

- [1] O. D. Asmara, E. D. Tenda, G. Singh, C. W. Pitoyo, C. M. Rumende, W. Rajabto, N. R. Ananda, I. Trisnawati, E. Budiyo, H. F. Thahadian, E. C. Boerma, A. Faisal, D. Hutagaol, W. Soeharto, F. Radityamurti, E. Marfiani, P. Z. Romadhon, F. N. Kholis, H. Suryadinata, A. Y. Soeroto, S. A. Gondhowiardjo, and W. H. van Geffen, "Lung cancer in indonesia," *J. Thorac. Oncol.*, vol. 18, no. 9, pp. 1134–1145, Sep. 2023.
- [2] S. Wankhade and Vigneshwari, "A novel hybrid deep learning method for early detection of lung cancer using neural networks," *Healthc. Anal. (N. Y.)*, vol. 3, no. 100195, p. 100195, Nov. 2023.
- [3] H. Sung, J. Ferlay, R. L. Siegel, M. Laversanne, I. Soerjomataram, A. Jemal, and F. Bray, "Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries," *CA Cancer J. Clin.*, vol. 71, no. 3, pp. 209–249, May 2021.
- [4] World Health Organization, "Breast cancer," <https://www.who.int/news-room/fact-sheets/detail/breast-cancer>, 2023, diakses pada 7 Februari 2023.
- [5] Kementerian Kesehatan Republik Indonesia, "Kanker payudara paling banyak di indonesia, kemenkes targetkan pemerataan layanan kesehatan," <https://www.kemkes.go.id/article/view/22020400002/kanker-payudara-paling-banyak-di-indonesia-kemenkes-targetkan-pemerataan-layanan-kesehatan>, 2023, diakses pada 7 Februari 2023.
- [6] W. Gautama, "Breast cancer in indonesia in 2022: 30 years of marching in place," *Indonesian Journal of Cancer*, vol. 16, no. 1, p. 1, Apr. 2022.
- [7] G. C. Wishart, M. Campisi, M. Boswell, D. Chapman, V. Shackleton, S. Iddles, A. Hallett, and P. D. Britton, "The accuracy of digital infrared imaging for breast cancer detection in women undergoing breast biopsy," *Eur. J. Surg. Oncol.*, vol. 36, no. 6, pp. 535–540, Jun. 2010.
- [8] K. Kratkiewicz, A. Pattyn, N. Alijabbari, and M. Mehrmohammadi, "Ultrasound and photoacoustic imaging of breast cancer: Clinical systems, challenges, and future outlook," *J. Clin. Med.*, vol. 11, no. 5, p. 1165, Feb. 2022.
- [9] J. Sun, B. Yuan, J. Tian, Z. Yuan, Y. Wu, X. He, C. Yang, and Z. Tao, "DDRA-net: Dual-channel deep residual attention UPerNet for breast lesions segmentation in ultrasound images," *IEEE Access*, pp. 1–1, 2024.
- [10] Y. Lyu, Y. Xu, X. Jiang, J. Liu, X. Zhao, and X. Zhu, "AMS-PAN: Breast ultrasound image segmentation model combining attention mechanism and multi-scale features," *Biomed. Signal Process. Control*, vol. 81, no. 104425, p. 104425, Mar. 2023.
- [11] U. Raghavendra, A. Gudigar, T. N. Rao, E. J. Ciaccio, E. Y. K. Ng, and U. Rajendra Acharya, "Computer-aided diagnosis for the identification of breast cancer using thermogram images: A comprehensive review," *Infrared Phys. Technol.*, vol. 102, no. 103041, p. 103041, Nov. 2019.

- [12] O. Faust, U. Rajendra Acharya, E. Y. K. Ng, T. J. Hong, and W. Yu, "Application of infrared thermography in computer aided diagnosis," *Infrared Phys. Technol.*, vol. 66, pp. 160–175, Sep. 2014.
- [13] R.-F. Chang, W.-J. Wu, W. K. Moon, and D.-R. Chen, "Automatic ultrasound segmentation and morphology based diagnosis of solid breast tumors," *Breast Cancer Res. Treat.*, vol. 89, no. 2, pp. 179–185, Jan. 2005.
- [14] Z. Ji, H. Sun, N. Yuan, H. Zhang, J. Sheng, X. Zhang, and I. Ganchev, "BGRD-TransUNet: A novel TransUNet-based model for ultrasound breast lesion segmentation," *IEEE Access*, vol. 12, pp. 31 182–31 196, 2024.
- [15] M. F. Dar and A. Ganivada, "EfficientU-net: A novel deep learning method for breast tumor segmentation and classification in ultrasound images," *Neural Process. Lett.*, vol. 55, no. 8, pp. 10 439–10 462, Dec. 2023.
- [16] Z. Ning, S. Zhong, Q. Feng, W. Chen, and Y. Zhang, "SMU-Net: Saliency-guided morphology-aware U-Net for breast lesion segmentation in ultrasound image," *IEEE Trans. Med. Imaging*, vol. 41, no. 2, pp. 476–490, Feb. 2022.
- [17] J. Civit-Masot, F. Luna-Perejón, J. M. R. Corral, M. Domínguez-Morales, A. Morgado-Estévez, and A. Civit, "A study on the use of edge TPUs for eye fundus image segmentation," *Eng. Appl. Artif. Intell.*, vol. 104, no. 104384, p. 104384, Sep. 2021.
- [18] R. Jahandideh, A. T. Targhi, and M. Tahmasbi, "Physical attribute prediction using deep residual neural networks," arXiv preprint arXiv:1812.07857, 2018, arXiv:1812.07857 [cs.CV].
- [19] O. Ronneberger, P. Fischer, and T. Brox, "U-Net: Convolutional networks for biomedical image segmentation," arXiv preprint arXiv:1505.04597, 2015, arXiv:1505.04597 [cs.CV].
- [20] V. Ummadi, "U-Net and its variants for medical image segmentation: A short review," arXiv preprint arXiv:2204.08470, 2022, arXiv:2204.08470 [eess.IV].
- [21] M. A. Ortega-Ruiz, C. Karabağ, E. Roman-Rangel, and C. C. Reyes-Aldasoro, "DRD-UNet, a UNet-like architecture for multi-class breast cancer semantic segmentation," *IEEE Access*, pp. 1–1, 2024.
- [22] M. A. Ortega-Ruiz, C. Karabağ, E. Roman-Rangel, and C. C. Reyes-Aldasoro, "DRD-UNet, a UNet-like architecture for multi-class breast cancer semantic segmentation," *IEEE Access*, pp. 1–1, 2024.
- [23] Z. Ji, H. Sun, N. Yuan, H. Zhang, J. Sheng, X. Zhang, and I. Ganchev, "Bgrd-transunet: A novel transunet-based model for ultrasound breast lesion segmentation," *IEEE Access*, vol. 12, pp. 31 182–31 196, 2024.
- [24] W. Qi, H. C. Wu, and S. C. Chan, "Mdf-net: A multi-scale dynamic fusion network for breast tumor segmentation of ultrasound images," *IEEE Transactions on Image Processing*, vol. 32, pp. 4842–4855, 2023.

- [25] A. D'Angelo, A. Orlandi, E. Bufi, S. Mercogliano, P. Belli, and R. Manfredi, "Automated breast volume scanner (ABVS) compared to handheld ultrasound (HHUS) and contrast-enhanced magnetic resonance imaging (CE-MRI) in the early assessment of breast cancer during neoadjuvant chemotherapy: an emerging role to monitoring tumor response?" *Radiol. Med.*, vol. 126, no. 4, pp. 517–526, Apr. 2021.
- [26] F. Cai, J. Wen, F. He, Y. Xia, W. Xu, Y. Zhang, L. Jiang, and J. Li, "SC-Unext: A lightweight image segmentation model with cellular mechanism for breast ultrasound and tumor diagnosis," *J. Imaging Inform. Med.*, vol. 37, no. 4, pp. 1505–1515, Aug. 2024.
- [27] Q. Zhou, Q. Wang, Y. Bao, L. Kong, X. Jin, and W. Ou, "LAEDNet: A lightweight attention Encoder–Decoder network for ultrasound medical image segmentation," *Comput. Electr. Eng.*, vol. 99, no. 107777, p. 107777, Apr. 2022.
- [28] L. Guo, H. Zhang, and C. Ma, "ESAM2-BLS: Enhanced segment anything model 2 for efficient breast lesion segmentation in ultrasound imaging," *Comput. Med. Imaging Graph.*, vol. 126, no. 102654, p. 102654, Oct. 2025.
- [29] J. Karlsson, I. Arvidsson, F. Sahlin, K. Åström, N. C. Overgaard, K. Lång, and A. Heyden, "Breast cancer classification in point-of-care ultrasound imaging—the impact of training data," *J. Med. Imaging (Bellingham)*, vol. 12, no. 1, p. 014502, Jan. 2025.
- [30] C. D. M. Fraleigh and E. Duff, "Point-of-care ultrasound: An emerging clinical tool to enhance physical assessment," *Nurse Pract.*, vol. 47, no. 8, pp. 14–20, Aug. 2022.
- [31] T. Shahriar, "Comparative analysis of lightweight deep learning models for memory-constrained devices," *arXiv preprint arXiv:2505.03303*, 2025.
- [32] H. Jasrotia, C. Singh, and S. Kaur, "EfficientNet-based attention residual u-net with guided loss for breast tumor segmentation in ultrasound images," *Ultrasound Med. Biol.*, vol. 51, no. 7, pp. 1112–1123, Jul. 2025.
- [33] F. Tang, J. Ding, Q. Quan, L. Wang, C. Ning, and S. K. Zhou, "Cmunext: An efficient medical image segmentation network based on large kernel and skip fusion," in *2024 IEEE International Symposium on Biomedical Imaging (ISBI)*, 2024, pp. 1–5.
- [34] H. Wu, X. Huang, X. Guo, Z. Wen, and J. Qin, "Cross-image dependency modeling for breast ultrasound segmentation," *IEEE Transactions on Medical Imaging*, vol. 42, no. 6, pp. 1619–1631, 2023.
- [35] G. Liu, J. Wang, D. Liu, and B. Chang, "A multiscale nonlocal feature extraction network for breast lesion segmentation in ultrasound images," *IEEE Transactions on Instrumentation and Measurement*, vol. 72, pp. 1–12, 2023.
- [36] H. Zhang, Z. Liu, Z. Zhang, Z. Lei, Z. Wang, H. Hasegawa, and S. Gao, "Dendritic kernel convolutional neural network for breast ultrasound images segmentation," *IEEE Trans. Syst. Man Cybern. Syst.*, vol. 55, no. 12, pp. 9483–9494, Dec. 2025.

- [37] J. Chen, X. Shen, Y. Zhao, W. Qian, H. Ma, and L. Sang, "Attention gate and dilation u-shaped network (GDUNet): an efficient breast ultrasound image segmentation network with multiscale information extraction," *Quant. Imaging Med. Surg.*, vol. 14, no. 2, pp. 2034–2048, Feb. 2024.
- [38] Y. Guo, X. Duan, C. Wang, and H. Guo, "Segmentation and recognition of breast ultrasound images based on an expanded U-Net," *PLoS One*, vol. 16, no. 6, p. e0253202, Jun. 2021.
- [39] Z. Zhuang, N. Li, A. N. Joseph Raj, V. G. V. Mahesh, and S. Qiu, "An RDAU-NET model for lesion segmentation in breast ultrasound images," *PLoS One*, vol. 14, no. 8, p. e0221535, Aug. 2019.
- [40] M. Xu, K. Huang, and X. Qi, "A regional-attentive multi-task learning framework for breast ultrasound image segmentation and classification," *IEEE Access*, vol. 11, pp. 5377–5392, 2023.
- [41] X. Qin, Z. Zhang, C. Huang, M. Dehghan, O. R. Zaiane, and M. Jagersand, "U2-Net: Going deeper with nested u-structure for salient object detection," *Pattern Recognit.*, vol. 106, no. 107404, p. 107404, Oct. 2020.
- [42] B.-D. Dinh, T.-T. Nguyen, T.-T. Tran, and V.-T. Pham, "1M parameters are enough? a lightweight CNN-based model for medical image segmentation," in *2023 Asia Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC)*. IEEE, Oct. 2023.
- [43] N. M. U. Din, R. A. Dar, M. Rasool, and A. Assad, "Breast cancer detection using deep learning: Datasets, methods, and challenges ahead," *Comput. Biol. Med.*, vol. 149, no. 106073, p. 106073, Oct. 2022.
- [44] V. Sreelekshmi, K. Pavithran, and J. J. Nair, "SwinCNN: An integrated swin transformer and CNN for improved breast cancer grade classification," *IEEE Access*, vol. 12, pp. 68 697–68 710, 2024.
- [45] S. Gokhale, "Ultrasound characterization of breast masses," *Indian J. Radiol. Imaging*, vol. 19, no. 3, pp. 242–247, Jul. 2009.
- [46] S. R. Sulistiyanti, F. X. A. Setyawan, and M. Komarudin, *Pengolahan Citra: Dasar dan Contoh Penerapannya*. Yogyakarta: Teknosain, 2016.
- [47] T. Tianur and E. Edilla, "Ekstraksi ciri nodul payudara pada citra ultrasonografi berdasarkan fitur posterior menggunakan metode block difference," *Jurnal komputer terapan*, no. Vol. 62 (2020), pp. 109–118, Nov. 2020.
- [48] A. Carriero, L. Groenhoff, E. Vologina, P. Basile, and M. Albera, "Deep learning in breast cancer imaging: State of the art and recent advancements in early 2024," *Diagnostics (Basel)*, vol. 14, no. 8, p. 848, Apr. 2024.
- [49] A. F. Jahwar and A. Mohsin Abdulazeez, "Segmentation and classification for breast cancer ultrasound images using deep learning techniques: A review," in *2022 IEEE 18th International Colloquium on Signal Processing & Applications (CSPA)*. IEEE, May 2022.

- [50] M. H. Yap, G. Pons, J. Martí, S. Ganau, M. Sentís, R. Zwigelaar, A. K. Davison, and R. Martí, “Automated breast ultrasound lesions detection using convolutional neural networks,” *IEEE J. Biomed. Health Inform.*, vol. 22, no. 4, pp. 1218–1226, Jul. 2018.
- [51] Z. Rezaei, “A review on image-based approaches for breast cancer detection, segmentation, and classification,” *Expert Syst. Appl.*, vol. 182, no. 115204, p. 115204, Nov. 2021.
- [52] S. Abut, H. Okut, and K. J. Kallail, “Paradigm shift from artificial neural networks (ANNs) to deep convolutional neural networks (DCNNs) in the field of medical image processing,” *Expert Syst. Appl.*, vol. 244, no. 122983, p. 122983, Jun. 2024.
- [53] H. Okut, “Bayesian regularized neural networks for small n big p data,” in *Artificial Neural Networks - Models and Applications*. InTech, Oct. 2016.
- [54] D. Gianola, H. Okut, K. A. Weigel, and G. J. Rosa, “Predicting complex quantitative traits with bayesian neural networks: a case study with jersey cows and wheat,” *BMC Genet.*, vol. 12, no. 1, p. 87, Oct. 2011.
- [55] L. Liu, J. Cheng, Q. Quan, F.-X. Wu, Y.-P. Wang, and J. Wang, “A survey on u-shaped networks in medical image segmentations,” *Neurocomputing*, vol. 409, pp. 244–258, Oct. 2020.
- [56] E. D. Carvalho, O. P. da Silva Neto, and A. O. de Carvalho Filho, “Deep learning-based tumor segmentation and classification in breast MRI with 3TP method,” *Biomed. Signal Process. Control*, vol. 93, no. 106199, p. 106199, Jul. 2024.
- [57] S. Öztürk, *Convolutional Neural Networks for Medical Image Processing Applications*. Oxon: CRC Press, 2023.
- [58] I. Goodfellow, Y. Bengio, and A. Courville, *Deep Learning*. Massachusetts: MIT Press, 2016.
- [59] H.-S. Feng and C.-H. Yang, “PolyLU: A simple and robust polynomial-based linear unit activation function for deep learning,” *IEEE Access*, vol. 11, pp. 101 347–101 358, 2023.
- [60] B. Chu, J. Zhao, W. Zheng, and Z. Xu, “(DA-U)2Net: double attention U2Net for retinal vessel segmentation,” *BMC Ophthalmol.*, vol. 25, no. 1, p. 86, Feb. 2025.
- [61] M. Sandler, A. Howard, M. Zhu, A. Zhmoginov, and L.-C. Chen, “MobileNetV2: Inverted residuals and linear bottlenecks,” arXiv preprint arXiv:1801.04381, 2018, arXiv:1801.04381 [cs.CV].
- [62] A. Hamza and M. Mezl, “Deep learning-enhanced ultrasound analysis: Classifying breast tumors using segmentation and feature extraction,” *IEEE Access*, vol. 13, pp. 83 528–83 541, 2025.
- [63] Y. Zou, L. Wu, C. Zuo, L. Chen, B. Zhou, and H. Zhang, “White blood cell classification network using MobileNetv2 with multiscale feature extraction module and attention mechanism,” *Biomed. Signal Process. Control*, vol. 99, no. 106820, p. 106820, Jan. 2025.

- [64] A. Kanadath, J. A. A. Jothi, and S. Urolagin, "Histopathology image segmentation using MobileNetV2 based u-net model," in *2021 International Conference on Intelligent Technologies (CONIT)*. IEEE, Jun. 2021.
- [65] A. Halder and D. Dey, "Atrous convolution aided integrated framework for lung nodule segmentation and classification," *Biomed. Signal Process. Control*, vol. 82, no. 104527, p. 104527, Apr. 2023.
- [66] N. Isong, "Building efficient lightweight CNN models," *arXiv preprint arXiv:2501.15547*, 2025.
- [67] Y. Tang, X. Wang, S. Guo, M. Xiao, E. Lin, H. Li, and A. Han, "An improved lightweight tongue image semantic segmentation model based on DeepLabV3+," *Biomed. Signal Process. Control*, vol. 109, no. 107911, p. 107911, Nov. 2025.
- [68] A. Abbasian Ardakani, A. Mohammadi, M. Mirza-Aghazadeh-Attari, and U. R. Acharya, "An open-access breast lesion ultrasound image database: Applicable in artificial intelligence studies," *Comput. Biol. Med.*, vol. 152, no. 106438, p. 106438, Jan. 2023.
- [69] D. S. Ametefe, D. John, A. A. Aliu, G. D. Ametefe, A. Hamid, and T. Darboe, "Advancing breast cancer diagnosis: Integrating deep transfer learning and U-Net segmentation for precise classification and delineation of ultrasound images," *Results Eng.*, vol. 26, no. 105047, p. 105047, Jun. 2025.
- [70] Z. Zhuang, N. Li, A. N. Joseph Raj, V. G. V. Mahesh, and S. Qiu, "An RDAU-NET model for lesion segmentation in breast ultrasound images," *PLoS One*, vol. 14, no. 8, p. e0221535, Aug. 2019.
- [71] G. Kourounis, A. A. Elmahmudi, B. Thomson, R. Nandi, S. J. Tingle, E. K. Glover, E. Thompson, B. Mahendran, C. Connelly, B. Gibson, L. Bates, N. S. Sheerin, J. Hunter, H. Ugail, and C. Wilson, "Deep learning for automated boundary detection and segmentation in organ donation photography," *Innov. Surg. Sci.*, vol. 10, no. 3, pp. 131–141, Sep. 2025.
- [72] Z. Zhou, M. M. Rahman Siddiquee, N. Tajbakhsh, and J. Liang, "UNet++: A nested U-Net architecture for medical image segmentation," in *Deep Learning in Medical Image Analysis and Multimodal Learning for Clinical Decision Support*, ser. Lecture notes in computer science. Cham: Springer International Publishing, 2018, pp. 3–11.
- [73] M. Z. Alom, M. Hasan, C. Yakopcic, T. M. Taha, and V. K. Asari, "Recurrent residual convolutional neural network based on U-Net (R2U-Net) for medical image segmentation," *arXiv preprint arXiv:1802.06955*, 2018, arXiv:1802.06955 [cs.CV].
- [74] O. Oktay, J. Schlemper, L. L. Folgoc, M. Lee, M. Heinrich, K. Misawa, K. Mori, S. McDonagh, N. Y. Hammerla, B. Kainz, B. Glocker, and D. Rueckert, "Attention U-Net: Learning where to look for the pancreas," *arXiv preprint arXiv:1804.03999*, 2018, arXiv:1804.03999 [cs.CV].
- [75] F. I. Diakogiannis, F. Waldner, P. Caccetta, and C. Wu, "ResUNet-a: A deep learning framework for semantic segmentation of remotely sensed data," *ISPRS J. Photogramm. Remote Sens.*, vol. 162, pp. 94–114, Apr. 2020.

- [76] G. Jocher and J. Qiu, “Ultralytics yolo11,” 2024. [Online]. Available: <https://github.com/ultralytics/ultralytics>
- [77] R. Sapkota and M. Karkee, “Comparing YOLOv11 and YOLOv8 for instance segmentation of occluded and non-occluded immature green fruits in complex orchard environment,” *arXiv preprint arXiv:2410.19869*, 2024, arXiv:2410.19869 [cs.CV].
- [78] R. Khanam and M. Hussain, “YOLOv11: An overview of the key architectural enhancements,” *arXiv preprint arXiv:2410.17725*, 2024, arXiv:2410.17725 [cs.CV].
- [79] G. Huang, Z. Liu, L. van der Maaten, and K. Q. Weinberger, “Densely connected convolutional networks,” *arXiv preprint arXiv:1608.06993*, 2016.
- [80] M. Tan and Q. V. Le, “EfficientNet: Rethinking model scaling for convolutional neural networks,” *arXiv preprint arXiv:1905.11946*, 2019.
- [81] S. Mehta, M. Rastegari, A. Caspi, L. Shapiro, and H. Hajishirzi, “ESPNet: Efficient spatial pyramid of dilated convolutions for semantic segmentation,” in *Computer Vision – ECCV 2018*, ser. Lecture notes in computer science. Cham: Springer International Publishing, 2018, pp. 561–580.
- [82] S. Mehta, M. Rastegari, L. Shapiro, and H. Hajishirzi, “Espnetv2: A light-weight, power efficient, and general purpose convolutional neural network,” in *2019 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2019, pp. 9182–9192.
- [83] D. Gutman, N. C. F. Codella, E. Celebi, B. Helba, M. Marchetti, N. Mishra, and A. Halpern, “Skin lesion analysis toward melanoma detection: A challenge at the international symposium on biomedical imaging (ISBI) 2016, hosted by the international skin imaging collaboration (ISIC),” *arXiv preprint arXiv:1605.01397*, 2016.
- [84] H. Ashraf, A. Waris, M. F. Ghafoor, S. O. Gilani, and I. K. Niazi, “Melanoma segmentation using deep learning with test-time augmentations and conditional random fields,” *Sci. Rep.*, vol. 12, no. 1, p. 3948, Mar. 2022.
- [85] J. Kim, S. Maranna, C. Watson, and N. Parange, “A scoping review on the integration of artificial intelligence in point-of-care ultrasound: Current clinical applications,” *Am. J. Emerg. Med.*, vol. 92, pp. 172–181, Jun. 2025.