4. KESIMPULAN

Berdasarkan hasil metrik evaluasi yang telah dilakukan maka dapat disimpulkan beberapa hal sebagai berikut:

1. Model YOLOv8 yang dilatih dengan 100 epoch dan batch ukuran 8 mampu mengklasifikasikan kesegaran buah (*fresh, semirotten, rotten*) dengan akurasi rata-rata 88%.

2. Evaluasi pada metrik umum menunjukkan presisi 74% dan recall 75% pada epoch ke-100. Sehingga Rata-rata presisi keseluruhan model dalam mendeteksi kesegaran buah adalah sekitar 73%.

5. SARAN

Model YOLOv8 yang dilatih dengan 100 *epoch*, 8 *batch* dan 5215 gambar memiliki tingkat akurasi sebesar 88%, ini menunjukkan dengan *epoch* yang terbatas model object YOLOv8 dapat masih bersaing dengan algoritma deteksi lainnya seperti gabungan ResNet, DenseNet, MobileNetV2, NASNet, dan EfficientNet yang memiliki akurasi sebesar 95,2 % [11]. Kemudian *Multilayer Perceptron* (MLP) dengan akurasi 97,2% [12], arsistektur Alexnet dengan akurasi 99.1% [13] dan YOLOv5 dengan akurasi sebesar 94.5% [14]. Oleh karena itu percobaan *epoch* dan *batch* yang lebih tinggi memiliki potensi menjadi penelitian selanjutnya, untuk dapat mengembangkan model YOLOv8 untuk deteksi buah dengan akurasiyang lebih tinggi.

DAFTAR PUSTAKA

[1] J. Ni, J. Gao, L. Deng, and Z. Han, "Monitoring the Change Process of Banana Freshness by GoogLeNet," *IEEE Access*, vol. 8, pp. 228369–228376, Jan. 2020, doi: 10.1109/ACCESS.2020.3045394.

[2] I. J. González-Hernández, R. Granillo-Macías, J. L. Martínez-Flores, D. Sánchez-Partida, and D. E. Gibaja-Romero, "Hybrid model to design an agro-food distribution network considering food quality," *International Journal of Industrial Engineering : Theory Applications and Practice*, vol. 26, no. 4, pp. 588–609, Jan. 2019.

[3] V. L. Flax, C. Thakwalakwa, C. H. Schnefke, J. C. Phuka, and L. M. Jaacks, "Food purchasing decisions of Malawian mothers with young children in households experiencing the nutrition transition," *Appetite*, vol. 156, p. 104855, Jan. 2021, doi: 10.1016/j.appet.2020.104855.

[4] V. Quick *et al.*, "Preserving farm freshness: Consumer preferences for local value-added products at urban farmers markets," *J Agric Food Syst Community Dev*, vol. 11, no. 2, pp. 113–134, doi: 10.5304/jafscd.2022.112.004.

[5] H. N. J. Schifferstein, T. Wehrle, and C. C. Carbon, "Consumer expectations for vegetables with typical and atypical colors: The case of carrots," *Food Qual Prefer*, vol. 72, pp. 98–108, Mar. 2019, doi: 10.1016/j.foodqual.2018.10.002.

[6] S. R. Jaeger, S. L. Chheang, C. M. Roigard, and M. B. Frøst, "Consumers' expectations and experiences of salad greens, herbs, and fruits from vertical farming: Comparison with organic produce," *Food Qual Prefer*, vol. 112, p. 105020, Dec. 2023, doi: 10.1016/j.foodqual.2023.105020.

[7] X. Du, M. Davila, C. Williams, and Y. Weng, "Fresh Cucumber Fruit Physicochemical Properties, Consumer Acceptance, and Impact of Variety and Harvest Date," *ACS Food Science and Technology*, vol. 2, no. 4, pp. 616–629, Apr. 2022, doi: 10.1021/acsfoodscitech.1c00433.

[8] H. Neetoo *et al.*, "A comparative assessment of the quality of minimally processed pineapples sold in wet markets and supermarkets of mauritius," *Current Research in Nutrition and Food Science*, vol. 7, no. 1, pp. 128–141, Apr. 2019, doi: 10.12944/CRNFSJ.7.1.13.

[9] P. Choosung, T. Wasusri, W. Utto, P. Boonyaritthongchai, and C. Wongs-Aree, "The supply chain and its development concept of fresh mulberry fruit in Thailand: Observations in Nan Province, the largest production area," *Open Agric*, vol. 7, no. 1, pp. 401–419, Jan. 2022, doi: 10.1515/opag-2022-0102.

[10]   "Produksi Tanaman Buah-buahan - Tabel Statistik - Badan Pusat Statistik Indonesia." Accessed: Apr. 04, 2024. [Online]. Available: https://www.bps.go.id/id/statistics-table/2/NjIjMg==/produksi-tanaman-buah-buahan.html

[11]   N. Ismail and O. A. Malik, "Real-time visual inspection system for grading fruits using computer vision and deep learning techniques," *Information Processing in Agriculture*, vol. 9, no. 1, pp. 24–37, Mar. 2022, doi: 10.1016/J.INPA.2021.01.005.

[12]   M. H. Zarnaq, M. Omid, M. S. Firouz, M. Jafarian, and P. Bazyar, "Freshness and quality assessment of parsley using image processing and artificial intelligence techniques," *Agricultural Engineering International: CIGR Journal*, vol. 24, no. 2, pp. 282–290, Jun. 2022.

[13]   U. Amin, M. I. Shahzad, A. Shahzad, M. Shahzad, U. Khan, and Z. Mahmood, "Automatic Fruits Freshness Classification Using CNN and Transfer Learning," *Applied Sciences 2023, Vol. 13, Page 8087*, vol. 13, no. 14, p. 8087, Jul. 2023, doi: 10.3390/APP13148087.

[14]   S. Ren, K. He, R. Girshick, and J. Sun, "Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks," *IEEE Trans Pattern Anal Mach Intell*, vol. 39, no. 6, pp. 1137–1149, Jun. 2017, doi: 10.1109/TPAMI.2016.2577031.

[15]   M. Sharafudeen and V. Chandra S S, "Multimodal Siamese Framework for Accurate Grade and Measure Estimation of Tropical Fruits," *IEEE Trans Industr Inform*, vol. 20, no. 3, pp. 4283–4291, Mar. 2024, doi: 10.1109/TII.2023.3316182.

[16]   D. Kholiya, A. K. Mishra, N. K. Pandey, and N. Tripathi, "Plant Detection and Counting using Yolo based Technique," *2023 3rd Asian Conference on Innovation in Technology, ASIANCON 2023*, p. Ravet, doi: 10.1109/ASIANCON58793.2023.10270530.

[17]   Sandhya and A. Kashyap, "A novel method for real-time object-based copy-move tampering localization in videos using fine-tuned YOLO V8," *Forensic Science International: Digital Investigation*, vol. 48, p. 301663, Mar. 2024, doi: 10.1016/j.fsidi.2023.301663.

[18]   Y. Tang, H. Zhou, H. Wang, and Y. Zhang, "Fruit detection and positioning technology for a Camellia oleifera C. Abel orchard based on improved YOLOv4-tiny model and binocular stereo vision," *Expert Syst Appl*, vol. 211, p. 118573, Jan. 2023, doi: 10.1016/j.eswa.2022.118573.

[19]   Z. Sun, P. Li, Q. Meng, Y. Sun, and Y. Bi, "An Improved YOLOv5 Method to Detect Tailings Ponds from High-Resolution Remote Sensing Images," *Remote Sens (Basel)*, vol. 15, no. 7, p. 1796, Apr. 2023, doi: 10.3390/rs15071796.

[20]   Z. Dahirou and M. Zheng, "Motion Detection and Object Detection: Yolo (You only Look Once)," *Proceedings - 2021 7th Annual International Conference on Network and Information Systems for Computers, ICNISC 2021*, pp. 250–257, 2021, doi: 10.1109/ICNISC54316.2021.00053.

[21]   J. N. University, "Fruits Detection and Quality Analysis Dataset," *Roboflow Universe*. Roboflow, Aug. 2023. [Online]. Available: https://universe.roboflow.com/jawaharlal-nehru-university-utour/fruits-detection-and-quality-analysis

[22]   V. K. Kavyapriya *et al.*, "CNN Based Identification of weeds in Tomato Farm," *2023 14th International Conference on Computing Communication and Networking Technologies, ICCCNT 2023*, p. Delhi, doi: 10.1109/ICCCNT56998.2023.10307829.

[23]   N. F. Alhussainan, B. Ben Youssef, and M. M. Ben Ismail, "A Deep Learning Approach for Brain Tumor Firmness Detection Based on Five Different YOLO Versions: YOLOv3–YOLOv7," *Computation*, vol. 12, no. 3, p. 44, Mar. 2024, doi: 10.3390/computation12030044.

[24]   Md. Akkas Ali, R. Kumar Dhanaraj, and S. Kadry, "AI-enabled IoT-based pest prevention and controlling system using sound analytics in large agricultural field," *Comput Electron Agric*, vol. 220, p. 108844, May 2024, doi: 10.1016/j.compag.2024.108844.

[25]   M. A. Ali, A. K. Sharma, and R. K. Dhanaraj, "Heterogeneous features and deep learning networks fusion-based pest detection, prevention and controlling system using IoT and pest sound analytics in a vast agriculture system," *Computers and Electrical Engineering*, vol. 116, p. 109146, May 2024, doi: 10.1016/j.compeleceng.2024.109146.

[26]   B.-G. M., H. A., P.-M. S., A.-C. R., M.-R. F., and P. G., "Performance evaluation of three versions of a convolutional neural network for object detection and segmentation using a multiclass and reduced panoramic radiograph dataset," *J Dent*, vol. 144, p. 104891, May 2024, doi: 10.1016/j.jdent.2024.104891.

[27]   D. Sukumarran *et al.*, "An optimised YOLOv4 deep learning model for efficient malarial cell detection in thin blood smear images," *Parasit Vectors*, vol. 17, no. 1, p. 188, Dec. 2024, doi: 10.1186/s13071-024-06215-7.

[28]   A. Smith *et al.*, "Computer vision model for the detection of canine pododermatitis and neoplasia of the paw," *Vet Dermatol*, vol. 35, no. 2, pp. 138–147, Apr. 2024, doi: 10.1111/vde.13221.