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Comparative analysis of features extraction techniques for black face age estimation

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Abstract

A computer-based age estimation is a technique that predicts an individual's age based on visual traits derived by analyzing a 2D picture of the individual's face. Age estimation is critical for access control, e-government, and effective human–computer interaction. The other-race effect has the potential to cause techniques designed for white faces to underperform when used in a region with black faces. The outcome is the consequence of intermittent training with faces of the same race and the encoding structure of the trained face images, which is based on the feature extraction technique used. This study contributes to a constructive comparison of three feature-extraction techniques, namely, local binary pattern (LBP), Gabor Wavelet (GW), and wavelet transformation, used in the development of a genetic algorithm (GA)-artificial neural network (ANN)-based age estimation system. The feature extraction techniques used are proven to produce a wealth of shape and textural information. The GA-ANN constitutes the age classifier module. The correct classification rate was chosen as the performance metrics in this study. The results demonstrated that the LBP is a more robust representation of the black face than the GW and Wavelet transformations, as evidenced by its

accuracy rate of 91.76 compared to 89.41 and 84.71 achieved with the GW and Wavelet transformation age estimation systems, respectively.

Availability of data and materials

Not applicable.

Code availability

Not applicable.

References

- Adeloye D, Thompson JY, Akanbi MA, Azuh D, Samuel V, Omoregbe N, Ayo CK (2016) The burden of road traffic crashes, injuries and deaths in Africa: a systematic review and meta-analysis. Bull World Health Organ 94(7):510

  Article Google Scholar

- Angulu R, Tapamo JR, Adewumi AO (2018a) Age estimation with local ternary directional patterns. Image Video Technol. https://doi.org/10.1007/978-3-319-75786-5_34

  Article Google Scholar

- Angulu R, Tapamo JR, Adewumi AO (2018b) Age-group estimation using feature and decision level fusion. Comput J 62(3):346–358. https://doi.org/10.1093/comjnl/bxy050

  MathSciNet Article Google Scholar

- Babatunde RS, Olabiyisi SO, Omidiora EO, Ganiyu RA (2014) Feature dimensionality reduction using a dual level metaheuristic algorithm. Int J Appl Inf Syst 7(1):49–52. https://doi.org/10.5120/ijais14-451134

  Article Google Scholar

- Brown TI, Uncapher MR, Chow TE, Eberhardt JL, Wagner AD (2017) Cognitive control, attention, and the other race effect in memory. PLoS One. https://doi.org/10.1371/journal.pone.0173579

Article **Google Scholar**

- Caldara R, Abdi H (2006) Simulating the 'other-race' effect with autoassociative neural networks: further evidence in favor of the face-space model. Perception 35(5):659–670. https://doi.org/10.1068/p5360

Article **Google Scholar**

- Chang K-Y, Chen C-S, Hung Y-P (2011) Ordinal hyperplanes ranker with cost sensitivities for age estimation. CVPR. https://doi.org/10.1109/cvpr.2011.5995437

Article **Google Scholar**

- Chen J, Zhu X (2019) The cross-race effect on face recognition and judgments of learning. In: Proceedings of the 3rd international conference on culture, education and economic development of modern society (ICCESE 2019). https://doi.org/10.2991/iccese-19.2019.147
- Chen K, Gong S, Xiang T, Loy CC (2013) Cumulative attribute space for age and crowd density estimation. In: 2013 IEEE conference on computer vision and pattern recognition. https://doi.org/10.1109/cvpr.2013.319
- Chen S, Zhang C, Dong M, Le J, Rao M (2017) Using ranking-CNN for age estimation. In: 2017 IEEE conference on computer vision and pattern recognition (CVPR). https://doi.org/10.1109/cvpr.2017.86
- Daisy MMH, Kannan P (2020) Investigation of rotated local Gabor features in face recognition using fusion techniques. J Ambient Intell Humaniz Comput 12(6):5895–5908. https://doi.org/10.1007/s12652-020-02134-4

Article **Google Scholar**

- Dalziel A (2021) Age fraud and African football. Footiecentral. https://www.footiecentral.com/20210404/age-fraud-and-african-football/. Accessed 16 Oct 2021
- Demontis A, Biggio B, Fumera G, Roli F (2015) Super-Sparse regression for fast age estimation from faces at Test Time. In: Image analysis and processing—ICIAP 2015, pp 551–562. https://doi.org/10.1007/978-3-319-23234-8_51
- Deng Y, Teng S, Fei L, Zhang W, Rida I (2021) A multifeature learning and Fusion Network for Facial Age estimation. Sensors 21(13):4597. https://doi.org/10.3390/s21134597

Article **Google Scholar**

- Drozdowski P, Prommegger B, Wimmer G, Schraml R, Rathgeb C, Uhl A, Busch C (2021) Demographic bias: a challenge for fingervein recognition systems? In: 2020 28th European signal processing conference (EUSIPCO). https://doi.org/10.23919/eusipco47968.2020.9287722
- Duan M, Li K, Yang C, Li K (2018) A hybrid deep learning CNN–elm for age and gender classification. Neurocomputing 275:448–461. https://doi.org/10.1016/j.neucom.2017.08.062

Article **Google Scholar**

- Geng X, Fu Y, Smith-Miles K (2010) Automatic facial age estimation, conference of artificial intelligence, Deagu, 2010
- Ghasemi F, Mehridehnavi A, Pérez-Garrido A, Pérez-Sánchez H (2018) Neural network and deep-learning algorithms used in QSAR studies: merits and drawbacks. Drug Discov Today 23(10):1784–1790. https://doi.org/10.1016/j.drudis.2018.06.016

Article **Google Scholar**

- Guo G, Mu G (2014) A framework for joint estimation of age, gender and ethnicity on a large database. Image vis Comput 32(10):761–770. https://doi.org/10.1016/j.imavis.2014.04.011

Article **Google Scholar**

- Han H, Otto C, Jain AK (2013) Age estimation from face images: human vs. machine performance. In: 2013 international conference on biometrics (ICB). https://doi.org/10.1109/icb.2013.6613022
- Hasan NF, Mahdi SQ (2020) Facial features extraction using LBP for human age estimation based on SVM Classifier. In: 2020 international conference on computer science and software engineering (CSASE). https://doi.org/10.1109/csase48920.2020.9142085
- Hosseini S, Lee SH, Kwon HJ, Koo HI, Cho NI (2018) Age and gender classification using wide convolutional neural network and Gabor Filter. In: 2018 international workshop on advanced image technology (IWAIT). https://doi.org/10.1109/iwait.2018.8369721
- Ji Z, Lang C, Li K, Xing J (2018) Deep age estimation model stabilization from images to videos. In: 2018 24th international conference on pattern recognition (ICPR). https://doi.org/10.1109/icpr.2018.8545283
- Jin Y, Ruan Q-Q (2007) Gabor-based improved locality preserving projections for face recognition. In: 2007 IEEE international conference on image processing. https://doi.org/10.1109/icip.2007.4378914
- Kang J, Kim C, Lee Y, Cho S, Park K (2018) Age estimation robust to optical and motion blurring by deep residual CNN. Symmetry 10(4):108. https://doi.org/10.3390/sym10040108

Article **Google Scholar**

- Li K, Xing J, Hu W, Maybank SJ (2017) D2C: deep cumulatively and comparatively learning for human age estimation. Pattern Recogn 66:95–105. https://doi.org/10.1016/j.patcog.2017.01.007

Article **Google Scholar**

- Munyoro I (2018) Research data collection in challenging environments: barriers to studying the performance of Zimbabwe's parliamentary constituency information Centres (PCICs). Afr J Inf Commun 21:81–95

Google Scholar

- Nam SH, Kim YH, Truong NQ, Choi J, Park KR (2020) Age estimation by super-resolution reconstruction based on adversarial networks. IEEE Access 8:17103–17120. https://doi.org/10.1109/access.2020.2967800

Article **Google Scholar**

- Nel E, Rich E, Morojele N, Harker Burnhams N, Petersen Williams P, Parry C (2017) Data collection challenges experienced while conducting the International alcohol control study (IAC) in Tshwane, South Africa. Drugs Educ Prev Policy 24(5):376–383

Article **Google Scholar**

- Ojala T, Pietikainen M, Maenpaa T (2002) Multiresolution gray-scale and rotation invariant texture classification with local binary patterns. IEEE Trans Pattern Anal Mach Intell 24(7):971–987. https://doi.org/10.1109/tpami.2002.1017623

Article **MATH** **Google Scholar**

- Oladele M, Omidiora E, Afolabi A (2016) A face-based age estimation system using back propagation neural network technique. Br J Math Comput Sci 13(5):1–9. https://doi.org/10.9734/bjmcs/2016/22869

Article **Google Scholar**

- Oladele M (2016) A face-based age estimation system using back propagation neural network technique. Dissertation, Ladoke Akintola University of Technology
- Oladipo O, Osamor IP, Osamor VC, Abiodun TN, Omoremi AO, Odim MO, Ekpo RH (2019) Face-age modeling: A pattern recognition analysis for age estimation. In: 2019 IEEE international conference on bioinformatics and biomedicine (BIBM). https://doi.org/10.1109/bibm47256.2019.8983347
- Omidiora E, Oladele M, Adepoju T, Sobowale A, Olatoke O (2016) Comparative analysis of back propagation neural network and self-organizing feature map in estimating age groups using facial features.

Br J Appl Sci Technol 15(1):1–7. https://doi.org/10.9734/bjast/2016/24303

Article **Google Scholar**

- Onapajo H (2014) Violence and votes in Nigeria: the dominance of incumbents in the use of violence to rig elections. Afr Spectr 49(2):27–51

Article **Google Scholar**

- Osamor IP, Osamor VC (2020) OsamorSoft: clustering index for comparison and quality validation in high throughput dataset. J Big Data 7(1):1–13

Article **Google Scholar**

- Pan Z, Li Z, Fan H, Wu X (2017) Feature based local binary pattern for rotation invariant texture classification. Expert Syst Appl 88:238–248. https://doi.org/10.1016/j.eswa.2017.07.007

Article **Google Scholar**

- Phillips PJ, Jiang F, Narvekar A, Ayyad J, O'Toole AJ (2011) An other-race effect for face recognition algorithms. ACM Trans Appl Percept 8(2):1–11. https://doi.org/10.1145/1870076.1870082

Article **Google Scholar**

- Pirlea F (2019) https://blogs.worldbank.org/opendata/birth-registration-less-50-many-african-countries. Accessed 20 Nov 2021
- Qawaqneh Z, Mallouh AA, Barkana BD (2017) Age and gender classification from speech and face images by jointly fine-tuned deep neural networks. Expert Syst Appl 85:76–86. https://doi.org/10.1016/j.eswa.2017.05.037

Article **Google Scholar**

- Rattani A, Reddy N, Derakhshani R (2018) Convolutional neural networks for gender prediction from smartphone-based ocular images. IET Biometrics 7(5):423–430. https://doi.org/10.1049/iet-bmt.2017.0171

Article **Google Scholar**

- Rodríguez P, Cucurull G, Gonfaus JM, Roca FX, Gonzàlez J (2017) Age and gender recognition in the wild with deep attention. Pattern Recogn 72:563–571. https://doi.org/10.1016/j.patcog.2017.06.028

Article **Google Scholar**

- Samad R, Sawada H (2011) Extraction of the minimum number of Gabor wavelet parameters for the recognition of natural facial expressions. Artif Life Robot 16(1):21–31. https://doi.org/10.1007/s10015-011-0871-6

Article **Google Scholar**

- Shen L, Bai L (2006) A review on Gabor wavelets for face recognition. Pattern Anal Appl 9(2–3):273–292. https://doi.org/10.1007/s10044-006-0033-y

MathSciNet **Article** **Google Scholar**

- Sokoh GC (2017) Age falsification and its impact on continuity and service delivery in the delta state civil service. IOSR J Humanit Soc Sci IOSR-JHSS 22:52–63

Google Scholar

- Tosam M (2015) The ethical and social implications of age-cheating in Africa. Int J Philos 3:1. https://doi.org/10.11648/j.ijp.20150301.11

Article **Google Scholar**

- Tripathi RK, Jalal AS (2021) Novel local feature extraction for age invariant face recognition. Expert Syst Appl 175:114786. https://doi.org/10.1016/j.eswa.2021.114786

Article **Google Scholar**

- Tumang B (2009) Age cheating: the scourge of Africa. Bleacher report. https://bleacherreport.com/articles/217628-age-cheating-the-scourge-of-africa. Accessed 20 Oct 2021
- Wan J, Tan Z, Lei Z, Guo G, Li SZ (2018) Auxiliary demographic information assisted age estimation with cascaded structure. IEEE Trans Cybern 48(9):2531–2541. https://doi.org/10.1109/tcyb.2017.2741998

Article **Google Scholar**

- Wang X, Kambhamettu C (2015) Age estimation via unsupervised neural networks. In: 2015 11th IEEE international conference and workshops on automatic face and gesture recognition (FG). https://doi.org/10.1109/fg.2015.7163119
- Woryi P (2018) 10 problems of research in Nigeria and possible solutions. Infoguide Nigeria. https://infoguidenigeria.com/problems-research-nigeria/ Accessed 20 Oct 2021
- Xu X, Li Y, Wu QM (2019) A multiscale hierarchical threshold-based completed local entropy binary pattern for texture classification. Cogn Comput 12(1):224–237. https://doi.org/10.1007/s12559-019-09673-9

Article **Google Scholar**

- Yi D, Lei Z, Li SZ (2015) Age estimation by multi-scale convolutional network. In: Computer vision—ACCV 2014, pp 144–158. https://doi.org/10.1007/978-3-319-16811-1_10
- Yoo BI, Kwak Y, Kim Y, Choi C, Kim J (2018) Deep facial age estimation using conditional multitask learning with weak label expansion. IEEE Signal Process Lett 25(6):808–812. https://doi.org/10.1109/lsp.2018.2822241

Article **Google Scholar**

- Zaghbani S, Boujneh N, Bouhlel MS (2018) Age estimation using deep learning. Comput Electr Eng 68:337–347. https://doi.org/10.1016/j.compeleceng.2018.04.012

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Contributions

VCO and EOO conceived the idea of the work. VCO and EOO designed the work OO, and VCO participated in the experiment execution. VCO, OO and EOO participated in writing of the manuscript. VCO and EOO supervised the work. All the authors reviewed the manuscript and approved it for submission.

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Ethics declarations

Conflict of interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethics approval

Not applicable.

Consent to participate

Not applicable.

Consent for publication

Not applicable.

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- **Black face**
- **Age estimation**
- **Local binary pattern**
- **Gabor wavelet**
- **Wavelet transformation**