

## REFERENCES

- [1] D. Maltoni, D. Maio, A. K. Jain, and S. Prabhakar, *Handbook of Fingerprint Recognition*, 2nd ed. Springer London, 2009. doi: <https://doi.org/10.1007/978-1-84882-254-2>.
- [2] J. L. J. Jing, T. P. Yi, R. J. C. Bose, J. R. McCarthy, N. Tharmalingam, and T. Madheswaran, “Hand sanitizers: A review on formulation aspects, adverse effects, and regulations,” *International Journal of Environmental Research and Public Health*, vol. 17, no. 9. MDPI AG, May 01, 2020. doi: [10.3390/ijerph17093326](https://doi.org/10.3390/ijerph17093326).
- [3] K. Panetta, S. K. M. Kamath, S. Rajeev, and S. S. Agaian, “LQM: Localized Quality Measure for Fingerprint Image Enhancement,” *IEEE Access*, vol. 7, pp. 104567–104576, 2019, doi: [10.1109/ACCESS.2019.2931980](https://doi.org/10.1109/ACCESS.2019.2931980).
- [4] S. Saponara, A. Elhanashi, and Q. Zheng, “Recreating fingerprint images by convolutional neural network autoencoder architecture,” *IEEE Access*, vol. 9, pp. 147888–147899, 2021, doi: [10.1109/ACCESS.2021.3124746](https://doi.org/10.1109/ACCESS.2021.3124746).
- [5] S. Adiga and J. Sivaswamy, “FPD-M-net: Fingerprint Image Denoising and Inpainting Using M-Net Based Convolutional Neural Networks,” Dec. 2018, [Online]. Available: <http://arxiv.org/abs/1812.10191>
- [6] R. Prabhu, X. Yu, Z. Wang, D. Liu, Anxiao, and Jiang, “U-Finger: Multi-Scale Dilated Convolutional Network for Fingerprint Image Denoising and Inpainting,” Jul. 2018, [Online]. Available: <http://arxiv.org/abs/1807.10993>
- [7] W. Fan, “Deep Encoder-Decoder Neural Network for Fingerprint Image Denoising and Inpainting,” 2020.
- [8] Y. Mansar, “Deep End-to-end Fingerprint Denoising and Inpainting,” Jul. 2018, [Online]. Available: <http://arxiv.org/abs/1807.11888>
- [9] A. Dabouei, S. Soleymani, H. Kazemi, S. M. Iranmanesh, J. Dawson, and N. M. Nasrabadi, “ID Preserving Generative Adversarial Network for Partial Latent Fingerprint Reconstruction,” Jul. 2018, [Online]. Available: <http://arxiv.org/abs/1808.00035>

- [10] W. J. Wong and S. H. Lai, "Multi-task CNN for restoring corrupted fingerprint images," *Pattern Recognition*, vol. 101, May 2020, doi: 10.1016/j.patcog.2020.107203.
- [11] J. Svoboda, F. Monti, and M. M. Bronstein, "Generative Convolutional Networks for Latent Fingerprint Reconstruction," May 2017, [Online]. Available: <http://arxiv.org/abs/1705.01707>
- [12] H. Zhao, O. Gallo, I. Frosio, and J. Kautz, "Loss Functions for Neural Networks for Image Processing," Nov. 2015, [Online]. Available: <http://arxiv.org/abs/1511.08861>
- [13] S. Adiga and J. Sivaswamy, "FPD-M-net: Fingerprint Image Denoising and Inpainting Using M-Net Based Convolutional Neural Networks," Dec. 2018, [Online]. Available: <http://arxiv.org/abs/1812.10191>
- [14] O. Oktay *et al.*, "Attention U-Net: Learning Where to Look for the Pancreas," Apr. 2018, [Online]. Available: <http://arxiv.org/abs/1804.03999>
- [15] U. Sara, M. Akter, and M. S. Uddin, "Image Quality Assessment through FSIM, SSIM, MSE and PSNR—A Comparative Study," *Journal of Computer and Communications*, vol. 07, no. 03, pp. 8–18, 2019, doi: 10.4236/jcc.2019.73002.
- [16] Y. Tu, Z. Yao, J. Xu, Y. Liu, and Z. Zhang, "Fingerprint restoration using cubic Bezier curve," *BMC Bioinformatics*, vol. 21, Dec. 2020, doi: 10.1186/s12859-020-03857-z.
- [17] P. Schuch, S. Schulz, and C. Busch, "De-convolutional auto-encoder for enhancement of fingerprint samples," Jan. 2017. doi: 10.1109/IPTA.2016.7821036.
- [18] I. Joshi, A. Anand, M. Vatsa, R. Singh, S. D. Roy, and P. K. Kalra, "Latent fingerprint enhancement using generative adversarial networks," in *Proceedings - 2019 IEEE Winter Conference on Applications of Computer Vision, WACV 2019*, Mar. 2019, pp. 895–903. doi: 10.1109/WACV.2019.00100.
- [19] N. Ratha and R. Bolle, *Automatic Fingerprint Recognition Systems*, 1st ed. New York,: Springer New York, NY, 2004. doi: <https://doi.org/10.1007/b97425>.
- [20] L. Hong, Y. Wan, and A. Jain, "Fingerprint image enhancement: Algorithm and performance evaluation," *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol. 20, no. 8, pp. 777–789, 1998, doi: 10.1109/34.709565.

- [21] P. Soille, “Morphological Image Analysis, Principles and Applications,” 1999.
- [22] G. Cao, L. Huang, H. Tian, X. Huang, Y. Wang, and R. Zhi, “Contrast Enhancement of Brightness-Distorted Images by Improved Adaptive Gamma Correction,” 2008.
- [23] Z. Wang, E. P. Simoncelli, and A. C. Bovik, “Multi-scale structural similarity for image quality assessment,” in *Conference Record of the Asilomar Conference on Signals, Systems and Computers*, 2003, vol. 2, pp. 1398–1402. doi: 10.1109/acssc.2003.1292216.
- [24] Z. Wang, A. C. Bovik, H. R. Sheikh, and E. P. Simoncelli, “Image quality assessment: From error visibility to structural similarity,” *IEEE Transactions on Image Processing*, vol. 13, no. 4, pp. 600–612, Apr. 2004, doi: 10.1109/TIP.2003.819861.
- [25] L. Zhang, L. Zhang, X. Mou, and D. Zhang, “FSIM: A Feature Similarity Index for Image Quality Assessment,” 2011.
- [26] Z. Li, W. Yang, S. Peng, and F. Liu, “A Survey of Convolutional Neural Networks Analysis, Applications, and Prospects,” 2020.
- [27] D. M. Hawkins, “The Problem of Overfitting,” *Journal of Chemical Information and Computer Sciences*, vol. 44, no. 1, pp. 1–12, Jan. 2004. doi: 10.1021/ci0342472.
- [28] J. Dai *et al.*, “Deformable Convolutional Networks,” Mar. 2017, [Online]. Available: <http://arxiv.org/abs/1703.06211>
- [29] G. B. Cavallari, L. S. F. Ribeiro, and M. A. Ponti, “Unsupervised representation learning using convolutional and stacked auto-encoders: a domain and cross-domain feature space analysis,” Nov. 2018, [Online]. Available: <http://arxiv.org/abs/1811.00473>
- [30] D. Choi, C. J. Shallue, Z. Nado, J. Lee, C. J. Maddison, and G. E. Dahl, “On Empirical Comparisons of Optimizers for Deep Learning,” Oct. 2019, [Online]. Available: <http://arxiv.org/abs/1910.05446>
- [31] D. P. Kingma and J. Ba, “Adam: A Method for Stochastic Optimization,” Dec. 2014, [Online]. Available: <http://arxiv.org/abs/1412.6980>
- [32] A. Vaswani *et al.*, “Attention Is All You Need,” Jun. 2017, [Online]. Available: <http://arxiv.org/abs/1706.03762>

- [33] X.-J. Mao, C. Shen, and Y.-B. Yang, “Image Restoration Using Convolutional Auto-encoders with Symmetric Skip Connections.”
- [34] O. Oktay *et al.*, “Attention U-Net: Learning Where to Look for the Pancreas,” Apr. 2018, [Online]. Available: <http://arxiv.org/abs/1804.03999>
- [35] O. Ronneberger, P. Fischer, and T. Brox, “U-Net: Convolutional Networks for Biomedical Image Segmentation,” May 2015, [Online]. Available: <http://arxiv.org/abs/1505.04597>
- [36] R. Mehta and J. Sivaswamy, “M-net: A Convolutional Neural Network for deep brain structure segmentation,” in *Proceedings - International Symposium on Biomedical Imaging*, Jun. 2017, pp. 437–440. doi: 10.1109/ISBI.2017.7950555.
- [37] N. Srivastava, G. Hinton, A. Krizhevsky, and R. Salakhutdinov, “Dropout: A Simple Way to Prevent Neural Networks from Overfitting,” 2014.
- [38] S. Ioffe and C. Szegedy, “Batch Normalization: Accelerating Deep Network Training by Reducing Internal Covariate Shift,” Feb. 2015, [Online]. Available: <http://arxiv.org/abs/1502.03167>
- [39] V. Nair and G. E. Hinton, “Rectified Linear Units Improve Restricted Boltzmann Machines,” 2010.
- [40] K. He, X. Zhang, S. Ren, and J. Sun, “Deep Residual Learning for Image Recognition,” Dec. 2015, [Online]. Available: <http://arxiv.org/abs/1512.03385>
- [41] J. Qi, J. Du, S. M. Siniscalchi, X. Ma, and C.-H. Lee, “On Mean Absolute Error for Deep Neural Network Based Vector-to-Vector Regression,” Aug. 2020, doi: 10.1109/LSP.2020.3016837.
- [42] Z. Wang, A. C. Bovik, H. R. Sheikh, and E. P. Simoncelli, “Image quality assessment: From error visibility to structural similarity,” *IEEE Transactions on Image Processing*, vol. 13, no. 4, pp. 600–612, Apr. 2004, doi: 10.1109/TIP.2003.819861.
- [43] F. A. Fardo, V. H. Conforto, F. C. de Oliveira, and P. S. Rodrigues, “A Formal Evaluation of PSNR as Quality Measurement Parameter for Image Segmentation Algorithms,” May 2016, [Online]. Available: <http://arxiv.org/abs/1605.07116>
- [44] Z. Wang, A. C. Bovik, H. R. Sheikh, and E. P. Simoncelli, “Image quality assessment: From error visibility to structural similarity,” *IEEE Transactions on*

