

DAFTAR PUSTAKA

- Abdo-Peralta, C. García-Pumagualle, K. Carrera-Silva, C. Frey, C. R. Rosero-Erazo, J. Ortega-Castro, J. S. S. Orozco, and T. Toulkeridis, "Implementation of an Enhanced Edge Computing System for the Optimization of Strawberry Crop in Greenhouses: A Smart Agriculture Approach," *Agronomy*, vol. 14, no. 3030, pp. 1–27, 2024, doi: 10.3390/agronomy14123030.
- Albanese, M. Nardello, and D. Brunelli, "Automated Pest Detection with DNN on the Edge for Precision Agriculture," *IEEE Journal on Emerging and Selected Topics in Circuits and Systems*, vol. 11, no. 4, pp. 1–12, 2021, doi: 10.1109/JETCAS.2021.3101740.
- Ali, W. Tariq, A. Razzaq, A. Rehman, S. Sarfraz, N. A. Rajput, S. Ali, K. Fatima, S. Jameel, N. Liaqat, and Z. Akash, "From Sensors to Insights: The Fusion of AI, Edge Computing, and Precision Agriculture," *Journal of Agriculture and Biology*, vol. 3, no. 1, pp. 160–170, 2025, doi: 10.55627/agribiol.003.01.1067.
- Alreshidi, "Smart sustainable agriculture solution underpinned by IoT and AI," *Sustainability*, vol. 11, no. 24, pp. 1–18, 2019.
- Alshehri and O. Alharbi, "Understanding the Landscape of Leveraging IoT for Sustainable Growth in Saudi Arabia," *King Saud University Journal of Computing and Information Sciences*, 2024.
- Alzubi and K. Galyna, "Artificial Intelligence and Internet of Things for Sustainable Farming and Smart Agriculture," *IEEE Access*, vol. 11, pp. 78686–78700, 2023, doi: 10.1109/ACCESS.2023.3298215.
- Antonini, M. Pincheira, M. Vecchio, and F. Antonelli, "An Adaptable and Unsupervised TinyML Anomaly Detection System for Extreme Industrial Environments," *Sensors*, vol. 23, no. 2344, pp. 1–21, 2023, doi: 10.3390/s23042344.
- Babar and Ö. B. Akan, "Sustainable and Precision Agriculture with the Internet of Everything (IoE)," *arXiv preprint arXiv:2404.06341*, 2024.
- Biral, M. Centenaro, A. Zanella, L. Vangelista, and M. Zorzi, "The challenges of M2M massive access in wireless cellular networks," *Digital Communications and Networks*, vol. 1, no. 1, pp. 1–19, 2015. doi: 10.1016/j.dcan.2015.02.001.
- Brockmann and T. Schlippe, "Optimizing Convolutional Neural Networks for Image Classification on Resource-Constrained Microcontroller Units," *Computers*, vol. 13, no. 173, pp. 1–18, 2024, doi: 10.3390/computers13070173.
- C. Motta, N. Vuillerme, H.-H. Pham, and F. A. P. de Figueiredo, "Machine Learning Techniques for Coffee Classification: A Comprehensive Review of Scientific Research," *Artificial Intelligence Review*, vol. 58, no. 15, pp. 1–45, 2025. doi: 10.1007/s10462-024-11004-w.
- C. Runck et al., "Real-time geoinformation systems to improve the quality, scalability, and cost of IoT for agri-environment research," *Computers and Electronics in Agriculture*, vol. 223, pp. 108195, 2024.
- Choudhary, P. Guha, G. Pau, and S. Mishra, "An overview of smart agriculture using Internet of Things (IoT) and web services," *Environmental and Sustainability Indicators*, vol. 26, 100607, 2025, doi: 10.1016/j.indic.2025.100607.

- E. C. Silva and J. Almeida, "An Edge Computing-Based Solution for Real-Time Leaf Disease Classification Using Thermal Imaging," *IEEE Geoscience and Remote Sensing Letters*, vol. 21, no. 4, pp. 1–5, 2024, doi: 10.1109/LGRS.2024.3456637.
- E. G. Rivas, P. L. L. Bertarini, and H. Fernandes, "Automated Coffee Roast Level Classification Using Machine Learning and Deep Learning Models," *Journal of Food Science*, vol. 90, e70532, 2025, doi: 10.1111/1750-3841.70532.
- E. Oncu, "Deep learning framework for coffee quality assessment via YOLOv8n," *IEEE Access*, vol. 13, pp. 1–16, 2025.
- F. L. dos Santos, J. T. F. Rosas, R. N. Martins, G. d. M. Araújo, L. d. A. Viana, and J. d. P. Gonçalves, "Quality Assessment of Coffee Beans through Computer Vision and Machine Learning Algorithms," *Coffee Science*, vol. 15, e151752, 2020, doi: 10.25186/v15i.1752.
- F. Serepas, I. Papias, K. Christakis, N. Dimitropoulos, and V. Marinakis, "Lightweight Embedded IoT Gateway for Smart Homes Based on an ESP32 Microcontroller," *Computers*, vol. 14, no. 391, pp. 1–19, 2025, doi: 10.3390/computers14090391.
- Gonzalez-Sanchez, O. Sandoval-Gonzalez, J. d. J. A. Flores-Cuautle, O. Landeta-Escamilla, O. Portillo-Rodriguez, and G. Aguila-Rodriguez, "A Study of the Physical Characteristics and Defects of Green Coffee Beans That Influence the Sensory Notes Using Machine Learning Models," *Processes*, vol. 12, no. 18, pp. 1–19, 2024, doi: 10.3390/pr12010018.
- Hassan, "Enhancing Coffee Bean Classification: A Comparative Analysis of Pre-Trained Deep Learning Models," *Neural Computing and Applications*, vol. 36, no. 9, pp. 9023–9052, 2024, doi: 10.1007/s00521-024-09623-z.
- He, H. Zhao, Y. Feng, Z. Wang, Z. Ning, and T. Luo, "Edge Computing-Oriented Smart Agricultural Supply Chain Mechanism with Auction and Fuzzy Neural Networks," *Journal of Cloud Computing: Advances, Systems and Applications*, vol. 13, no. 66, pp. 1–18, 2024, doi: 10.1186/s13677-024-00626-8.
- J. Miao, D. Rajasekhar, S. Mishra, S. K. Nayak, and R. Yadav, "A Microservice-Based Smart Agriculture System to Detect Animal Intrusion at the Edge," *Future Internet*, vol. 16, no. 296, pp. 1–20, 2024, doi: 10.3390/fi16080296.
- J. Zhang, L. He, S. Liu, and Y. Chen, "Coffee Green Bean Defect Detection Method Based on an Improved YOLOv8 Model," *Journal of Food Processing and Preservation*, vol. 1, no. 2864052, pp. 1–9, 2024, doi: 10.1155/2024/2864052.
- Jiang, Z. Shen, Q. Zheng, T. Zhang, W. Xiang, and J. Jin, "Farm-LightSeek: An edge-centric multimodal agricultural IoT data analytics framework with lightweight LLMs," *IEEE Internet of Things Journal*, vol. 12, no. 4, pp. 3510–3523, 2025.
- Korkmaz et al., "Comparison of deep learning models in automatic classification of coffee bean species," *Expert Systems with Applications*, vol. 245, pp. 123456, 2025.
- Korkmaz, T. Talan, S. Koşunalp, and T. Iliev, "Comparison of Deep Learning Models in Automatic Classification of Coffee Bean Species," *PeerJ Computer Science*, vol. 11, e2759, 2025, doi: 10.7717/peerj-cs.2759.
- L. Gope, H. Fukai, F. M. Ruhad, and S. Barman, "Comparative Analysis of YOLO Models for Green Coffee Bean Detection and Defect Classification,"

- Scientific Reports, vol. 14, 28946, pp. 1–15, 2024, doi: 10.1038/s41598-024-78598-7.
- Li et al., “Coffee green bean defect detection method based on an improved YOLOv8 model,” *Sensors*, vol. 24, no. 5, pp. 1–15, 2024.
- Lloret, S. Viciano-Tudela, D. Carrasco, L. Parra, and S. Sendra, “Design, Deployment, and Testing a Device with Edge Computing Energy Efficiency Algorithm for Water Quality Monitoring,” in Proc. 7th Int. Conf. on Future Networks and Distributed Systems (FMEC), IEEE, 2022, doi: 10.1109/FMEC57183.2022.10062622.
- M. C. Batistatos, T. De Cola, M. A. Kourtis, V. Apostolopoulou, G. K. Xilouris, and N. C. Sagias, “AGRARIAN: A Hybrid AI-Driven Architecture for Smart Agriculture,” Preprints.org, 25 Mar. 2025, doi: 10.20944/preprints202503.1805.v1.
- M. Dutta, D. Gupta, S. Tharewal, D. Goyal, J. K. Sandhu, M. Kaur, A. A. Alzubi, and J. M. Alanazi, “Internet of Things-Based Smart Precision Farming in Soilless Agriculture: Opportunities and Challenges for Global Food Security,” *IEEE Access*, vol. 13, pp. 1–23, 2025, doi: 10.1109/ACCESS.2025R395.
- M. E. Karar, F. Alotaibi, A. A. Rasheed, and O. Reyad, “A Pilot Study of Smart Agricultural Irrigation using Unmanned Aerial Vehicles and IoT-Based Cloud System,” *International Journal of Information Sciences Letters*, vol. 10, no. 1, pp. 115–125, 2025, doi: 10.18576/isl/100115.
- M. El-Dosuky, “Real-time framework for interoperable semantic-driven IoT in smart agriculture,” *IEEE Access*, vol. 13, pp. 1–17, 2025.
- M. García, J. E. Candelo-Becerra, and F. Hoyos, “Quality and defect inspection of green coffee beans using a computer vision system,” *Computers and Electronics in Agriculture*, vol. 162, pp. 735–746, 2019.
- M. J. Hoque, M. S. Islam, I. Ahmed, and M. Nurullah, “Enhancing Precision Agriculture Efficiency Through Edge Computing-Enabled Wireless Sensor Networks: A Data Aggregation Perspective,” *Engineering Proceedings*, vol. 82, no. 90, pp. 1–12, 2024, doi: 10.3390/ecsa-11-20412.
- M. J. O’Grady, D. Langton, and G. M. P. O’Hare, “Edge computing: A tractable model for smart agriculture?” *Artificial Intelligence in Agriculture*, vol. 3, pp. 42–51, 2019.
- M. N. Akhtar, A. J. Shaikh, A. Khan, H. Awais, E. A. Bakar, and A. R. Othman, “Smart Sensing with Edge Computing in Precision Agriculture for Soil Assessment and Heavy Metal Monitoring: A Review,” *Agriculture*, vol. 11, no. 475, pp. 1–37, 2021, doi: 10.3390/agriculture11060475.
- M. N. Anjum, M. A. Ashir, M. T. Ahad, M. Talukder, and T. Rahman, “IoT-based smart agriculture aiming to achieve sustainable development goals,” *Sustainable Computing: Informatics and Systems*, vol. 36, pp. 100709, 2022.
- M. Nawaz and M. I. K. Babar, “IoT and AI for Smart Agriculture in Resource-Constrained Environments: Challenges, Opportunities and Solutions,” *Discover Internet of Things*, vol. 5, no. 24, 2025, doi: 10.1007/s43926-025-00119-3.
- M. Oksanen, R. Linkolehto, and I. Seilonen, “Adapting an Industrial Automation Protocol to Remote Monitoring of Mobile Agricultural Machinery: A

- Combine Harvester with IoT,” *IFAC-PapersOnLine*, vol. 49, no. 16, pp. 127–131, 2016. doi: 10.1016/j.ifacol.2016.10.024.
- M. R. Zhang and X. Li, “Edge Computing Driven Data Sensing Strategy in the Entire Crop Lifecycle for Smart Agriculture,” *Sensors*, vol. 21, no. 7502, pp. 1–17, 2021, doi: 10.3390/s21227502.
- M. S. M. Rafi, M. Behjati, and A. S. Rafsanjani, “Reliable and Cost-Efficient IoT Connectivity for Smart Agriculture: A Comparative Study of LPWAN, 5G, and Hybrid Connectivity Models,” *Sunway University Technical Review*, 2025.
- M. U. Tariq, S. M. Saqib, T. Mazhar, M. A. Khan, T. Shahzad, and H. Hamam, “Edge-enabled Smart Agriculture Framework: Integrating IoT, Lightweight Deep Learning, and Agentic AI for Context-aware Farming,” *Results in Engineering*, vol. 28, 107342, 2025, doi: 10.1016/j.rineng.2025.107342.
- Miao, D. Rajasekhar, S. Mishra, S. K. Nayak, and R. Yadav, “A fog-based smart agriculture system to detect animal intrusion,” *IEEE Internet of Things Journal*, vol. 10, no. 7, pp. 6123–6135, 2023.
- Min, Y. Ye, S. Xiong, and X. Chen, “Computer Vision Meets Generative Models in Agriculture: Technological Advances, Challenges and Opportunities,” *Applied Sciences*, vol. 15, no. 7663, pp. 1–42, 2025, doi: 10.3390/app15147663.
- Mohapatra, “A LoRa IoT framework with machine learning for remote livestock monitoring,” *IEEE Sensors Journal*, vol. 25, no. 8, pp. 1–12, 2025.
- Mulyono, P. Apnitami, I. S. Wangi, K. N. P. Wicaksono, and C. Apriono, “The Potential of Smart Farming IoT Implementation for Coffee Farming in Indonesia: A Systematic Review,” *Green Intelligent Systems and Applications*, vol. 2, no. 2, pp. 53–70, 2022. doi: 10.53623/gisa.v2i2.95.
- N. Arun, B. Lee, F. A. Castiblanco, et al., “Ambient IoT: Communications enabling precision agriculture,” *IEEE Communications Magazine*, vol. 62, no. 3, pp. 72–78, 2024.
- N. Godwin and J. Mwebaze, “A Smart IoT Framework for Climate-Resilient and Sustainable Maize Farming in Uganda,” *Makerere University Journal of Smart Agriculture Research, Sensors*, vol. 25, no. 3, pp. 1–18, 2025.
- N. M. Matsveichuk and Y. N. Sotskov, “Digital Technologies, Internet of Things and Cloud Computations Used in Agriculture: Surveys and Literature in Russian,” *Preprints.org*, 18 Jul. 2023, doi: 10.20944/preprints202307.1162.v1.
- N. V. Hoang, “Multi-Access Edge Computing Architecture and Smart Agriculture Application in Ubiquitous Power Internet of Things,” *SSRN Electronic Journal*, pp. 1–15, 2024, doi: 10.2139/ssrn.4618689.
- N. Wilberforce and M. Johnson, “A framework for IoT-enabled smart agriculture,” *International Journal of Distributed Sensor Networks*, vol. 21, no. 1, pp. 1–14, 2025.
- Navarro, N. Costa, and A. Pereira, “A Systematic Review of IoT Solutions for Smart Farming,” *Sensors*, vol. 20, no. 15, p. 4231, Jul. 2020. doi: 10.3390/s20154231.
- P. Rajak, A. Ganguly, S. Adhikary, and S. Bhattacharya, “Internet of Things and Smart Sensors in Agriculture: Scopes and Challenges,” *Journal of Agriculture and Food Research*, vol. 14, 100776, 2023, doi: 10.1016/j.jafr.2023.100776.

- R. Gong, H. Zhang, G. Li, and J. He, "Edge computing-enabled smart agriculture: Technical architectures, practical evolution, and bottleneck breakthroughs," *Sensors*, vol. 25, no. 5302, pp. 1–26, 2025, doi: 10.3390/s25175302.
- R. Zhang, X. Wu, J. Li, P. Zhao, Q. Zhang, L. Wuri, D. Zhang, Z. Zhang, and L. Yang, "A Bibliometric Review of Deep Learning in Crop Monitoring: Trends, Challenges, and Future Perspectives," *Frontiers in Artificial Intelligence*, vol. 8, 1636898, 2025, doi: 10.3389/frai.2025.1636898.
- S. Takahashi, Y. Sakaguchi, N. Kouno, K. Takasawa, K. Ishizu, Y. Akagi, R. Aoyama, N. Teraya, A. Bolatkan, N. Shinkai, H. Machino, K. Kobayashi, K. Asada, M. Komatsu, S. Kaneko, M. Sugiyama, and R. Hamamoto, "Comparison of Vision Transformers and Convolutional Neural Networks in Medical Image Analysis: A Systematic Review," *Journal of Medical Systems*, vol. 48, no. 84, pp. 1–22, 2024. doi: 10.1007/s10916-024-02105-8.
- S.-J. Chang and C.-Y. Huang, "Deep Learning Model for the Inspection of Coffee Bean Defects," *Applied Sciences*, vol. 11, no. 8226, pp. 1–22, 2021, doi: 10.3390/app11178226.
- T. Vo, P. Dave, G. Bajpai, and R. Kashef, "Edge, Fog, and Cloud Computing: An Overview on Challenges and Applications," *arXiv preprint arXiv:2211.01863*, 2022.
- V. T. Krishnaprasath, H. M. A. Ghanimi, S. Sengan, and M. G. Alharbi, "An online tool based on the Internet of Things and intelligent blockchain technology for data privacy and security in rural and agricultural development," *Scientific Reports*, vol. 15, no. 27349, pp. 1–15, 2025, doi: 10.1038/s41598-025-13231-9.
- Wang and J. Gong, "Intelligent agricultural greenhouse control system based on IoT and machine learning," *IEEE Access*, vol. 13, pp. 1–15, 2025.
- Wang and J. Gong, "Intelligent Agricultural Greenhouse Control System Based on Internet of Things and Machine Learning," *arXiv preprint arXiv:2402.09488*, 2025.
- X. Zou, Z. Liu, X. Zhu, W. Zhang, Y. Qian, and Y. Li, "Application of Vision Technology and Artificial Intelligence in Smart Farming," *Agriculture*, vol. 13, no. 2106, pp. 1–5, 2023, doi: 10.3390/agriculture13112106.
- Y. Lu, Y. Tang, J. Zhang, S. Liu, X. Liang, M. Li, and R. Li, "Variations and Trends in Rice Quality across Different Types of Approved Varieties in China, 1978–2022," *Agronomy*, vol. 14, no. 1234, pp. 1–12, 2024, doi: 10.3390/agronomy14061234.
- Y. Wu, L. Zhang, R. Lou, and X. Li, "Recognition of Lane Changing Maneuvers for Vehicle Driving Safety," *Electronics*, vol. 12, no. 1456, pp. 1–11, 2023, doi: 10.3390/electronics12061456.
- Y.-H. Chang, F.-C. Wu, and H.-W. Lin, "Design and Implementation of ESP32-Based Edge Computing for Object Detection," *Sensors*, vol. 25, no. 1656, pp. 1–26, 2025, doi: 10.3390/s25061656.
- Ye, R. Xue, and H. Xu, "ASD-YOLO: A Lightweight Network for Coffee Fruit Ripening Detection in Complex Scenarios," *Frontiers in Plant Science*, vol. 16, 1484784, 2025, doi: 10.3389/fpls.2025.1484784.
- Z. Babar and Ö. B. Akan, "Sustainable and precision agriculture with the Internet of Everything," *IEEE Communications Magazine*, vol. 62, no. 5, pp. 60–66, 2024.

- Z. Cao, S. Sun, and X. Bao, "A Review of Computer Vision and Deep Learning Applications in Crop Growth Management," *Applied Sciences*, vol. 15, no. 8438, pp. 1–28, 2025, doi: 10.3390/app15158438.
- Z. Salman, A. Muhammad, M. J. Piran, and D. Han, "Crop-saving with AI: Latest Trends in Deep Learning Techniques for Plant Pathology," *Frontiers in Plant Science*, vol. 14, no. 1224709, pp. 1–12, 2023, doi: 10.3389/fpls.2023.1224709.
- Zhang, Y. Wang, S. Lu, L. Liu, L. Xu, and W. Shi, "OpenEI: An Open Framework for Edge Intelligence," in *Proc. 39th IEEE International Conference on Distributed Computing Systems (ICDCS)*, Dallas, TX, USA, 2019, pp. 1–10, doi: 10.1109/ICDCS.2019.00001.
- Zhu and Y. Ding, "Optimized Dynamic Collision Avoidance Algorithm for USV Path Planning," *Sensors*, vol. 23, no. 4567, pp. 1–18, 2023, doi: 10.3390/s23094567.