

- [28] Kim K, Kang S, Chi S, *et al.* Human age estimation using multi-class SVM. In: Proc. of the Int'l Conf. on Ubiquitous Robots and Ambient Intelligence. 2015. 370–372. [doi: 10.1109/URAI.2015.7358911]
- [29] Zhang C, Guo G. Age estimation with expression changes using multiple aging subspaces. In: Proc. of the IEEE Int'l Conf. on Biometrics: Theory, Applications and Systems. 2013. 1–6. [doi: 10.1109/BTAS.2013.6712720]
- [30] Li Z, Fu Y, Huang T. A robust framework for multi-view age estimation. In: Proc. of the Int'l Conf. on Computer Vision and Pattern Recognition Workshops. 2010. 9–16. [doi: 10.1109/CVPRW.2010.5543813]
- [31] Guo G, Mu G, Fu Y, *et al.* A study on automatic age estimation using a large database. In: Proc. of the 12th IEEE Int'l Conf. on Computer Vision. 2009. 1986–1991. [doi: 10.1109/ICCV.2009.5459438]
- [32] Wang X, Guo G. A study on human age estimation under facial expression changes. In: Proc. of the IEEE Int'l Conf. on Computer Vision and Pattern Recognition. 2012. 2547–2553. [doi: 10.1109/CVPR.2012.6247972]
- [33] Guo G, Mu G, Fu Y, *et al.* Human age estimation using bio-inspired features. In: Proc. of the IEEE Conf. on Computer Vision and Pattern Recognition. 2009. 112–119. [doi: 10.1109/CVPR.2009.5206681]
- [34] Torrisi A, Farinella GM, Puglisi G, *et al.* Selecting discriminative CLBP patterns for age estimation. In: Proc. of the IEEE Int'l Conf. on Multimedia & Expo Workshops. 2015. 1–6. [doi: 10.1109/ICMEW.2015.7169755]
- [35] Yu Q, Du JY. Age estimation of facial image based on an improved non-negative matrix factorization algorithm. Journal of Image and Graphics, 2008,13(10):1865–1868 (in Chinese with English abstract). [doi: 10.11834/jig.20091029]
- [36] Du JY, Zhai CM, Shang L. Age automation estimation based on a ICA coefficient sparse description algorithm. Journal of Image and Graphics, 2009,14(10):2102–2105 (in Chinese with English abstract). [doi: 10.11834/jig.20091029]
- [37] Lu J, Liong VE, Zhou J. Cost-sensitive local binary feature learning for facial age estimation. IEEE Trans. on Image Processing, 2015,24(12):5356–5368. [doi: 10.1109/TIP.2015.2481327]
- [38] Geng X, Yin C, Zhou ZH. Facial age estimation by learning from label distributions. IEEE Trans. on Pattern Analysis & Machine Intelligence, 2013,35(10):2401–2412. [doi: 10.1109/TPAMI.2013.51]
- [39] Geng X, Wang Q, Xia Y. Facial age estimation by adaptive label distribution learning. In: Proc. of the 22nd IEEE Int'l Conf. on Pattern Recognition. 2014. 4465–4470. [doi: 10.1109/ICPR.2014.764]
- [40] Huo Z, Yang X, Xing C, *et al.* Deep age distribution learning for apparent age estimation. In: Proc. of the IEEE Conf. on Computer Vision and Pattern Recognition Workshops. 2016. 17–24. [doi: 10.1109/CVPRW.2016.95]
- [41] Yang X, Gao B, Xing C, *et al.* Deep label distribution learning for apparent age estimation. In: Proc. of the IEEE Int'l Conf. on Computer Vision Workshop. 2015. 344–350. [doi: 10.1109/ICCVW.2015.53]
- [42] Li C, Liu Q, Liu J, *et al.* Learning distance metric regression for facial age estimation. In: Proc. of the 21st IEEE Int'l Conf. on Pattern Recognition. 2012. 2327–2330.
- [43] Tian Q, Chen S, Qiao L. Ordinal margin metric learning and its extension for cross-distribution image data. Information Sciences, 2016,349:50–64. [doi: 10.1016/j.ins.2016.02.033]
- [44] Tian Q, Chen S. Cross-heterogeneous-database age estimation with co-representation among them. In: Proc. of the Int'l Conf. on Pattern Recognition. 2016. 1333–1338. [doi: 10.1109/ICPR.2016.7899822]
- [45] Suo J, Wu T, Zhu S, *et al.* Design sparse features for age estimation using hierarchical face model. In: Proc. of the 8th IEEE Int'l Conf. on Automatic Face & Gesture Recognition. 2008. 1–6. [doi: 10.1109/AFGR.2008.4813314]
- [46] Chen C, Yang W, Wang Y, *et al.* Learning gabor features for facial age estimation. In: Sun Z, Lai Z, Chen X, Tan T, eds. Biometric Recognition. Lecture Notes in Computer Science, Beijing, 2011. 204–213. [doi: 10.1007/978-3-642-25449-9_26]
- [47] Chen K, Gong S, Xiang T, *et al.* Cumulative attribute space for age and crowd density estimation. In: Proc. of the IEEE Int'l Conf. on Computer Vision and Pattern Recognition. 2013. 2467–2474. [doi: 10.1109/CVPR.2013.319]
- [48] Zhu Y, Li Y, Mu G, *et al.* A study on apparent age estimation. In: Proc. of the IEEE Int'l Conf. on Computer Vision Workshop. 2015. 267–273. [doi: 10.1109/ICCVW.2015.43]
- [49] Tian Q, Chen S. Cumulative attribute relation regularization learning for human age estimation. Neurocomputing, 2015,165: 456–467. [doi: 10.1016/j.neucom.2015.03.078]
- [50] Fernández C, Huerta I, Prati A. A comparative evaluation of regression learning algorithms for facial age estimation. In: Ji Q, Moeslund TB, Hua G, Nasrollahi K, eds. Face and Facial Expression Recognition from Real World Videos. Lecture Notes in Computer Science, Stockholm, 2015. 133–144. [doi: 10.1007/978-3-319-13737-7_12]
- [51] Liang Y, Liu L, Xu Y, *et al.* Multi-task GLOH feature selection for human age estimation. In: Proc. of the 18th IEEE Int'l Conf. on Image Processing. 2011. 565–568. [doi: 10.1109/ICIP.2011.6116611]
- [52] Lu J, Tan Y. Fusing shape and texture information for facial age estimation. In: Proc. of the IEEE Int'l Conf. on Acoustics, Speech, and Signal Processing. 2011. 1477–1480. [doi: 10.1109/ICASSP.2011.5946772]

- [53] Lu J, Tan Y. Ordinary preserving manifold analysis for human age estimation. In: Proc. of the IEEE Computer Society Conf. on Computer Vision and Pattern Recognition Workshops. 2010. 90–95. [doi: 10.1109/TSMCC.2012.2192727]
- [54] Lu J, Tan Y. Ordinary preserving manifold analysis for human age and head pose estimation. IEEE Trans. on Human-machine Systems, 2013,43(2):249–258. [doi: 10.1109/TSMCC.2012.2192727]
- [55] Geng X, Zhou ZH, Zhang Y, *et al.* Learning from facial aging patterns for automatic age estimation. In: Proc. of the 14th ACM Int'l Conf. on Multimedia. 2006. 307–316. [doi: 10.1145/1180639.1180711]
- [56] Xiao B, Yang XK, Xu Y, *et al.* Learning distance metric for regression by semidefinite programming with application to human age estimation. In: Proc. of the 17th ACM Int'l Conf. on Multimedia. 2009. 451–460. [doi: 10.1145/1631272.1631334]
- [57] Liu X, Li S, Kan M, *et al.* AgeNet: Deeply learned regressor and classifier for robust apparent age estimation. In: Proc. of the IEEE Int'l Conf. on Computer Vision Workshop. 2015. 258–266. [doi: 10.1109/ICCVW.2015.42]
- [58] Guo G, Fu Y, Dyer C, *et al.* A probabilistic fusion approach to human age prediction. In: Proc. of the IEEE Computer Society Conf. on Computer Vision & Pattern Recognition Workshops. 2008. 1–6. [doi: 10.1109/CVPRW.2008.4563041]
- [59] Zhang Y, Zhou ZH. A new age estimation method based on ensemble learning. ACTA Automatica Sinica, 2008,34(8):997–1000 (in Chinese with English abstract). [doi: 10.3724/SP.J.1004.2008.00997]
- [60] Guo, G, Fu, Y, Dyer C, *et al.* Image-based human age estimation by manifold learning and locally adjusted robust regression. IEEE Trans. on Image Processing, 2008,17(7):1178–1188. [doi: 10.1109/TIP.2008.924280]
- [61] Guo, G, Fu, Y, Huang T, *et al.* Locally adjusted robust regression for human age estimation. In: Proc. of the IEEE Workshop on Application of Computer Vision. 2008. 1–6. [doi: 10.1109/WACV.2008.4544009]
- [62] Shu X, Tang J, Lai H, *et al.* Personalized age progression with aging dictionary. In: Proc. of the IEEE Int'l Conf. on Computer Vision. 2015. 3970–3978. [doi: 10.1109/ICCV.2015.452]
- [63] Guo G, Mu G. Joint estimation of age, gender and ethnicity: CCA vs. PLS. In: Proc. of the 10th IEEE Int'l Conf. and Workshops on Automatic Face and Gesture Recognition. 2013. 1–6. [doi: 10.1109/FG.2013.6553737]
- [64] Guo G, Mu G. A framework for joint estimation of age, gender and ethnicity on a large database. Image & Vision Computing, 2014,32(10):761–770. [doi: 10.1016/j.imavis.2014.04.011]
- [65] Guo G, Mu G. A study of large-scale ethnicity estimation with gender and age variations. In: Proc. of the IEEE Int'l Conf. on Computer Vision and Pattern Recognition Workshops. 2010. 79–86. [doi: 10.1109/CVPRW.2010.5543608]
- [66] Andrew YN, Michael IJ. On discriminative vs. generative classifiers: A comparison of logistic regression and naïve Bayes. In: Proc. of the Neural Information Processing Systems. 2002. 605–610.
- [67] Eidinger E, Enbar R, Hassner T. Age and gender estimation of unfiltered faces. IEEE Trans. on Information Forensics & Security, 2014,9(12):2170–2179. [doi: 10.1109/TIFS.2014.2359646]
- [68] Chen BC, Chen CS, Hsu WH. Face recognition and retrieval using cross-age reference coding with cross-age celebrity dataset. IEEE Trans. on Multimedia, 2015,17(6):804–815. [doi: 10.1109/TMM.2015.2420374]
- [69] Li K, Xing J, Hu W, *et al.* D2C: Deep cumulatively and comparatively learning for human age estimation. Pattern Recognition, 2017,66:95–105. [doi: 10.1016/j.patcog.2017.01.007]
- [70] Tian Q, Chen S. Joint gender classification and age estimation by nearly orthogonalizing their semantic spaces. Image and Vision computing, 2018,69:9–21. [doi: 10.1016/j.imavis.2017.10.003]
- [71] Xing J, Li K, Hu W, *et al.* Diagnosing deep learning models for high accuracy age estimation from a single image. Pattern Recognition, 2017,66:106–116. [doi: 10.1016/j.patcog.2017.01.005]
- [72] Lu X, Jain A. Ethnicity identification from face images. Int'l Society for Optics and Photonics, 2004,5404:114–123.
- [73] Lu H, Liu J, Li C, *et al.* Learning ordinal discriminative features for age estimation. In: Proc. of the IEEE Conf. on Computer Vision and Pattern Recognition. 2012. 2570–2577. [doi: 10.1109/CVPR.2012.6247975]
- [74] He Z, Li X, Zhang Z, *et al.* Data-dependent label distribution learning for age estimation. IEEE Trans. on Image Processing, 2017, 26(8):3846–3858. [doi: 10.1109/TIP.2017.2655445]
- [75] Rothe R, Timofte R, Gool LV. DEX: Deep expectation of apparent age from a single image. In: Proc. of the IEEE Int'l Conf. on Computer Vision Workshop. 2015. 252–257. [doi: 10.1109/ICCVW.2015.41]
- [76] Rothe R, Timofte R, Gool LV. Deep expectation of real and apparent age from a single image without facial landmarks. Int'l Journal of Computer Vision, 2018,4:144–157. [doi: 10.1007/s11263-016-0940-3]
- [77] Lou Z, Alnajjar F, Alvarez JM, *et al.* Expression-invariant age estimation using structured learning. IEEE Trans. on Pattern Analysis and Machine Intelligence, 2018,40(2):365–375. [doi: 10.1109/TPAMI.2017.2679739]
- [78] Li Y, Peng Z, Liang D, *et al.* Facial age estimation by using stacked feature composition and selection. The Visual Computer, 2016,32(12):1525–1536. [doi: 10.1007/s00371-015-1137-4]

- [79] Niu Z, Zhou M, Wang L, *et al.* Ordinal regression with multiple output CNN for age estimation. In: Proc. of the IEEE Conf. on Computer Vision and Pattern Recognition. 2016. 4920–4928. [doi: 10.1109/CVPR.2016.532]
- [80] Shu X, Tang J, Li Z, *et al.* Personalized age progression with bi-level aging dictionary learning. IEEE Trans. on Pattern Analysis and Machine Intelligence, 2017,40:905–917. [doi: 10.1109/TPAMI.2017.2705122]
- [81] Guo G, Zhang C. A study on cross-population age estimation. In: Proc. of the IEEE Conf. on Computer Vision and Pattern Recognition. 2014. 4257–4263. [doi: 10.1109/CVPR.2014.542]
- [82] Li K, Xing J, Su C, Hu W, *et al.* Deep cost-sensitive and order-preserving feature learning for cross-population age estimation. In: Proc. of the IEEE Int'l Conf. on Computer Vision and Pattern Recognition. 2018. 399–408. [doi: 10.1109/CVPR.2018.00049]
- [83] Guo G, Dyer CR, Fu Y, *et al.* Is gender recognition affected by age? In: Proc. of the 12th IEEE Int'l Conf. on Computer Vision Workshops. 2009. 2032–2039. [doi: 10.1109/ICCVW.2009.5457531]
- [84] Wang Y, Ricanek K, Chen C, *et al.* Gender classification from infants to seniors. In: Proc. of the IEEE Int'l Conf. on Biometrics: Theory Applications and Systems. 2010. 1–6. [doi: 10.1109/BTAS.2010.5634518]
- [85] Lu X, Chen H, Jain AK. Multimodal facial gender and ethnicity identification. In: Zhang D, Jain AK, eds. Advances in Biometrics. Lecture Notes in Computer Science, Hong Kong, 2006. 554–561. [doi: 10.1007/11608288_74]
- [86] Narang N, Bourlai T. Gender and ethnicity classification using deep learning in heterogeneous face recognition. In: Proc. of the Int'l Conf. on Biometrics. 2016. 1–8. [doi: 10.1109/ICB.2016.7550082]
- [87] Ozbulak G, Aytar Y, Ekenel HK. How transferable are CNN-based features for age and gender classification. In: Proc. of the Int'l Conf. of the Biometrics Special Interest Group. 2016. 1–6. [doi: 10.1109/BIOSIG.2016.7736925]
- [88] Levi G. Age and gender classification using convolutional neural networks. In: Proc. of the IEEE Conf. on Computer Vision and Pattern Recognition Workshops. 2015. 34–42. [doi: 10.1109/CVPRW.2015.7301352]
- [89] Uricar M, Timofte R, Rothe R, *et al.* Structured output SVM prediction of apparent age, gender and smile from deep features. In: Proc. of the IEEE Conf. on Computer Vision and Pattern Recognition Workshops. 2016. 730–738. [doi: 10.1109/CVPRW.2016.96]
- [90] Tian Q, Chen S, Tan X. A unified gender-aware age estimation. In: Proc. of the IEEE Conf. on Computer Vision and Pattern Recognition. 2016. 1–8.
- [91] Guo G, Mu G. Simultaneous dimensionality reduction and human age estimation via kernel partial least squares regression. In: Proc. of the IEEE Int'l Conf. on Computer Vision and Pattern Recognition. 2011. 657–664. [doi: 10.1109/CVPR.2011.5995404]
- [92] Yi D, Lei Z, Li SZ. Age estimation by multi-scale convolutional network. In: Cremers D, Reid I, Saito H, Yang MH, eds. Proc. of the Computer Vision-ACCV 2014. Lecture Notes in Computer Science, Singapore, 2014. 144–158. [doi: 10.1007/978-3-319-16811-1_10]

附中文参考文献:

- [1] 陆丽.基于人脸图像的性别识别与年龄估计研究[博士学位论文].上海:上海交通大学,2010.
- [35] 余庆,杜吉祥.基于一种改进的 NMF 算法的人脸年龄估计方法.中国图像图形学报,2008,13(10):1865–1868.
- [36] 杜吉祥,翟传敏,尚丽.基于 ICA 系数稀疏表示的年龄自动估计.中国图像图形学报,2009,14(10):2102–2105.
- [59] 张宇,周志华.基于集成的年龄估计方法.自动化学报,2008,34(8):997–1000.



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