 ± 0.01	0.10 ± 0.02	0.12 ± 0.02	0.08 ± 0.02	0.49 ± 0.07	0.60 ± 0.08	0.14 ± 0.01	0.05 ± 0.02	0.12 ± 0.02	0.10 ± 0.02	0.65 ± 0.07	W Africa M	E Europe M	0.49
16	0.37 ± 0.06	0.10 ± 0.01	0.11 ± 0.02	0.14 ± 0.02	0.08 ± 0.02	0.51 ± 0.06	0.60 ± 0.07	0.19 ± 0.01	0.07 ± 0.02	0.14 ± 0.02	0.13 ± 0.03	0.70 ± 0.06	W Africa M	E Europe M	0.46
17	0.36 ± 0.05	0.122 ± 0.010	0.17 ± 0.03	0.17 ± 0.02	0.09 ± 0.02	0.60 ± 0.06	0.72 ± 0.07	0.24 ± 0.01	0.08 ± 0.02	0.22 ± 0.02	0.16 ± 0.03	0.74 ± 0.05	W Africa M	E Europe M	0.43
18	0.42 ± 0.05	0.131 ± 0.009	0.19 ± 0.02	0.19 ± 0.02	0.13 ± 0.02	0.63 ± 0.06	0.75 ± 0.05	0.27 ± 0.01	0.16 ± 0.03	0.26 ± 0.02	0.18 ± 0.02	0.82 ± 0.04	W Africa M	S E Asia F	0.40
19	0.45 ± 0.05	0.153 ± 0.008	0.25 ± 0.02	0.22 ± 0.02	0.13 ± 0.02	0.66 ± 0.04	0.82 ± 0.04	0.31 ± 0.01	0.18 ± 0.02	0.32 ± 0.02	0.23 ± 0.02	0.86 ± 0.03	W Africa M	S E Asia F	0.37
20	0.51 ± 0.04	0.180 ± 0.009	0.30 ± 0.02	0.25 ± 0.01	0.18 ± 0.02	0.67 ± 0.04	0.87 ± 0.03	0.35 ± 0.01	0.21 ± 0.03	0.43 ± 0.02	0.29 ± 0.03	0.84 ± 0.03	E Africa M	E Asia F	0.33
21	0.56 ± 0.04	0.195 ± 0.008	0.33 ± 0.02	0.28 ± 0.02	0.18 ± 0.01	0.69 ± 0.04	0.85 ± 0.03	0.40 ± 0.01	0.34 ± 0.03	0.49 ± 0.02	0.32 ± 0.02	0.89 ± 0.02	W Africa M	S E Asia F	0.30
22	0.60 ± 0.04	0.228 ± 0.009	0.38 ± 0.02	0.32 ± 0.01	0.22 ± 0.02	0.75 ± 0.03	0.88 ± 0.03	0.45 ± 0.01	0.38 ± 0.03	0.56 ± 0.02	0.38 ± 0.03	0.91 ± 0.02	W Africa M	S E Asia F	0.27
23	0.60 ± 0.04	0.237 ± 0.008	0.44 ± 0.02	0.34 ± 0.01	0.27 ± 0.02	0.76 ± 0.03	0.92 ± 0.02	0.49 ± 0.01	0.48 ± 0.02	0.61 ± 0.01	0.43 ± 0.03	0.94 ± 0.02	W Africa M	E Asia F	0.25
24	0.65 ± 0.03	0.276 ± 0.008	0.47 ± 0.01	0.38 ± 0.01	0.29 ± 0.02	0.80 ± 0.02	0.94 ± 0.02	0.55 ± 0.01	0.57 ± 0.02	0.67 ± 0.01	0.49 ± 0.03	0.95 ± 0.01	W Africa M	E Asia F	0.23
25	0.70 ± 0.03	0.321 ± 0.008	0.55 ± 0.01	0.41 ± 0.01	0.34 ± 0.02	0.84 ± 0.02	0.96 ± 0.01	0.60 ± 0.01	0.62 ± 0.02	0.71 ± 0.01	0.54 ± 0.02	0.96 ± 0.01	W Africa M	E Asia F	0.20
26	0.73 ± 0.02	0.350 ± 0.007	0.58 ± 0.01	0.44 ± 0.01	0.37 ± 0.01	0.84 ± 0.02	0.97 ± 0.01	0.64 ± 0.01	0.68 ± 0.02	0.738 ± 0.010	0.62 ± 0.02	0.975 ± 0.008	W Africa M	E Asia F	0.19
27	0.74 ± 0.02	0.379 ± 0.007	0.63 ± 0.01	0.473 ± 0.009	0.43 ± 0.02	0.85 ± 0.02	0.96 ± 0.01	0.682 ± 0.010	0.74 ± 0.02	0.779 ± 0.008	0.65 ± 0.02	0.973 ± 0.008	W Africa M	E Asia F	0.16
28	0.79 ± 0.02	0.422 ± 0.007	0.67 ± 0.01	0.513 ± 0.009	0.48 ± 0.02	0.87 ± 0.02	0.96 ± 0.01	0.73 ± 0.01	0.80 ± 0.01	0.811 ± 0.007	0.71 ± 0.02	0.982 ± 0.006	W Africa M	E Asia F	0.15
29	0.80 ± 0.02	0.460 ± 0.007	0.71 ± 0.01	0.537 ± 0.009	0.51 ± 0.02	0.87 ± 0.01	0.969 ± 0.010	0.767 ± 0.008	0.82 ± 0.01	0.834 ± 0.006	0.76 ± 0.02	0.988 ± 0.005	W Africa M	E Asia F	0.13
30	0.81 ± 0.02	0.506 ± 0.008	0.756 ± 0.010	0.570 ± 0.008	0.56 ± 0.01	0.89 ± 0.01	0.978 ± 0.009	0.798 ± 0.008	0.88 ± 0.01	0.856 ± 0.006	0.78 ± 0.02	0.983 ± 0.005	W Africa M	E Asia F	0.12
31	0.85 ± 0.02	0.553 ± 0.007	0.793 ± 0.010	0.594 ± 0.008	0.61 ± 0.02	0.90 ± 0.02	0.978 ± 0.009	0.832 ± 0.007	0.899 ± 0.010	0.879 ± 0.005	0.80 ± 0.02	0.990 ± 0.004	W Africa M	E Asia F	0.10
32	0.87 ± 0.02	0.595 ± 0.007	0.826 ± 0.010	0.642 ± 0.008	0.64 ± 0.01	0.92 ± 0.01	0.986 ± 0.007	0.858 ± 0.007	0.925 ± 0.008	0.902 ± 0.005	0.83 ± 0.02	0.991 ± 0.004	W Africa M	E Asia F	0.09
33	0.88 ± 0.02	0.631 ± 0.008	0.843 ± 0.010	0.674 ± 0.008	0.68 ± 0.01	0.92 ± 0.01	0.991 ± 0.005	0.890 ± 0.006	0.940 ± 0.007	0.921 ± 0.004	0.87 ± 0.02	0.990 ± 0.004	E Africa M	E Asia F	0.08
34	0.87 ± 0.02	0.677 ± 0.006	0.867 ± 0.010	0.711 ± 0.008	0.71 ± 0.01	0.94 ± 0.01	0.987 ± 0.007	0.896 ± 0.006	0.964 ± 0.005	0.930 ± 0.004	0.90 ± 0.01	0.990 ± 0.004	W Africa M	E Asia F	0.07

Table 39. *For algorithm roc-000 with Application images, Challenge-25 accept rate by age, sex and region of birth. The final columns give groups that give the highest and lowest accept rate and the Gini summary of variability. Gini is computed over the 12 accept-rate values to its left; lower values are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Accept	min Accept	Gini
14	0.04 ± 0.02	0.034 ± 0.008	0.000 ± 0.000	0.006 ± 0.004	0.04 ± 0.02	0.04 ± 0.02	0.013 ± 0.008	0.030 ± 0.008	0.000 ± 0.000	0.003 ± 0.003	0.03 ± 0.02	0.004 ± 0.004	S E Asia F	E Europe F	0.49
15	0.06 ± 0.02	0.07 ± 0.02	0.003 ± 0.003	0.027 ± 0.010	0.06 ± 0.02	0.08 ± 0.04	0.03 ± 0.02	0.05 ± 0.01	0.000 ± 0.000	0.011 ± 0.006	0.03 ± 0.01	0.02 ± 0.02	W Africa F	E Europe M	0.43
16	0.11 ± 0.03	0.14 ± 0.02	0.005 ± 0.005	0.03 ± 0.01	0.11 ± 0.03	0.14 ± 0.04	0.05 ± 0.02	0.06 ± 0.01	0.003 ± 0.003	0.018 ± 0.009	0.05 ± 0.02	0.05 ± 0.03	W Africa F	E Europe M	0.45
17	0.18 ± 0.04	0.17 ± 0.02	0.02 ± 0.01	0.07 ± 0.01	0.13 ± 0.03	0.22 ± 0.04	0.07 ± 0.03	0.12 ± 0.02	0.000 ± 0.000	0.04 ± 0.01	0.11 ± 0.03	0.11 ± 0.03	W Africa F	E Europe M	0.38
18	0.19 ± 0.03	0.22 ± 0.02	0.05 ± 0.02	0.07 ± 0.01	0.20 ± 0.03	0.26 ± 0.04	0.13 ± 0.03	0.17 ± 0.02	0.007 ± 0.005	0.07 ± 0.01	0.14 ± 0.02	0.15 ± 0.03	W Africa F	E Europe M	0.33
19	0.26 ± 0.03	0.31 ± 0.02	0.08 ± 0.02	0.12 ± 0.01	0.29 ± 0.03	0.38 ± 0.05	0.25 ± 0.03	0.28 ± 0.02	0.019 ± 0.009	0.11 ± 0.02	0.23 ± 0.03	0.28 ± 0.04	W Africa F	E Europe M	0.29
20	0.37 ± 0.04	0.40 ± 0.02	0.10 ± 0.02	0.18 ± 0.02	0.38 ± 0.03	0.41 ± 0.04	0.32 ± 0.03	0.39 ± 0.02	0.04 ± 0.01	0.21 ± 0.02	0.35 ± 0.03	0.39 ± 0.04	W Africa F	E Europe M	0.24
21	0.41 ± 0.04	0.52 ± 0.02	0.15 ± 0.02	0.23 ± 0.02	0.48 ± 0.03	0.50 ± 0.04	0.46 ± 0.04	0.51 ± 0.02	0.06 ± 0.02	0.30 ± 0.02	0.50 ± 0.03	0.51 ± 0.04	E Asia F	E Europe M	0.23
22	0.51 ± 0.03	0.60 ± 0.02	0.22 ± 0.02	0.28 ± 0.02	0.59 ± 0.02	0.57 ± 0.04	0.63 ± 0.04	0.62 ± 0.02	0.18 ± 0.03	0.42 ± 0.02	0.58 ± 0.03	0.61 ± 0.04	E Africa M	E Europe M	0.19
23	0.57 ± 0.03	0.70 ± 0.02	0.29 ± 0.02	0.35 ± 0.02	0.68 ± 0.02	0.65 ± 0.03	0.66 ± 0.03	0.74 ± 0.02	0.23 ± 0.03	0.55 ± 0.02	0.72 ± 0.03	0.70 ± 0.03	E Asia M	E Europe M	0.17
24	0.65 ± 0.03	0.76 ± 0.01	0.39 ± 0.02	0.42 ± 0.01	0.76 ± 0.02	0.70 ± 0.03	0.78 ± 0.03	0.82 ± 0.01	0.41 ± 0.03	0.66 ± 0.02	0.81 ± 0.02	0.79 ± 0.03	E Asia M	E Europe F	0.14
25	0.69 ± 0.03	0.83 ± 0.01	0.47 ± 0.02	0.47 ± 0.02	0.82 ± 0.02	0.78 ± 0.02	0.83 ± 0.02	0.88 ± 0.01	0.55 ± 0.03	0.73 ± 0.02	0.88 ± 0.02	0.86 ± 0.02	E Asia M	E Europe F	0.12
26	0.74 ± 0.02	0.872 ± 0.009	0.57 ± 0.02	0.55 ± 0.01	0.87 ± 0.01	0.82 ± 0.02	0.88 ± 0.02	0.936 ± 0.009	0.64 ± 0.03	0.81 ± 0.01	0.92 ± 0.02	0.91 ± 0.02	E Asia M	S Asia F	0.10
27	0.78 ± 0.02	0.915 ± 0.008	0.67 ± 0.02	0.61 ± 0.01	0.90 ± 0.01	0.86 ± 0.02	0.91 ± 0.02	0.965 ± 0.007	0.77 ± 0.02	0.86 ± 0.01	0.95 ± 0.01	0.93 ± 0.01	E Asia M	S Asia F	0.08
28	0.83 ± 0.02	0.939 ± 0.006	0.75 ± 0.02	0.67 ± 0.01	0.932 ± 0.009	0.90 ± 0.02	0.94 ± 0.01	0.982 ± 0.005	0.85 ± 0.02	0.903 ± 0.008	0.97 ± 0.01	0.96 ± 0.01	E Asia M	S Asia F	0.06
29	0.88 ± 0.01	0.968 ± 0.004	0.83 ± 0.01	0.73 ± 0.01	0.949 ± 0.008	0.93 ± 0.01	0.967 ± 0.010	0.989 ± 0.004	0.91 ± 0.02	0.943 ± 0.006	0.980 ± 0.008	0.975 ± 0.008	E Asia M	S Asia F	0.04
30	0.91 ± 0.02	0.981 ± 0.003	0.88 ± 0.01	0.78 ± 0.01	0.976 ± 0.006	0.93 ± 0.01	0.972 ± 0.010	0.992 ± 0.003	0.95 ± 0.01	0.955 ± 0.006	0.987 ± 0.008	0.984 ± 0.007	E Asia M	S Asia F	0.03
31	0.92 ± 0.01	0.988 ± 0.003	0.91 ± 0.01	0.825 ± 0.010	0.982 ± 0.004	0.96 ± 0.01	0.981 ± 0.007	0.998 ± 0.002	0.970 ± 0.009	0.974 ± 0.004	0.995 ± 0.005	0.989 ± 0.006	E Asia M	S Asia F	0.03
32	0.95 ± 0.01	0.991 ± 0.003	0.953 ± 0.008	0.875 ± 0.008	0.986 ± 0.005	0.966 ± 0.010	0.990 ± 0.006	0.999 ± 0.001	0.980 ± 0.007	0.985 ± 0.003	0.995 ± 0.004	0.995 ± 0.004	E Asia M	S Asia F	0.02
33	0.96 ± 0.01	0.995 ± 0.002	0.963 ± 0.008	0.903 ± 0.008	0.992 ± 0.004	0.978 ± 0.008	0.995 ± 0.005	0.999 ± 0.001	0.994 ± 0.004	0.989 ± 0.003	0.996 ± 0.004	0.996 ± 0.003	E Asia M	S Asia F	0.01
34	0.979 ± 0.008	0.998 ± 0.001	0.980 ± 0.006	0.933 ± 0.008	0.997 ± 0.003	0.989 ± 0.006	0.995 ± 0.004	0.999 ± 0.001	0.996 ± 0.004	0.993 ± 0.002	1.000 ± 0.000	0.996 ± 0.004	S E Asia M	S Asia F	0.01

Table 40. *For algorithm roc-000 with Border images, Challenge-25 accept rate by age, sex and region of birth. The final columns give groups that give the highest and lowest accept rate and the Gini summary of variability. Gini is computed over the 12 accept-rate values to its left; lower values are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Accept	min Accept	Gini
14	0.14 ± 0.05	0.10 ± 0.01	0.009 ± 0.006	0.03 ± 0.01	0.05 ± 0.02	0.13 ± 0.05	0.12 ± 0.04	0.045 ± 0.008	0.002 ± 0.002	0.007 ± 0.004	0.03 ± 0.01	0.09 ± 0.04	E Africa F	E Europe M	0.47
15	0.18 ± 0.05	0.15 ± 0.01	0.02 ± 0.01	0.05 ± 0.01	0.08 ± 0.02	0.25 ± 0.06	0.19 ± 0.06	0.09 ± 0.01	0.004 ± 0.004	0.010 ± 0.005	0.06 ± 0.02	0.18 ± 0.06	W Africa F	E Europe M	0.47
16	0.29 ± 0.06	0.19 ± 0.01	0.03 ± 0.01	0.07 ± 0.01	0.14 ± 0.02	0.27 ± 0.06	0.22 ± 0.06	0.13 ± 0.01	0.002 ± 0.002	0.023 ± 0.007	0.09 ± 0.02	0.13 ± 0.04	E Africa F	E Europe M	0.43
17	0.38 ± 0.06	0.27 ± 0.01	0.05 ± 0.02	0.10 ± 0.01	0.20 ± 0.03	0.37 ± 0.06	0.25 ± 0.06	0.19 ± 0.01	0.014 ± 0.008	0.07 ± 0.01	0.15 ± 0.02	0.25 ± 0.05	E Africa F	E Europe M	0.37
18	0.45 ± 0.05	0.35 ± 0.01	0.09 ± 0.02	0.14 ± 0.02	0.27 ± 0.02	0.38 ± 0.05	0.32 ± 0.05	0.26 ± 0.01	0.02 ± 0.01	0.10 ± 0.01	0.22 ± 0.03	0.34 ± 0.05	E Africa F	E Europe M	0.32
19	0.49 ± 0.04	0.42 ± 0.01	0.12 ± 0.02	0.20 ± 0.02	0.32 ± 0.02	0.47 ± 0.05	0.44 ± 0.05	0.36 ± 0.01	0.03 ± 0.01	0.16 ± 0.02	0.31 ± 0.02	0.42 ± 0.05	E Africa F	E Europe M	0.28
20	0.58 ± 0.04	0.51 ± 0.01	0.18 ± 0.02	0.24 ± 0.02	0.42 ± 0.02	0.58 ± 0.04	0.58 ± 0.04	0.47 ± 0.01	0.07 ± 0.01	0.26 ± 0.02	0.42 ± 0.02	0.52 ± 0.04	E Africa M	E Europe M	0.25
21	0.61 ± 0.04	0.58 ± 0.01	0.23 ± 0.02	0.32 ± 0.01	0.49 ± 0.02	0.61 ± 0.04	0.61 ± 0.04	0.59 ± 0.01	0.13 ± 0.02	0.34 ± 0.02	0.55 ± 0.03	0.61 ± 0.04	E Africa F	E Europe M	0.20
22	0.72 ± 0.04	0.663 ± 0.010	0.31 ± 0.02	0.38 ± 0.01	0.58 ± 0.02	0.70 ± 0.03	0.75 ± 0.04	0.69 ± 0.01	0.22 ± 0.02	0.46 ± 0.02	0.67 ± 0.03	0.73 ± 0.03	E Africa M	E Europe M	0.18
23	0.76 ± 0.03	0.727 ± 0.008	0.37 ± 0.02	0.44 ± 0.01	0.67 ± 0.02	0.76 ± 0.02	0.80 ± 0.03	0.768 ± 0.009	0.32 ± 0.02	0.57 ± 0.02	0.74 ± 0.02	0.80 ± 0.02	W Africa M	E Europe M	0.15
24	0.79 ± 0.02	0.781 ± 0.008	0.45 ± 0.01	0.51 ± 0.01	0.74 ± 0.01	0.80 ± 0.02	0.85 ± 0.02	0.831 ± 0.009	0.46 ± 0.02	0.66 ± 0.01	0.81 ± 0.02	0.86 ± 0.02	W Africa M	E Europe F	0.12
25	0.82 ± 0.02	0.836 ± 0.007	0.53 ± 0.01	0.56 ± 0.01	0.79 ± 0.01	0.84 ± 0.02	0.91 ± 0.02	0.893 ± 0.007	0.57 ± 0.02	0.74 ± 0.01	0.89 ± 0.02	0.90 ± 0.02	E Africa M	E Europe F	0.10
26	0.86 ± 0.02	0.875 ± 0.005	0.60 ± 0.01	0.632 ± 0.009	0.85 ± 0.01	0.86 ± 0.02	0.93 ± 0.02	0.927 ± 0.006	0.67 ± 0.02	0.797 ± 0.009	0.92 ± 0.01	0.93 ± 0.01	E Africa M	E Europe F	0.08
27	0.85 ± 0.02	0.905 ± 0.004	0.68 ± 0.01	0.677 ± 0.009	0.875 ± 0.010	0.90 ± 0.01	0.94 ± 0.01	0.948 ± 0.005	0.76 ± 0.02	0.855 ± 0.007	0.949 ± 0.010	0.953 ± 0.010	W Africa M	S Asia F	0.07
28	0.92 ± 0.02	0.927 ± 0.004	0.75 ± 0.01	0.735 ± 0.008	0.912 ± 0.009	0.91 ± 0.01	0.96 ± 0.01	0.966 ± 0.004	0.84 ± 0.01	0.898 ± 0.006	0.958 ± 0.010	0.969 ± 0.008	W Africa M	S Asia F	0.05
29	0.93 ± 0.02	0.949 ± 0.003	0.815 ± 0.009	0.773 ± 0.007	0.933 ± 0.008	0.94 ± 0.01	0.982 ± 0.008	0.978 ± 0.003	0.86 ± 0.01	0.922 ± 0.005	0.973 ± 0.007	0.980 ± 0.006	E Africa M	S Asia F	0.04
30	0.93 ± 0.01	0.961 ± 0.003	0.861 ± 0.009	0.824 ± 0.006	0.952 ± 0.007	0.95 ± 0.01	0.986 ± 0.007	0.984 ± 0.002	0.922 ± 0.009	0.943 ± 0.004	0.983 ± 0.006	0.984 ± 0.005	E Africa M	S Asia F	0.03
31	0.95 ± 0.01	0.972 ± 0.002	0.892 ± 0.007	0.855 ± 0.006	0.962 ± 0.006	0.970 ± 0.008	0.988 ± 0.007	0.986 ± 0.002	0.949 ± 0.007	0.961 ± 0.003	0.982 ± 0.007	0.989 ± 0.004	W Africa M	S Asia F	0.02
32	0.970 ± 0.010	0.979 ± 0.002	0.931 ± 0.007	0.884 ± 0.005	0.967 ± 0.006	0.974 ± 0.008	0.991 ± 0.005	0.991 ± 0.002	0.964 ± 0.006	0.971 ± 0.003	0.986 ± 0.005	0.992 ± 0.004	W Africa M	S Asia F	0.02
33	0.981 ± 0.008	0.983 ± 0.002	0.949 ± 0.005	0.914 ± 0.005	0.977 ± 0.005	0.981 ± 0.007	0.996 ± 0.004	0.994 ± 0.002	0.979 ± 0.004	0.980 ± 0.002	0.990 ± 0.005	0.995 ± 0.003	E Africa M	S Asia F	0.01
34	0.975 ± 0.010	0.986 ± 0.002	0.967 ± 0.005	0.933 ± 0.004	0.984 ± 0.004	0.989 ± 0.005	0.999 ± 0.002	0.994 ± 0.001	0.983 ± 0.004	0.985 ± 0.002	0.995 ± 0.004	0.996 ± 0.002	E Africa M	S Asia F	0.01

Table 41. *For algorithm unissey-001 with Application images, Challenge-25 accept rate by age, sex and region of birth. The final columns give groups that give the highest and lowest accept rate and the Gini summary of variability. Gini is computed over the 12 accept-rate values to its left; lower values are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Accept	min Accept	Gini
14	0.04 ± 0.02	0.07 ± 0.01	0.02 ± 0.01	0.024 ± 0.008	0.05 ± 0.02	0.11 ± 0.04	0.04 ± 0.02	0.07 ± 0.01	0.009 ± 0.007	0.022 ± 0.007	0.06 ± 0.02	0.04 ± 0.02	W Africa F	E Europe M	0.35
15	0.09 ± 0.03	0.13 ± 0.02	0.06 ± 0.02	0.06 ± 0.02	0.10 ± 0.03	0.15 ± 0.04	0.06 ± 0.02	0.12 ± 0.02	0.02 ± 0.01	0.05 ± 0.01	0.09 ± 0.03	0.06 ± 0.03	W Africa F	E Europe M	0.27
16	0.12 ± 0.03	0.19 ± 0.02	0.10 ± 0.03	0.10 ± 0.02	0.16 ± 0.04	0.19 ± 0.05	0.11 ± 0.03	0.17 ± 0.02	0.05 ± 0.02	0.10 ± 0.02	0.17 ± 0.04	0.08 ± 0.04	E Asia F	E Europe M	0.21
17	0.17 ± 0.04	0.26 ± 0.02	0.19 ± 0.04	0.15 ± 0.02	0.21 ± 0.04	0.29 ± 0.05	0.20 ± 0.04	0.26 ± 0.02	0.04 ± 0.02	0.15 ± 0.02	0.23 ± 0.04	0.14 ± 0.04	W Africa F	E Europe M	0.20
18	0.22 ± 0.03	0.32 ± 0.02	0.22 ± 0.03	0.18 ± 0.02	0.24 ± 0.03	0.32 ± 0.04	0.27 ± 0.03	0.32 ± 0.02	0.12 ± 0.03	0.26 ± 0.02	0.28 ± 0.03	0.25 ± 0.04	E Asia F	E Europe M	0.14
19	0.28 ± 0.03	0.41 ± 0.02	0.25 ± 0.04	0.27 ± 0.02	0.32 ± 0.03	0.41 ± 0.04	0.41 ± 0.04	0.40 ± 0.02	0.22 ± 0.04	0.36 ± 0.02	0.36 ± 0.03	0.29 ± 0.04	E Asia F	E Europe M	0.12
20	0.37 ± 0.04	0.48 ± 0.02	0.36 ± 0.03	0.32 ± 0.02	0.39 ± 0.03	0.50 ± 0.05	0.52 ± 0.04	0.49 ± 0.02	0.30 ± 0.04	0.47 ± 0.02	0.46 ± 0.03	0.42 ± 0.04	E Africa M	E Europe M	0.10
21	0.42 ± 0.04	0.55 ± 0.02	0.42 ± 0.03	0.38 ± 0.02	0.46 ± 0.02	0.52 ± 0.04	0.57 ± 0.04	0.57 ± 0.02	0.40 ± 0.04	0.54 ± 0.02	0.55 ± 0.03	0.48 ± 0.04	E Africa M	S Asia F	0.08
22	0.48 ± 0.03	0.61 ± 0.02	0.54 ± 0.03	0.44 ± 0.02	0.53 ± 0.02	0.59 ± 0.04	0.69 ± 0.04	0.64 ± 0.02	0.54 ± 0.04	0.65 ± 0.02	0.60 ± 0.03	0.52 ± 0.04	E Africa M	S Asia F	0.08
23	0.52 ± 0.03	0.69 ± 0.02	0.60 ± 0.02	0.51 ± 0.02	0.61 ± 0.02	0.65 ± 0.03	0.73 ± 0.03	0.74 ± 0.02	0.60 ± 0.04	0.73 ± 0.02	0.69 ± 0.03	0.60 ± 0.04	E Asia M	S Asia F	0.07
24	0.58 ± 0.03	0.73 ± 0.01	0.68 ± 0.02	0.57 ± 0.02	0.68 ± 0.02	0.68 ± 0.03	0.77 ± 0.03	0.76 ± 0.02	0.73 ± 0.03	0.80 ± 0.02	0.75 ± 0.03	0.66 ± 0.03	S Asia M	S Asia F	0.06
25	0.64 ± 0.02	0.78 ± 0.01	0.75 ± 0.02	0.60 ± 0.01	0.72 ± 0.02	0.74 ± 0.03	0.84 ± 0.03	0.83 ± 0.02	0.80 ± 0.02	0.85 ± 0.01	0.81 ± 0.02	0.72 ± 0.03	S Asia M	S Asia F	0.06
26	0.72 ± 0.02	0.82 ± 0.01	0.82 ± 0.01	0.65 ± 0.01	0.77 ± 0.02	0.77 ± 0.03	0.88 ± 0.02	0.87 ± 0.01	0.85 ± 0.02	0.87 ± 0.01	0.85 ± 0.02	0.77 ± 0.02	E Africa M	S Asia F	0.05
27	0.73 ± 0.02	0.865 ± 0.009	0.85 ± 0.01	0.69 ± 0.01	0.81 ± 0.01	0.81 ± 0.02	0.90 ± 0.02	0.90 ± 0.01	0.90 ± 0.02	0.906 ± 0.010	0.88 ± 0.02	0.81 ± 0.02	S Asia M	S Asia F	0.05
28	0.78 ± 0.02	0.894 ± 0.008	0.88 ± 0.01	0.72 ± 0.01	0.85 ± 0.01	0.85 ± 0.02	0.92 ± 0.01	0.93 ± 0.01	0.93 ± 0.01	0.926 ± 0.008	0.91 ± 0.02	0.82 ± 0.02	E Europe M	S Asia F	0.04
29	0.83 ± 0.02	0.922 ± 0.007	0.92 ± 0.01	0.78 ± 0.01	0.88 ± 0.01	0.88 ± 0.02	0.93 ± 0.01	0.954 ± 0.008	0.95 ± 0.01	0.944 ± 0.007	0.93 ± 0.01	0.89 ± 0.02	E Asia M	S Asia F	0.03
30	0.85 ± 0.02	0.942 ± 0.006	0.934 ± 0.009	0.81 ± 0.01	0.91 ± 0.01	0.88 ± 0.02	0.94 ± 0.01	0.966 ± 0.007	0.971 ± 0.009	0.954 ± 0.005	0.95 ± 0.01	0.89 ± 0.01	E Europe M	S Asia F	0.03
31	0.87 ± 0.02	0.951 ± 0.006	0.961 ± 0.008	0.842 ± 0.009	0.92 ± 0.01	0.89 ± 0.02	0.97 ± 0.01	0.977 ± 0.005	0.981 ± 0.008	0.964 ± 0.005	0.97 ± 0.01	0.91 ± 0.01	E Europe M	S Asia F	0.03
32	0.90 ± 0.02	0.958 ± 0.005	0.969 ± 0.007	0.873 ± 0.008	0.940 ± 0.010	0.91 ± 0.01	0.974 ± 0.009	0.982 ± 0.005	0.989 ± 0.006	0.976 ± 0.004	0.978 ± 0.008	0.92 ± 0.01	E Europe M	S Asia F	0.02
33	0.91 ± 0.02	0.976 ± 0.004	0.969 ± 0.008	0.895 ± 0.008	0.952 ± 0.010	0.94 ± 0.01	0.967 ± 0.008	0.991 ± 0.004	0.996 ± 0.004	0.981 ± 0.003	0.986 ± 0.007	0.95 ± 0.01	E Europe M	S Asia F	0.02
34	0.93 ± 0.02	0.982 ± 0.004	0.982 ± 0.006	0.922 ± 0.007	0.971 ± 0.007	0.94 ± 0.01	0.988 ± 0.007	0.993 ± 0.003	0.998 ± 0.003	0.987 ± 0.003	0.987 ± 0.007	0.95 ± 0.01	E Europe M	S Asia F	0.01

Table 42. *For algorithm unissey-001 with Border images, Challenge-25 accept rate by age, sex and region of birth. The final columns give groups that give the highest and lowest accept rate and the Gini summary of variability. Gini is computed over the 12 accept-rate values to its left; lower values are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Accept	min Accept	Gini
14	0.10 ± 0.05	0.050 ± 0.009	0.03 ± 0.02	0.034 ± 0.010	0.03 ± 0.02	0.06 ± 0.03	0.05 ± 0.03	0.033 ± 0.007	0.007 ± 0.007	0.013 ± 0.006	0.04 ± 0.01	0.01 ± 0.01	E Africa F	E Europe M	0.34
15	0.09 ± 0.04	0.082 ± 0.010	0.07 ± 0.02	0.05 ± 0.01	0.08 ± 0.02	0.13 ± 0.05	0.15 ± 0.05	0.060 ± 0.009	0.03 ± 0.01	0.034 ± 0.009	0.04 ± 0.01	0.06 ± 0.03	E Africa M	E Europe M	0.29
16	0.14 ± 0.05	0.12 ± 0.01	0.10 ± 0.02	0.08 ± 0.02	0.08 ± 0.02	0.18 ± 0.05	0.12 ± 0.04	0.10 ± 0.01	0.03 ± 0.01	0.06 ± 0.01	0.08 ± 0.02	0.08 ± 0.04	W Africa F	E Europe M	0.22
17	0.14 ± 0.04	0.16 ± 0.01	0.12 ± 0.02	0.11 ± 0.01	0.11 ± 0.02	0.24 ± 0.06	0.14 ± 0.04	0.14 ± 0.01	0.03 ± 0.01	0.11 ± 0.01	0.12 ± 0.02	0.13 ± 0.04	W Africa F	E Europe M	0.19
18	0.25 ± 0.04	0.197 ± 0.010	0.20 ± 0.02	0.14 ± 0.02	0.14 ± 0.02	0.24 ± 0.04	0.24 ± 0.04	0.19 ± 0.01	0.10 ± 0.02	0.15 ± 0.01	0.15 ± 0.02	0.19 ± 0.04	E Africa F	E Europe M	0.15
19	0.29 ± 0.04	0.25 ± 0.01	0.21 ± 0.02	0.18 ± 0.01	0.18 ± 0.02	0.31 ± 0.04	0.32 ± 0.05	0.24 ± 0.01	0.12 ± 0.02	0.22 ± 0.02	0.20 ± 0.02	0.21 ± 0.04	E Africa M	E Europe M	0.14
20	0.33 ± 0.04	0.308 ± 0.010	0.28 ± 0.02	0.21 ± 0.02	0.23 ± 0.02	0.37 ± 0.04	0.39 ± 0.04	0.30 ± 0.01	0.19 ± 0.02	0.31 ± 0.02	0.28 ± 0.02	0.23 ± 0.03	E Africa M	E Europe M	0.13
21	0.39 ± 0.04	0.35 ± 0.01	0.32 ± 0.02	0.25 ± 0.01	0.26 ± 0.02	0.43 ± 0.04	0.44 ± 0.04	0.36 ± 0.01	0.29 ± 0.03	0.40 ± 0.02	0.34 ± 0.02	0.29 ± 0.03	E Africa M	S Asia F	0.11
22	0.45 ± 0.04	0.388 ± 0.010	0.40 ± 0.02	0.30 ± 0.01	0.31 ± 0.02	0.47 ± 0.03	0.52 ± 0.04	0.43 ± 0.01	0.36 ± 0.02	0.47 ± 0.02	0.41 ± 0.03	0.35 ± 0.03	E Africa M	S Asia F	0.10
23	0.51 ± 0.04	0.438 ± 0.009	0.45 ± 0.02	0.34 ± 0.01	0.38 ± 0.02	0.53 ± 0.03	0.57 ± 0.04	0.50 ± 0.01	0.47 ± 0.02	0.55 ± 0.01	0.51 ± 0.03	0.41 ± 0.03	E Africa M	S Asia F	0.09
24	0.54 ± 0.03	0.506 ± 0.008	0.51 ± 0.01	0.40 ± 0.01	0.45 ± 0.02	0.56 ± 0.03	0.61 ± 0.04	0.57 ± 0.01	0.57 ± 0.02	0.63 ± 0.01	0.56 ± 0.03	0.44 ± 0.03	S Asia M	S Asia F	0.08
25	0.61 ± 0.03	0.558 ± 0.008	0.58 ± 0.01	0.41 ± 0.01	0.51 ± 0.02	0.61 ± 0.02	0.70 ± 0.03	0.62 ± 0.01	0.63 ± 0.02	0.68 ± 0.01	0.63 ± 0.02	0.52 ± 0.03	E Africa M	S Asia F	0.08
26	0.67 ± 0.03	0.615 ± 0.008	0.64 ± 0.01	0.478 ± 0.009	0.54 ± 0.02	0.62 ± 0.02	0.73 ± 0.03	0.69 ± 0.01	0.71 ± 0.02	0.72 ± 0.01	0.68 ± 0.02	0.56 ± 0.02	E Africa M	S Asia F	0.07
27	0.68 ± 0.03	0.653 ± 0.007	0.69 ± 0.01	0.501 ± 0.009	0.61 ± 0.01	0.68 ± 0.02	0.76 ± 0.03	0.738 ± 0.010	0.78 ± 0.02	0.766 ± 0.008	0.74 ± 0.02	0.63 ± 0.02	E Europe M	S Asia F	0.07
28	0.74 ± 0.02	0.710 ± 0.006	0.742 ± 0.009	0.550 ± 0.008	0.65 ± 0.01	0.68 ± 0.02	0.82 ± 0.02	0.788 ± 0.009	0.84 ± 0.01	0.810 ± 0.007	0.78 ± 0.02	0.68 ± 0.02	E Europe M	S Asia F	0.07
29	0.77 ± 0.03	0.745 ± 0.007	0.796 ± 0.010	0.586 ± 0.007	0.69 ± 0.02	0.74 ± 0.02	0.83 ± 0.02	0.825 ± 0.008	0.87 ± 0.01	0.841 ± 0.007	0.83 ± 0.02	0.72 ± 0.02	E Europe M	S Asia F	0.06
30	0.77 ± 0.02	0.781 ± 0.006	0.834 ± 0.009	0.628 ± 0.008	0.74 ± 0.01	0.75 ± 0.02	0.85 ± 0.02	0.859 ± 0.007	0.90 ± 0.01	0.867 ± 0.006	0.85 ± 0.02	0.76 ± 0.02	E Europe M	S Asia F	0.05
31	0.81 ± 0.02	0.821 ± 0.006	0.861 ± 0.008	0.665 ± 0.008	0.77 ± 0.01	0.78 ± 0.02	0.89 ± 0.02	0.886 ± 0.006	0.933 ± 0.008	0.891 ± 0.005	0.86 ± 0.02	0.76 ± 0.02	E Europe M	S Asia F	0.05
32	0.83 ± 0.02	0.845 ± 0.005	0.893 ± 0.008	0.715 ± 0.007	0.80 ± 0.01	0.80 ± 0.02	0.92 ± 0.02	0.912 ± 0.005	0.951 ± 0.007	0.910 ± 0.004	0.88 ± 0.01	0.79 ± 0.02	E Europe M	S Asia F	0.05
33	0.87 ± 0.02	0.872 ± 0.005	0.914 ± 0.008	0.755 ± 0.007	0.84 ± 0.01	0.84 ± 0.02	0.92 ± 0.02	0.930 ± 0.005	0.961 ± 0.006	0.925 ± 0.004	0.93 ± 0.01	0.82 ± 0.02	E Europe M	S Asia F	0.04
34	0.87 ± 0.02	0.895 ± 0.004	0.935 ± 0.007	0.791 ± 0.007	0.86 ± 0.01	0.85 ± 0.02	0.94 ± 0.01	0.942 ± 0.005	0.979 ± 0.005	0.938 ± 0.003	0.94 ± 0.01	0.86 ± 0.01	E Europe M	S Asia F	0.04

Table 43. *For algorithm yoti-001 with Application images, Challenge-25 accept rate by age, sex and region of birth. The final columns give groups that give the highest and lowest accept rate and the Gini summary of variability. Gini is computed over the 12 accept-rate values to its left; lower values are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Accept	min Accept	Gini
14	0.03 ± 0.02	0.014 ± 0.006	0.03 ± 0.01	0.027 ± 0.008	0.04 ± 0.02	0.06 ± 0.03	0.006 ± 0.006	0.005 ± 0.003	0.000 ± 0.000	0.002 ± 0.002	0.005 ± 0.005	0.000 ± 0.000	W Africa F	E Europe M	0.60
15	0.05 ± 0.02	0.041 ± 0.010	0.07 ± 0.02	0.07 ± 0.02	0.04 ± 0.02	0.09 ± 0.04	0.008 ± 0.008	0.006 ± 0.004	0.000 ± 0.000	0.007 ± 0.005	0.002 ± 0.002	0.01 ± 0.01	W Africa F	E Europe M	0.54
16	0.13 ± 0.03	0.08 ± 0.01	0.11 ± 0.03	0.12 ± 0.02	0.15 ± 0.04	0.17 ± 0.05	0.02 ± 0.01	0.010 ± 0.005	0.003 ± 0.003	0.006 ± 0.004	0.003 ± 0.003	0.02 ± 0.02	W Africa F	S E Asia M	0.54
17	0.18 ± 0.04	0.14 ± 0.02	0.19 ± 0.04	0.21 ± 0.03	0.18 ± 0.04	0.24 ± 0.05	0.02 ± 0.01	0.036 ± 0.009	0.003 ± 0.003	0.021 ± 0.008	0.02 ± 0.01	0.08 ± 0.03	W Africa F	E Europe M	0.46
18	0.23 ± 0.03	0.19 ± 0.02	0.26 ± 0.04	0.25 ± 0.02	0.26 ± 0.03	0.32 ± 0.04	0.07 ± 0.02	0.059 ± 0.010	0.03 ± 0.01	0.04 ± 0.01	0.04 ± 0.01	0.10 ± 0.03	W Africa F	E Europe M	0.40
19	0.34 ± 0.04	0.29 ± 0.02	0.36 ± 0.04	0.35 ± 0.02	0.38 ± 0.03	0.44 ± 0.04	0.13 ± 0.03	0.12 ± 0.01	0.05 ± 0.02	0.09 ± 0.01	0.11 ± 0.02	0.18 ± 0.04	W Africa F	E Europe M	0.34
20	0.39 ± 0.03	0.40 ± 0.02	0.45 ± 0.04	0.43 ± 0.02	0.48 ± 0.03	0.49 ± 0.04	0.24 ± 0.04	0.22 ± 0.02	0.13 ± 0.03	0.18 ± 0.02	0.22 ± 0.03	0.28 ± 0.04	W Africa F	E Europe M	0.23
21	0.50 ± 0.04	0.51 ± 0.02	0.56 ± 0.03	0.56 ± 0.02	0.62 ± 0.03	0.61 ± 0.04	0.32 ± 0.04	0.35 ± 0.02	0.23 ± 0.03	0.30 ± 0.02	0.35 ± 0.03	0.38 ± 0.04	S E Asia F	E Europe M	0.18
22	0.56 ± 0.03	0.63 ± 0.02	0.68 ± 0.03	0.63 ± 0.02	0.70 ± 0.02	0.65 ± 0.03	0.50 ± 0.04	0.51 ± 0.02	0.40 ± 0.03	0.43 ± 0.02	0.49 ± 0.03	0.50 ± 0.04	S E Asia F	E Europe M	0.11
23	0.67 ± 0.03	0.73 ± 0.02	0.76 ± 0.02	0.72 ± 0.02	0.78 ± 0.02	0.77 ± 0.03	0.59 ± 0.03	0.62 ± 0.02	0.55 ± 0.04	0.60 ± 0.02	0.64 ± 0.03	0.65 ± 0.04	S E Asia F	E Europe M	0.07
24	0.72 ± 0.03	0.80 ± 0.01	0.86 ± 0.02	0.79 ± 0.01	0.86 ± 0.01	0.79 ± 0.03	0.73 ± 0.03	0.75 ± 0.02	0.73 ± 0.03	0.72 ± 0.02	0.77 ± 0.02	0.73 ± 0.03	S E Asia F	E Africa F	0.04
25	0.77 ± 0.02	0.870 ± 0.010	0.90 ± 0.01	0.84 ± 0.01	0.90 ± 0.01	0.84 ± 0.02	0.78 ± 0.03	0.84 ± 0.01	0.85 ± 0.02	0.83 ± 0.01	0.85 ± 0.02	0.81 ± 0.02	E Europe F	E Africa F	0.03
26	0.82 ± 0.02	0.913 ± 0.008	0.949 ± 0.008	0.883 ± 0.009	0.939 ± 0.009	0.88 ± 0.02	0.87 ± 0.02	0.915 ± 0.010	0.91 ± 0.02	0.89 ± 0.01	0.92 ± 0.02	0.88 ± 0.02	E Europe F	E Africa F	0.02
27	0.86 ± 0.02	0.950 ± 0.006	0.967 ± 0.007	0.912 ± 0.008	0.955 ± 0.008	0.91 ± 0.01	0.89 ± 0.02	0.949 ± 0.009	0.95 ± 0.01	0.941 ± 0.008	0.95 ± 0.01	0.91 ± 0.02	E Europe F	E Africa F	0.02
28	0.90 ± 0.02	0.967 ± 0.005	0.983 ± 0.005	0.931 ± 0.006	0.965 ± 0.007	0.94 ± 0.01	0.95 ± 0.01	0.971 ± 0.006	0.977 ± 0.008	0.963 ± 0.005	0.97 ± 0.01	0.95 ± 0.01	E Europe F	E Africa F	0.01
29	0.93 ± 0.01	0.980 ± 0.003	0.989 ± 0.004	0.954 ± 0.005	0.985 ± 0.005	0.94 ± 0.01	0.96 ± 0.01	0.986 ± 0.004	0.990 ± 0.006	0.978 ± 0.004	0.978 ± 0.008	0.972 ± 0.008	E Europe M	E Africa F	0.01
30	0.95 ± 0.01	0.987 ± 0.003	0.995 ± 0.003	0.965 ± 0.005	0.990 ± 0.004	0.96 ± 0.01	0.972 ± 0.009	0.991 ± 0.004	0.995 ± 0.004	0.986 ± 0.003	0.987 ± 0.007	0.978 ± 0.007	E Europe M	E Africa F	0.01
31	0.96 ± 0.01	0.991 ± 0.002	0.996 ± 0.003	0.975 ± 0.004	0.991 ± 0.004	0.96 ± 0.01	0.985 ± 0.007	0.996 ± 0.002	0.997 ± 0.003	0.992 ± 0.002	0.991 ± 0.006	0.989 ± 0.005	E Europe M	E Africa F	0.01
32	0.964 ± 0.009	0.995 ± 0.002	0.999 ± 0.002	0.982 ± 0.004	0.993 ± 0.004	0.97 ± 0.01	0.987 ± 0.007	0.996 ± 0.002	0.998 ± 0.003	0.997 ± 0.001	0.993 ± 0.005	0.994 ± 0.004	E Europe F	E Africa F	0.01
33	0.980 ± 0.008	0.996 ± 0.002	0.997 ± 0.003	0.987 ± 0.003	0.996 ± 0.003	0.978 ± 0.008	0.995 ± 0.004	0.998 ± 0.002	0.999 ± 0.002	0.997 ± 0.002	0.996 ± 0.004	0.994 ± 0.004	E Europe M	W Africa F	0.00
34	0.980 ± 0.008	0.998 ± 0.001	0.997 ± 0.003	0.993 ± 0.002	0.997 ± 0.002	0.983 ± 0.007	0.997 ± 0.003	0.998 ± 0.002	0.999 ± 0.002	0.998 ± 0.001	0.997 ± 0.004	0.997 ± 0.003	E Europe M	E Africa F	0.00

Table 44. *For algorithm yoti-001 with Border images, Challenge-25 accept rate by age, sex and region of birth. The final columns give groups that give the highest and lowest accept rate and the Gini summary of variability. Gini is computed over the 12 accept-rate values to its left; lower values are better.*

Age	F E Africa	F E Asia	F E Europe	F S Asia	F SE Asia	F W Africa	M E Africa	M E Asia	M E Europe	M S Asia	M SE Asia	M W Africa	max Accept	min Accept	Gini
14	0.15 ± 0.05	0.11 ± 0.01	0.08 ± 0.02	0.07 ± 0.02	0.13 ± 0.03	0.17 ± 0.05	0.06 ± 0.03	0.033 ± 0.007	0.012 ± 0.010	0.020 ± 0.007	0.05 ± 0.02	0.07 ± 0.04	W Africa F	E Europe M	0.37
15	0.16 ± 0.05	0.14 ± 0.01	0.12 ± 0.03	0.10 ± 0.02	0.19 ± 0.03	0.20 ± 0.05	0.09 ± 0.04	0.072 ± 0.009	0.02 ± 0.01	0.026 ± 0.008	0.07 ± 0.02	0.14 ± 0.05	W Africa F	E Europe M	0.31
16	0.21 ± 0.05	0.20 ± 0.01	0.18 ± 0.03	0.15 ± 0.02	0.28 ± 0.03	0.25 ± 0.05	0.16 ± 0.05	0.11 ± 0.01	0.04 ± 0.01	0.05 ± 0.01	0.12 ± 0.03	0.18 ± 0.04	S E Asia F	E Europe M	0.27
17	0.23 ± 0.05	0.28 ± 0.01	0.26 ± 0.03	0.21 ± 0.02	0.34 ± 0.03	0.29 ± 0.06	0.22 ± 0.06	0.19 ± 0.01	0.06 ± 0.02	0.12 ± 0.01	0.20 ± 0.03	0.28 ± 0.05	S E Asia F	E Europe M	0.19
18	0.36 ± 0.05	0.34 ± 0.01	0.33 ± 0.03	0.27 ± 0.02	0.44 ± 0.02	0.38 ± 0.05	0.33 ± 0.06	0.28 ± 0.01	0.13 ± 0.02	0.15 ± 0.02	0.32 ± 0.03	0.33 ± 0.04	S E Asia F	E Europe M	0.16
19	0.40 ± 0.04	0.42 ± 0.01	0.40 ± 0.02	0.35 ± 0.02	0.48 ± 0.02	0.44 ± 0.05	0.39 ± 0.05	0.37 ± 0.01	0.20 ± 0.03	0.26 ± 0.02	0.41 ± 0.03	0.43 ± 0.04	S E Asia F	E Europe M	0.11
20	0.49 ± 0.04	0.51 ± 0.01	0.47 ± 0.02	0.43 ± 0.02	0.56 ± 0.02	0.50 ± 0.04	0.52 ± 0.04	0.49 ± 0.01	0.31 ± 0.03	0.36 ± 0.02	0.54 ± 0.03	0.53 ± 0.04	S E Asia F	E Europe M	0.09
21	0.54 ± 0.04	0.58 ± 0.01	0.55 ± 0.02	0.49 ± 0.02	0.63 ± 0.02	0.60 ± 0.04	0.61 ± 0.04	0.61 ± 0.01	0.47 ± 0.03	0.45 ± 0.02	0.63 ± 0.02	0.66 ± 0.04	W Africa M	S Asia M	0.07
22	0.62 ± 0.04	0.643 ± 0.009	0.61 ± 0.02	0.56 ± 0.01	0.68 ± 0.02	0.66 ± 0.03	0.73 ± 0.04	0.72 ± 0.01	0.58 ± 0.03	0.58 ± 0.02	0.74 ± 0.02	0.73 ± 0.03	S E Asia M	S Asia F	0.06
23	0.62 ± 0.03	0.719 ± 0.008	0.69 ± 0.02	0.62 ± 0.01	0.76 ± 0.02	0.67 ± 0.03	0.76 ± 0.03	0.79 ± 0.01	0.71 ± 0.02	0.67 ± 0.01	0.82 ± 0.02	0.80 ± 0.03	S E Asia M	S Asia F	0.06
24	0.70 ± 0.03	0.759 ± 0.007	0.75 ± 0.01	0.67 ± 0.01	0.79 ± 0.01	0.71 ± 0.03	0.82 ± 0.03	0.845 ± 0.009	0.80 ± 0.02	0.76 ± 0.01	0.86 ± 0.02	0.86 ± 0.02	S E Asia M	S Asia F	0.05
25	0.72 ± 0.03	0.810 ± 0.007	0.81 ± 0.01	0.706 ± 0.010	0.83 ± 0.01	0.75 ± 0.02	0.90 ± 0.02	0.902 ± 0.006	0.87 ± 0.01	0.835 ± 0.009	0.91 ± 0.01	0.90 ± 0.02	S E Asia M	S Asia F	0.05
26	0.77 ± 0.03	0.850 ± 0.006	0.840 ± 0.009	0.748 ± 0.008	0.87 ± 0.01	0.80 ± 0.02	0.91 ± 0.02	0.932 ± 0.005	0.90 ± 0.01	0.877 ± 0.007	0.94 ± 0.01	0.93 ± 0.01	S E Asia M	S Asia F	0.04
27	0.81 ± 0.02	0.881 ± 0.005	0.885 ± 0.008	0.783 ± 0.008	0.893 ± 0.009	0.83 ± 0.02	0.94 ± 0.01	0.951 ± 0.005	0.937 ± 0.009	0.908 ± 0.006	0.959 ± 0.009	0.94 ± 0.01	S E Asia M	S Asia F	0.04
28	0.83 ± 0.02	0.908 ± 0.004	0.914 ± 0.007	0.815 ± 0.007	0.913 ± 0.008	0.83 ± 0.02	0.96 ± 0.01	0.964 ± 0.004	0.965 ± 0.006	0.936 ± 0.005	0.968 ± 0.008	0.959 ± 0.010	S E Asia M	S Asia F	0.04
29	0.88 ± 0.02	0.929 ± 0.004	0.938 ± 0.006	0.833 ± 0.006	0.928 ± 0.009	0.87 ± 0.01	0.978 ± 0.009	0.978 ± 0.003	0.968 ± 0.006	0.950 ± 0.004	0.978 ± 0.007	0.974 ± 0.007	S E Asia M	S Asia F	0.03
30	0.88 ± 0.02	0.944 ± 0.003	0.954 ± 0.005	0.858 ± 0.006	0.944 ± 0.007	0.88 ± 0.02	0.978 ± 0.010	0.983 ± 0.003	0.977 ± 0.005	0.967 ± 0.003	0.986 ± 0.006	0.977 ± 0.006	S E Asia M	S Asia F	0.03
31	0.90 ± 0.02	0.957 ± 0.003	0.966 ± 0.004	0.888 ± 0.005	0.946 ± 0.007	0.90 ± 0.01	0.984 ± 0.007	0.990 ± 0.002	0.989 ± 0.003	0.975 ± 0.002	0.991 ± 0.005	0.987 ± 0.005	S E Asia M	S Asia F	0.02
32	0.92 ± 0.02	0.965 ± 0.003	0.976 ± 0.004	0.904 ± 0.005	0.965 ± 0.005	0.91 ± 0.01	0.986 ± 0.007	0.990 ± 0.002	0.990 ± 0.003	0.982 ± 0.002	0.984 ± 0.006	0.987 ± 0.004	E Asia M	S Asia F	0.02
33	0.93 ± 0.02	0.972 ± 0.002	0.979 ± 0.004	0.912 ± 0.004	0.968 ± 0.006	0.93 ± 0.01	0.993 ± 0.005	0.993 ± 0.002	0.996 ± 0.002	0.987 ± 0.002	0.992 ± 0.004	0.994 ± 0.003	E Europe M	S Asia F	0.02
34	0.93 ± 0.01	0.977 ± 0.002	0.984 ± 0.003	0.930 ± 0.004	0.975 ± 0.005	0.95 ± 0.01	0.993 ± 0.005	0.994 ± 0.002	0.997 ± 0.002	0.990 ± 0.001	0.995 ± 0.003	0.993 ± 0.004	E Europe M	S Asia F	0.01

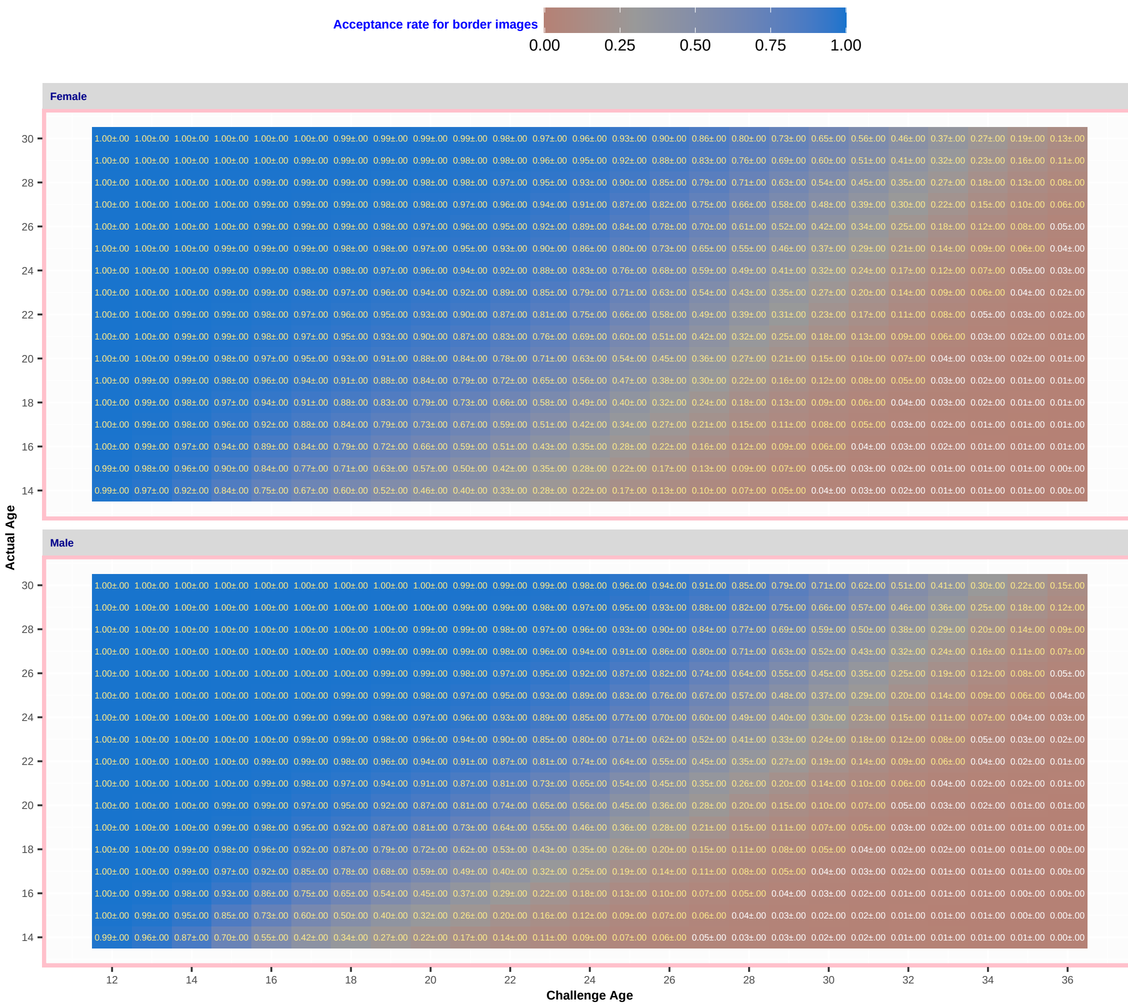

Fig. 27. *For algorithm Dermalog 001 applied border-crossing photos, the heatmap and text shows proportion of photos of the persons of an actual age are accepted at a particular challenge age.*

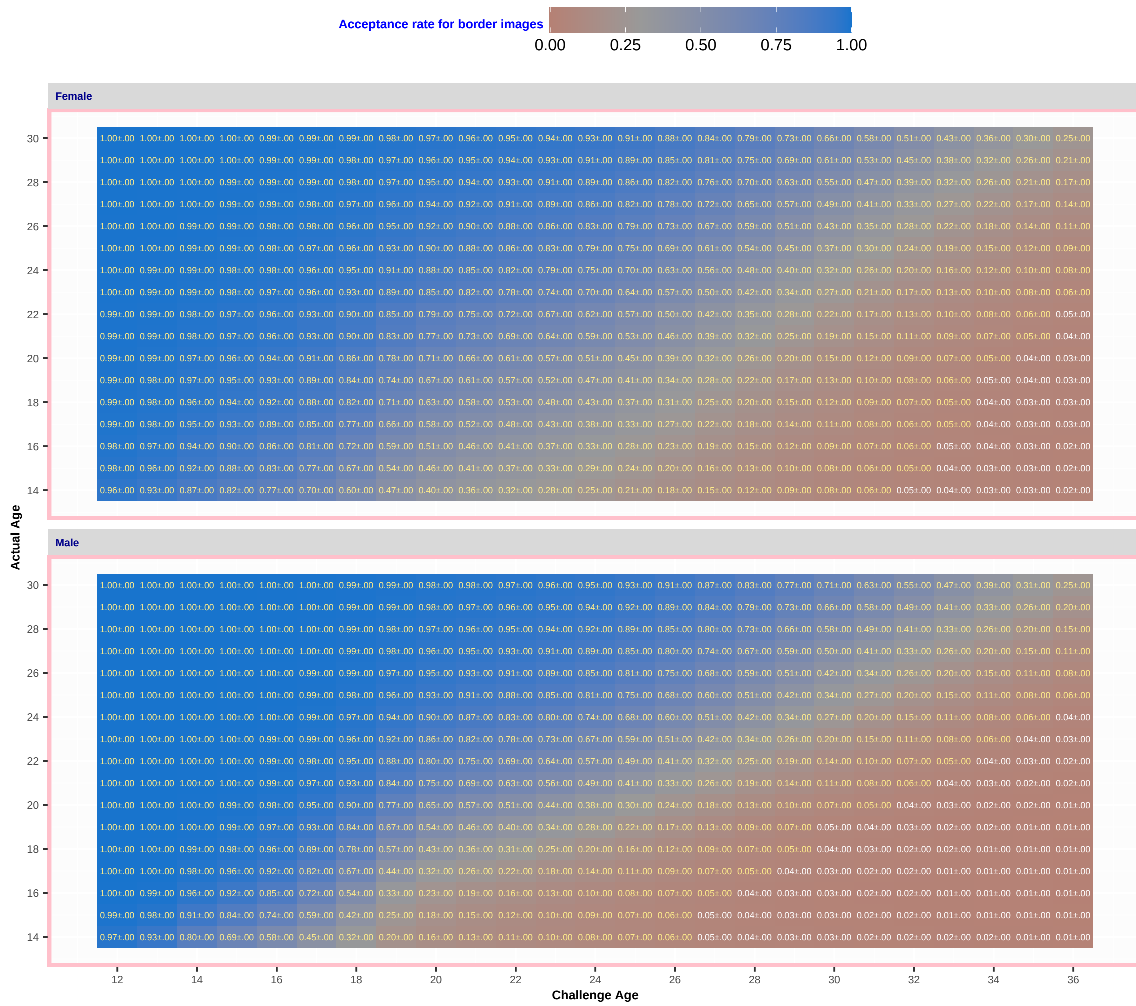

Fig. 28. *For algorithm Incode 000 applied border-crossing photos, the heatmap and text shows proportion of photos of the persons of an actual age are accepted at a particular challenge age.*

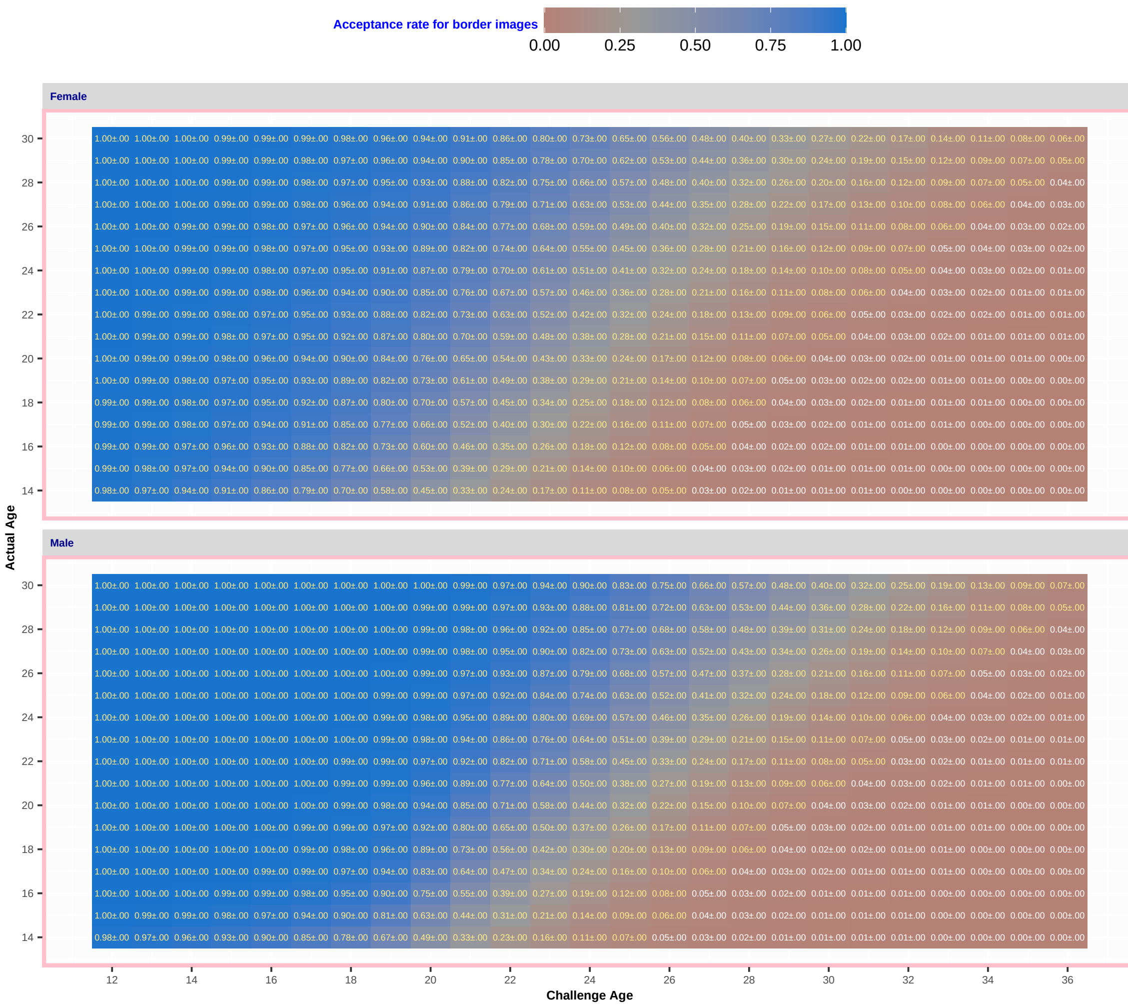

Fig. 29. *For algorithm Neurotechnology 000 applied border-crossing photos, the heatmap and text shows proportion of photos of the persons of an actual age are accepted at a particular challenge age.*

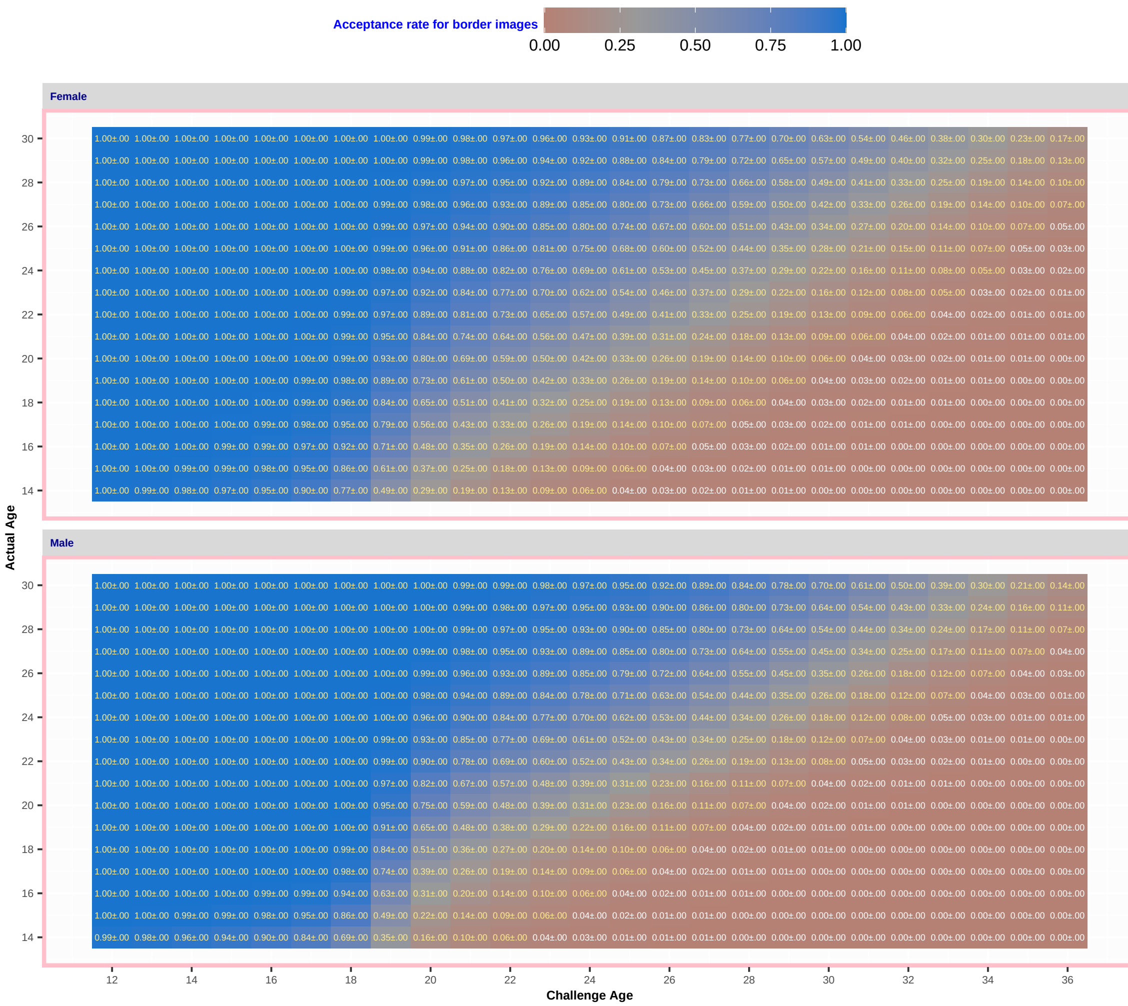

Fig. 30. *For algorithm ROC 000 applied border-crossing photos, the heatmap and text shows proportion of photos of the persons of an actual age are accepted at a particular challenge age.*

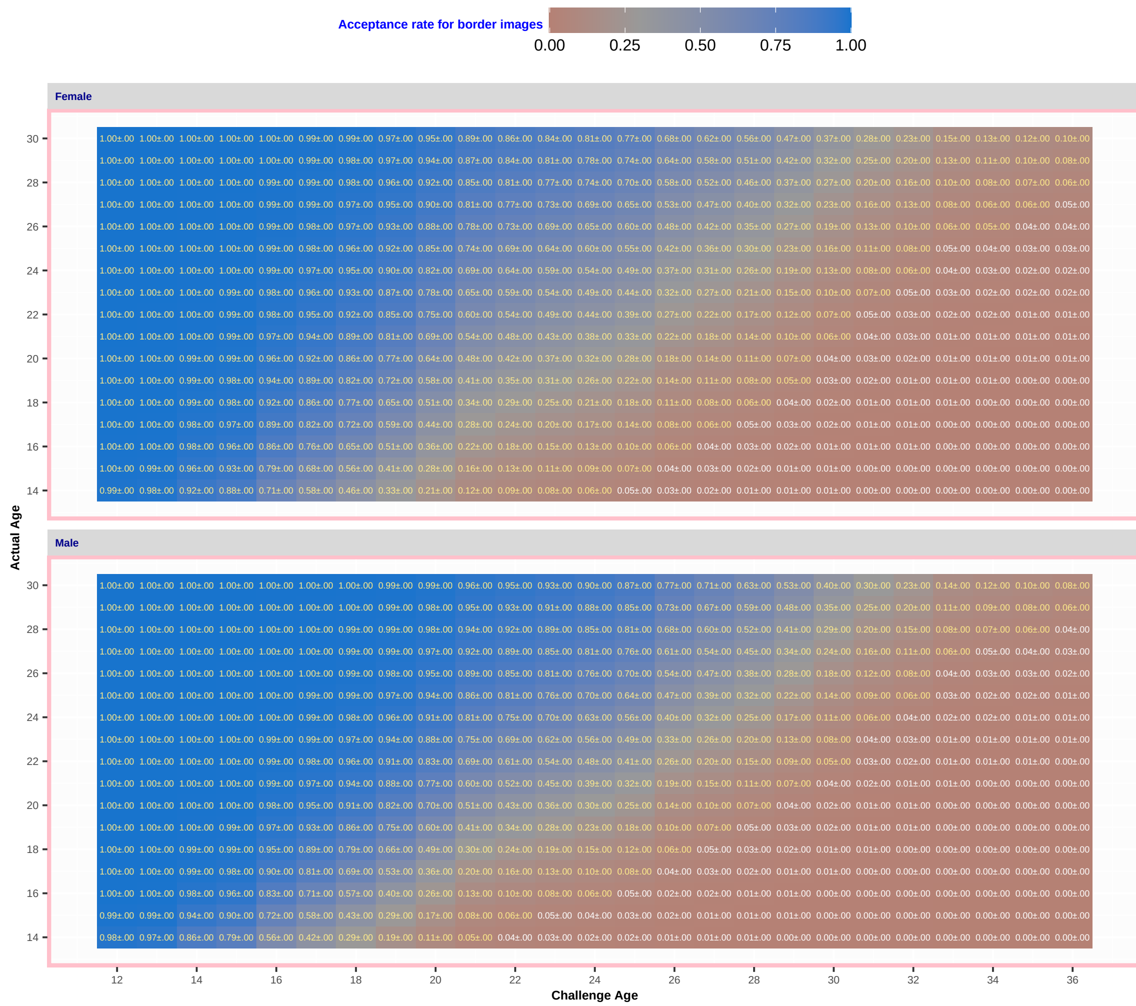

Fig. 31. *For algorithm Unissey 001 applied border-crossing photos, the heatmap and text shows proportion of photos of the persons of an actual age are accepted at a particular challenge age.*

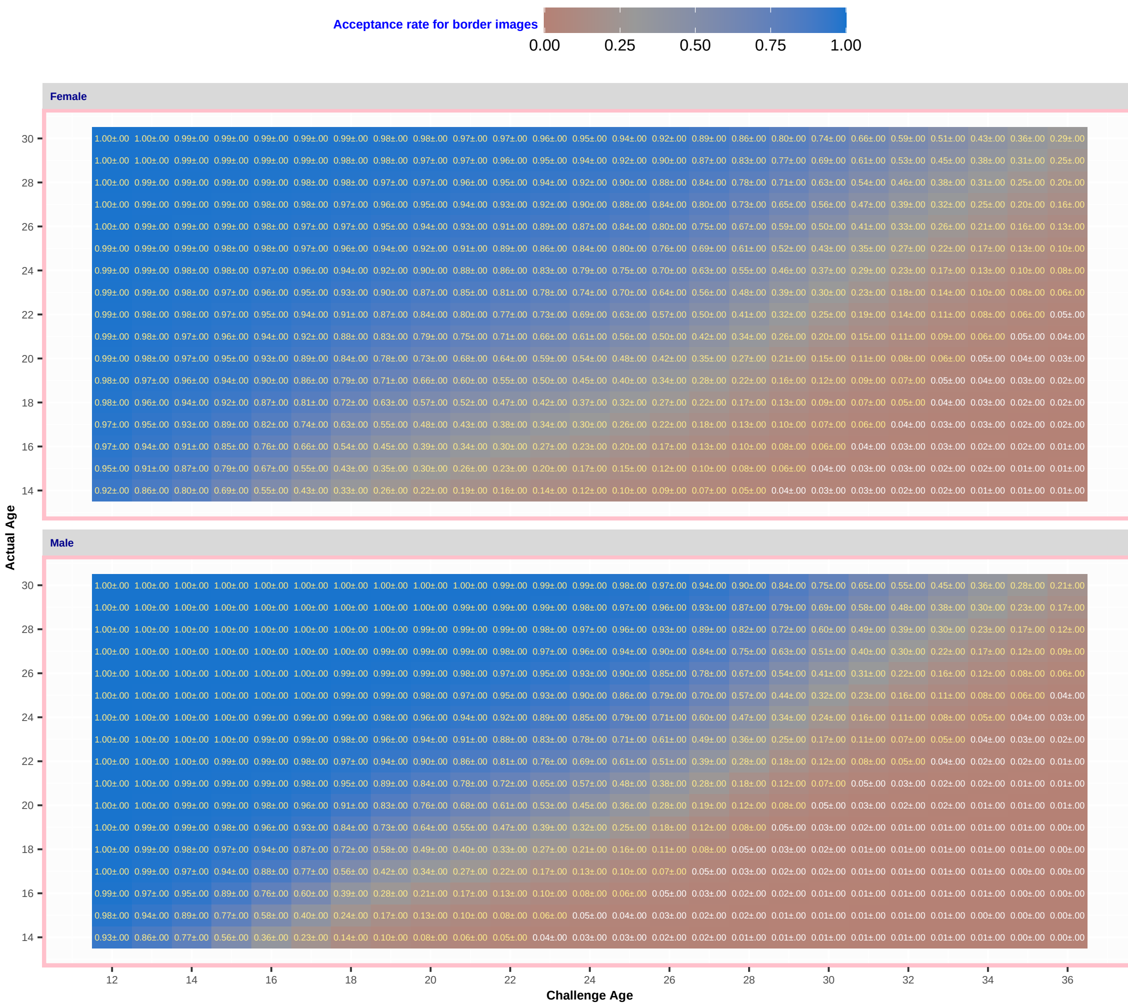

Fig. 32. *For algorithm Yoti 001 applied border-crossing photos, the heatmap and text shows proportion of photos of the persons of an actual age are accepted at a particular challenge age.*