

DAFTAR PUSTAKA

- [1] WSFS Secretariat, “Feeding the World in 2050,” Rome, Nov 2009.
- [2] H. Shahab, M. Iqbal, A. Sohaib, F. Ullah Khan, dan M. Waqas, “IoT-based agriculture management techniques for sustainable farming: A comprehensive review,” 1 Mei 2024, *Elsevier B.V.* doi: 10.1016/j.compag.2024.108851.
- [3] A. Bin Rashid, A. K. Kausik, A. Khandoker, dan S. N. Siddque, “Integration of Artificial Intelligence and IoT with UAVs for Precision Agriculture,” 1 September 2025, *Elsevier B.V.* doi: 10.1016/j.hybadv.2025.100458.
- [4] S. Wolfert dan G. Isakhanyan, “Sustainable agriculture by the Internet of Things – A practitioner’s approach to monitor sustainability progress,” *Comput Electron Agric*, vol. 200, Sep 2022, doi: 10.1016/j.compag.2022.107226.
- [5] Y. S. Goh, Y. C. Hum, Y. L. Lee, K. W. Lai, W. S. Yap, dan Y. K. Tee, “A meta-analysis: Food production and vegetable crop yields of hydroponics,” 1 November 2023, *Elsevier B.V.* doi: 10.1016/j.scienta.2023.112339.
- [6] Y. M. Qin, Y. H. Tu, T. Li, Y. Ni, R. F. Wang, dan H. Wang, “Deep Learning for Sustainable Agriculture: A Systematic Review on Applications in Lettuce Cultivation,” 1 April 2025, *Multidisciplinary Digital Publishing Institute (MDPI)*. doi: 10.3390/su17073190.
- [7] M. J. Kim, Y. Moon, J. C. Tou, B. Mou, dan N. L. Waterland, “Nutritional value, bioactive compounds and health benefits of lettuce (*Lactuca sativa* L.),” 1 Juni 2016, *Academic Press Inc.* doi: 10.1016/j.jfca.2016.03.004.

- [8] Richard Smith *dkk.*, “Vegetable Production Series_ Lettuce Production in California,” *UC Vegetable Research & Information Center*, hlm. 1–11, 2024, doi: doi.org/10.3733/WXXE1505.
- [9] V. Keshavarz-Tohid dan S. Ebrahimi, “Phylogeny, phenotypic characteristics and pathogenicity of *Sphingomonas* sp. and *Erwinia persicina* as bacterial causal agents of lettuce diseases in southwest of Iran,” *Physiol Mol Plant Pathol*, vol. 127, Sep 2023, doi: [10.1016/j.pmpp.2023.102124](https://doi.org/10.1016/j.pmpp.2023.102124).
- [10] C. S. Cabral *dkk.*, “Phenotypic and genetic variability of fungal isolates associated with the Septoria leaf spot disease of lettuce (*Lactuca sativa*) in Brazil,” *Journal of Plant Diseases and Protection*, vol. 129, no. 1, hlm. 53–62, Feb 2022, doi: [10.1007/s41348-021-00537-9](https://doi.org/10.1007/s41348-021-00537-9).
- [11] A. GhalehgoLabbehbahani *dkk.*, “Integrated Control of Powdery Mildew Using UV Light Exposure and OMRI-Certified Fungicide for Greenhouse Organic Lettuce Production,” *Horticulturae*, vol. 11, no. 3, Mar 2025, doi: [10.3390/horticulturae11030246](https://doi.org/10.3390/horticulturae11030246).
- [12] S. Ban *dkk.*, “Evaluation and Early Detection of Downy Mildew of Lettuce Using Hyperspectral Imagery,” *Agriculture (Switzerland)*, vol. 15, no. 5, Mar 2025, doi: [10.3390/agriculture15050444](https://doi.org/10.3390/agriculture15050444).
- [13] W. Gao, C. Zong, M. Wang, H. Zhang, dan Y. Fang, “Intelligent identification of rice leaf disease based on YOLO V5-EFFICIENT,” *Crop Protection*, vol. 183, Sep 2024, doi: [10.1016/j.cropro.2024.106758](https://doi.org/10.1016/j.cropro.2024.106758).
- [14] G. Rajendiran, J. Rethnaraj, dan J. Malaisamy, “Enhanced CNN Model for Lettuce Disease Identification in Indoor Aeroponic Vertical Farming Systems,” dalam *4th International Conference on Sustainable Expert Systems, ICSES 2024 - Proceedings*, Institute of

- Electrical and Electronics Engineers Inc., 2024, hlm. 1407–1412. doi: 10.1109/ICSES63445.2024.10763148.
- [15] K. Nafil *dkk.*, “Lettuce Leaf Disease Protection and Detection Using Image Processing Technique,” dalam *Proceedings - 10th International Conference on Wireless Networks and Mobile Communications, WINCOM 2023*, Institute of Electrical and Electronics Engineers Inc., 2023. doi: 10.1109/WINCOM59760.2023.10323013.
- [16] R. Abbasi, P. Martinez, dan R. Ahmad, “Crop diagnostic system: A robust disease detection and management system for leafy green crops grown in an aquaponics facility,” *Artificial Intelligence in Agriculture*, vol. 10, hlm. 1–12, Des 2023, doi: 10.1016/j.aiaa.2023.09.001.
- [17] Y. Wang, M. Wu, dan Y. Shen, “Identifying the Growth Status of Hydroponic Lettuce Based on YOLO-EfficientNet,” *Plants*, vol. 13, no. 3, Feb 2024, doi: 10.3390/plants13030372.
- [18] W. N. Weaver, J. Ng, dan R. G. Laport, “LeafMachine: Using machine learning to automate leaf trait extraction from digitized herbarium specimens,” *Appl Plant Sci*, vol. 8, no. 6, Jun 2020, doi: 10.1002/aps3.11367.
- [19] R. Hu, W. H. Su, J. Le Li, dan Y. Peng, “Real-time lettuce-weed localization and weed severity classification based on lightweight YOLO convolutional neural networks for intelligent intra-row weed control,” *Comput Electron Agric*, vol. 226, Nov 2024, doi: 10.1016/j.compag.2024.109404.
- [20] N. Jegham, C. Y. Koh, M. Abdelatti, dan A. Hendawi, “YOLO Evolution: A Comprehensive Benchmark and Architectural Review of YOLOv12, YOLO11, and Their Previous Versions,” Okt 2024, [Daring]. Tersedia pada: <http://arxiv.org/abs/2411.00201>

- [21] R. Sapkota, Z. Meng, M. Churuvija, X. Du, Z. Ma, dan M. Karkee, “Comprehensive Performance Evaluation of YOLOv12, YOLO11, YOLOv10, YOLOv9 and YOLOv8 on Detecting and Counting Fruitlet in Complex Orchard Environments,” Jul 2024, [Daring]. Tersedia pada: <http://arxiv.org/abs/2407.12040>
- [22] Y. Tian, Q. Ye, dan D. Doermann, “YOLOv12: Attention-Centric Real-Time Object Detectors Latency (ms) MS COCO mAP (%)”, doi: 10.0.
- [23] R. Khanam dan M. Hussain, “YOLOv11: An Overview of the Key Architectural Enhancements,” Okt 2024, [Daring]. Tersedia pada: <http://arxiv.org/abs/2410.17725>
- [24] B. Ahmad *dkk.*, “Efficient Real-Time Detection of Plant Leaf Diseases Using YOLOv8 and Raspberry Pi,” *VFAST Transactions on Software Engineering*, vol. 12, no. 2, hlm. 250–259, Jun 2024, doi: 10.21015/vtse.v12i2.1869.
- [25] J. Song, D. Kim, E. Jeong, dan J. Park, “Determination of Optimal Dataset Characteristics for Improving YOLO Performance in Agricultural Object Detection,” *Agriculture (Switzerland)*, vol. 15, no. 7, Apr 2025, doi: 10.3390/agriculture15070731.
- [26] I. Loshchilov dan F. Hutter, “Decoupled Weight Decay Regularization,” Nov 2017, [Daring]. Tersedia pada: <http://arxiv.org/abs/1711.05101>
- [27] I. S. Isa, M. S. A. Rosli, U. K. Yusof, M. I. F. Maruzuki, dan S. N. Sulaiman, “Optimizing the Hyperparameter Tuning of YOLOv5 for Underwater Detection,” *IEEE Access*, vol. 10, hlm. 52818–52831, 2022, doi: 10.1109/ACCESS.2022.3174583.
- [28] U. Obu, Y. Ambekar, H. Dhote, S. Wadbudhe, S. Khandelwal, dan S. Dongre, “Crop Disease Detection using Yolo V5 on Raspberry Pi,”

dalam *Proceedings - 2023 3rd International Conference on Pervasive Computing and Social Networking, ICPCSN 2023*, Institute of Electrical and Electronics Engineers Inc., 2023, hlm. 528–533. doi: 10.1109/ICPCSN58827.2023.00092.

- [29] E. H. I. Eliwa dan T. Abd El-Hafeez, “Advancing crop health with YOLOv11 classification of plant diseases,” *Neural Comput Appl*, 2025, doi: 10.1007/s00521-025-11287-2.
- [30] A. Sharma, V. Kumar, dan L. Longchamps, “Comparative performance of YOLOv8, YOLOv9, YOLOv10, YOLOv11 and Faster R-CNN models for detection of multiple weed species,” *Smart Agricultural Technology*, vol. 9, Des 2024, doi: 10.1016/j.atech.2024.100648.
- [31] A. Tripathi, V. Gohokar, dan R. Kute, “Comparative Analysis of YOLOv8 and YOLOv9 Models for Real-Time Plant Disease Detection in Hydroponics,” *Engineering, Technology and Applied Science Research*, vol. 14, no. 5, hlm. 17269–17275, Okt 2024, doi: 10.48084/etasr.8301.
- [32] I. Simko *dkk.*, “Genomics and Marker-Assisted Improvement of Vegetable Crops,” *CRC Crit Rev Plant Sci*, vol. 40, no. 4, hlm. 303–365, 2021, doi: 10.1080/07352689.2021.1941605.
- [33] A. Chiesa, A. León, D. Frezza, dan A. Chiesa, “Effect of nutrient solution composition and storage conditions on postharvest of minimally processed butterhead lettuce,” 2009. [Daring]. Tersedia pada: <https://www.researchgate.net/publication/288762766>
- [34] B. Mou, “Genetic Variation of Beta-carotene and Lutein Contents in Lettuce,” 2005.
- [35] Krishna V. Subbarao, R. Michael Davis, Robert L. Gilbertson, dan Richard N. Raid, *Compendium of Lettuce Diseases and Pests*

SECOND EDITION, 2nd ed. St. Paul, Minnesota: The American Phytopathological Society, 2017.

- [36] Tim O'neil, "Diseases of lettuce crops," 2019.
- [37] Margaret Tuttle McGrath, "Downy mildew on lettuce," Long Island Horticultural Research & Extension Center – Cornell University. Diakses: 3 Juni 2025. [Daring]. Tersedia pada: <https://blogs.cornell.edu/livepath/gallery/lettuce/downy-mildew-on-lettuce/>
- [38] Margaret Tuttle McGrath, "Powdery Mildew," Long Island Horticultural Research & Extension Center – Cornell University. Diakses: 3 Juni 2025. [Daring]. Tersedia pada: <https://blogs.cornell.edu/livepath/gallery/lettuce/powdery-mildew-on-lettuce>
- [39] Margaret Tuttle McGrath, "Septoria Blight Spot on Lettuce," UC Agriculture and Natural Resources. Diakses: 2 Juni 2025. [Daring]. Tersedia pada: <https://blogs.cornell.edu/livepath/gallery/lettuce/downy-mildew-on-lettuce/>
- [40] S. German-Retana, J. Walter, dan O. Le Gall, "Lettuce mosaic virus: From pathogen diversity to host interactors," Maret 2008. doi: 10.1111/j.1364-3703.2007.00451.x.
- [41] G. Sandoya dan D. C. Otero, "Bacterial Leaf Spot of Lettuce Disease: An Unpredictable Enemy to the Florida Lettuce Industry," *EDIS*, vol. 2021, no. 3, Mei 2021, doi: 10.32473/edis-hs1412-2021.
- [42] S.T. Koike dan T.A. Turini, "Bacterial Leaf Spot – Agriculture: Lettuce Pest Management Guidelines," UC Agriculture and Natural Resources. Diakses: 2 Juni 2025. [Daring]. Tersedia pada: <https://ipm.ucanr.edu/agriculture/lettuce/bacterial-leaf-spot/>

- [43] K. T. Peterson Bayer dan B. Van Duijn, “Leveraging Artificial Intelligence for Enhanced Seed Testing: Current trends and future prospects.” [Daring]. Tersedia pada: www.seedtest.org
- [44] A. Jafar, N. Bibi, R. A. Naqvi, A. Sadeghi-Niaraki, dan D. Jeong, “Revolutionizing agriculture with artificial intelligence: plant disease detection methods, applications, and their limitations,” 2024, *Frontiers Media SA*. doi: 10.3389/fpls.2024.1356260.
- [45] L. Lei, Q. Yang, L. Yang, T. Shen, R. Wang, dan C. Fu, “Deep learning implementation of image segmentation in agricultural applications: a comprehensive review,” *Artif Intell Rev*, vol. 57, no. 6, Jun 2024, doi: 10.1007/s10462-024-10775-6.
- [46] S. Srivastava, A. V. Divekar, C. Anilkumar, I. Naik, V. Kulkarni, dan V. Pattabiraman, “Comparative analysis of deep learning image detection algorithms,” *J Big Data*, vol. 8, no. 1, Des 2021, doi: 10.1186/s40537-021-00434-w.
- [47] Y. Huang, “Deep Learning in Image Recognition,” *Applied and Computational Engineering*, vol. 8, no. 1, hlm. 61–67, Agu 2023, doi: 10.54254/2755-2721/8/20230082.
- [48] Y. Lecun, Y. Bengio, dan G. Hinton, “Deep learning,” 27 Mei 2015, *Nature Publishing Group*. doi: 10.1038/nature14539.
- [49] S. Minaee, Y. Boykov, F. Porikli, A. Plaza, N. Kehtarnavaz, dan D. Terzopoulos, “Image Segmentation Using Deep Learning: A Survey,” Jan 2020, [Daring]. Tersedia pada: <http://arxiv.org/abs/2001.05566>
- [50] K. O’Shea dan R. Nash, “An Introduction to Convolutional Neural Networks,” Nov 2015, [Daring]. Tersedia pada: <http://arxiv.org/abs/1511.08458>
- [51] Y. Lecun, E. Bottou, Y. Bengio, dan P. Haffner, “Gradient-Based Learning Applied to Document Recognition,” 1998.

- [52] I. H. Sarker, “Machine Learning: Algorithms, Real-World Applications and Research Directions,” 1 Mei 2021, *Springer*. doi: 10.1007/s42979-021-00592-x.
- [53] P. Tsirtsakis, G. Zacharis, G. S. Maraslidis, dan G. F. Fragulis, “Deep learning for object recognition: A comprehensive review of models and algorithms,” *International Journal of Cognitive Computing in Engineering*, vol. 6, hlm. 298–312, Des 2025, doi: 10.1016/j.ijcce.2025.01.004.
- [54] X. Feng, Y. Jiang, X. Yang, M. Du, dan X. Li, “Computer vision algorithms and hardware implementations: A survey,” 1 November 2019, *Elsevier B.V.* doi: 10.1016/j.vlsi.2019.07.005.
- [55] T. Jiang dan Y. Zhong, “ODverse33: Is the New YOLO Version Always Better? A Multi Domain benchmark from YOLO v5 to v11,” Feb 2025, [Daring]. Tersedia pada: <http://arxiv.org/abs/2502.14314>
- [56] R. Sapkota *dkk.*, “YOLO advances to its genesis: a decadal and comprehensive review of the You Only Look Once (YOLO) series,” Jun 2024, doi: 10.1007/s10462-025-11253-3.
- [57] M. Al, R. Alif, dan M. Hussain, “YOLOV1 TO YOLOV10: A COMPREHENSIVE REVIEW OF YOLO VARIANTS AND THEIR APPLICATION IN THE AGRICULTURAL DOMAIN,” 2024.
- [58] P. Hidayatullah, N. Syakrani, M. R. Sholahuddin, T. Gelar, dan R. Tubagus, “YOLOv8 to YOLO11: A Comprehensive Architecture In-depth Comparative Review A PREPRINT.”
- [59] K. Fang, R. Zhou, N. Deng, C. Li, dan X. Zhu, “RLDD-YOLOv11n: Research on Rice Leaf Disease Detection Based on YOLOv11,” *Agronomy*, vol. 15, no. 6, hlm. 1266, Mei 2025, doi: 10.3390/agronomy15061266.

- [60] R. Sapkota, Z. Meng, M. Churuvija, X. Du, Z. Ma, dan M. Karkee, "Comprehensive Performance Evaluation of YOLOv12, YOLO11, YOLOv10, YOLOv9 and YOLOv8 on Detecting and Counting Fruitlet in Complex Orchard Environments," Jul 2024, [Daring]. Tersedia pada: <http://arxiv.org/abs/2407.12040>
- [61] Ultralytics, "Ultralytics YOLOv11," <https://docs.ultralytics.com/>. Diakses: 30 Mei 2025. [Daring]. Tersedia pada: <https://docs.ultralytics.com/>
- [62] N. J. Hayati, D. Singasatia, M. R. Muttaqin, T. Informatika, S. Tinggi, dan T. Wastukancana, "OBJECT TRACKING MENGGUNAKAN ALGORITMA YOU ONLY LOOK ONCE (YOLO)v8 UNTUK MENGHITUNG KENDARAAN," *KOMPUTA: Jurnal Ilmiah Komputer dan Informatika*, vol. 12, no. 2, 2023, [Daring]. Tersedia pada: <https://universe.roboflow.com/>
- [63] R. Abbasi, P. Martinez, dan R. Ahmad, "Crop diagnostic system: A robust disease detection and management system for leafy green crops grown in an aquaponics facility," *Artificial Intelligence in Agriculture*, vol. 10, hlm. 1–12, Des 2023, doi: 10.1016/j.aiaa.2023.09.001.
- [64] K. Maharana, S. Mondal, dan B. Nemade, "A review: Data pre-processing and data augmentation techniques," *Global Transitions Proceedings*, vol. 3, no. 1, hlm. 91–99, Jun 2022, doi: 10.1016/j.gltp.2022.04.020.
- [65] C. Yu, J. Xie, dan F. J. A. Tony, "BGM-YOLO: An accurate and efficient detector for detecting plant disease," *PLoS One*, vol. 20, no. 5, hlm. e0322750, Mei 2025, doi: 10.1371/journal.pone.0322750.
- [66] K. N. Rahman, S. C. Banik, R. Islam, dan A. Al Fahim, "A real time monitoring system for accurate plant leaves disease detection using

- deep learning,” *Crop Design*, vol. 4, no. 1, Feb 2025, doi: 10.1016/j.crope.2024.100092.
- [67] K. M. Kahloot dan P. Ekler, “Algorithmic Splitting: A Method for Dataset Preparation,” *IEEE Access*, vol. 9, hlm. 125229–125237, 2021, doi: 10.1109/ACCESS.2021.3110745.
- [68] M. Shahriar Zaman Abid, B. Jahan, A. Al Mamun, M. Jakir Hossen, dan S. Hossain Mazumder, “Bangladeshi crops leaf disease detection using YOLOv8,” *Heliyon*, vol. 10, no. 18, Sep 2024, doi: 10.1016/j.heliyon.2024.e36694.
- [69] A. Nugroho dan M. R. A. Cahyono, “IMPLEMENTASI OBJECT RECOGNITION PADA RAMBU-RAMBU DAN LAMPU LALU LINTAS DENGAN RASPBERRY PI DENGAN ALGORITMA YOLOV5,” *Sebatik*, vol. 26, no. 2, hlm. 549–556, Des 2022, doi: 10.46984/sebatik.v26i2.2047.
- [70] S. Kumar, P. Asiamah, O. Jolaoso, dan U. Esiowu, “Enhancing Image Classification with Augmentation: Data Augmentation Techniques for Improved Image Classification,” Feb 2025, [Daring]. Tersedia pada: <http://arxiv.org/abs/2502.18691>
- [71] H. A. Shehu, A. Ackley, M. Mark, O. E. Eteng, Md. H. Sharif, dan H. Kusetogullari, “YOLO for early detection and management of Tuta absoluta-induced tomato leaf diseases,” *Front Plant Sci*, vol. 16, Mei 2025, doi: 10.3389/fpls.2025.1524630.
- [72] S. Ruder, “An overview of gradient descent optimization algorithms,” Jun 2017, [Daring]. Tersedia pada: <http://arxiv.org/abs/1609.04747>
- [73] Y. Liu, Y. Gao, dan W. Yin, “An Improved Analysis of Stochastic Gradient Descent with Momentum,” Agu 2020, [Daring]. Tersedia pada: <http://arxiv.org/abs/2007.07989>

- [74] N. Qian, “On the momentum term in gradient descent learning algorithms,” Agu 1999.
- [75] A. Kumar, R. Shen, S. Bubeck, dan S. Gunasekar, “How to Fine-Tune Vision Models with SGD,” Okt 2023, [Daring]. Tersedia pada: <http://arxiv.org/abs/2211.09359>
- [76] X. Wang dan J. Liu, “Vegetable disease detection using an improved YOLOv8 algorithm in the greenhouse plant environment,” *Sci Rep*, vol. 14, no. 1, Des 2024, doi: 10.1038/s41598-024-54540-9.
- [77] R. Khanam dan M. Hussain, “A Review of YOLOv12: Attention-Based Enhancements vs. Previous Versions,” Apr 2025, [Daring]. Tersedia pada: <http://arxiv.org/abs/2504.11995>
- [78] X. Wang *dkk.*, “Empowering Edge Intelligence: A Comprehensive Survey on On-Device AI Models,” Mar 2025, doi: 10.1145/3724420.
- [79] Ultralytics, “Raspberry Pi with Ultralytics YOLO11,” Ultralytics.com. Diakses: 3 Juli 2025. [Daring]. Tersedia pada: <https://docs.ultralytics.com/guides/raspberry-pi/#detailed-comparison-table>
- [80] Raspberry Pi Foundation, “Raspberry Pi 3,” Jan 2025.
- [81] “Webcam SPC.” Diakses: 10 Juni 2025. [Daring]. Tersedia pada: <https://blezacomputer.com/product/webcam-spc-wc02-fhd-1080p/>
- [82] Waveshare Foundation, “Waveshare 7in Capacitive Touch,” Waveshare.com. Diakses: 6 Juni 2025. [Daring]. Tersedia pada: https://www.waveshare.com/wiki/7inch_HDMI_LCD
- [83] “POWER SUPPLY RASPBERRY PI ADAPTOR MICRO USB EU 5VDC 5 VOLT 3A 3 AMPERE.” Diakses: 14 Mei 2025. [Daring]. Tersedia pada: <https://www.tokopedia.com/mullehwaroeng/power->

supply-raspberry-pi-adaptor-micro-usb-eu-5vdc-5-volt-3a-3-ampere-
1729915918548698843

- [84] Pravalika, “Lettuce Dataset,” Roboflow Universe. Diakses: 3 Juni 2025. [Daring]. Tersedia pada: <https://universe.roboflow.com/pravalika-odkyr/lettuce-qcfff>
- [85] Ashish Jena, “Lettuce Leaf Diagnosia: Cultivating Insights for Crop Health,” Kaggle.com. Diakses: 1 Mei 2025. [Daring]. Tersedia pada: <https://www.kaggle.com/datasets/ashishjena/lettuce-leaf-diagnosia-cultivating-insights>
- [86] Thee, “Lettuce_Disease_Custom_Dataset.” Diakses: 1 Juli 2025. [Daring]. Tersedia pada: https://universe.roboflow.com/thee-msxvq/lettuce_leaf_disease_project-ecole