*FruitVision: A benchmark for fresh, rotten, and formalin-mixed fruit detection*

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**Related Work Table**

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| **Ref. No** | **Year** | **Method** | **Dataset** | **Categories** | **Model** | **Advantages** | **Limitations** |
| [1] | 2025 | Supervised Learning | Data in Brief | 8 | ResNet50,  Gaussian filter | High accuracies beyond 99% ensure robustness and prevent overfitting | Lack of external validation, in a real-world application, the models would need to be paired with additional sensors and systems that enable a 360-degree view of each fruit. |
| [2] | 2024 | Supervised learning | Custom-built by authors | 4 | DurbeenNet | 96.71 % accuracy in detecting potentially chemically contaminated fruits | Cannot specify the particular harmful elements mixed with the fruits |
| [3] | 2022 | Self  supervised | Riseholme‑2021:3,520 RGB strawberry images from a mobile robot | 2 | Custom 2D CNN encoder (ResNet) | • Learns color-specific features • Early stopping via proxy task accuracy • Lightweight, real-time on robots | • Only captures color anomalies • Limited to strawberries and RGB data • May miss structural anomalies |
| [4] | 2025 | Self  supervised | Hyperspectral datasets of strawberry & blueberry | 4 | SimCLR | • Exploits rich spectral + spatial data • High detection performance 92% accuracy. | • Requires expensive hyperspectral sensors • PCA may discard nuances • Tested only on two fruit types |
| [5] | 2025 | Supervised Learning | Fruit Freshness Classification and Detection | 3 | ResNet-101 | Robust Detection &  Improve accuracy | Increased computational overhead |
| [6] | 2023 | Self  supervised | A Self‑Supervised Anomaly Detector of Fruits Based on Hyperspectral Imaging | 6 | Hyperspectral imaging or  CNN based | 92% high accuracy, detects subtle defects | Requires hyperspectral imaging, not multiclass |
| [7] | 2023 | Supervised Learning | Public dataset from Kaggle: **12,000 images**, 10 fruits + 5 vegetables | 20 | SVM, LDA, Bagging | 1. **High accuracy** (96.98% overall with SVM + all 3 CNNs + PCA).  2. **Efficient feature extraction** using pre-trained networks, no need for extensive training. | 1. **Variable performance**: poor detection on "rotten bell pepper" and "rotten potato" (accuracy under 90%).  2. Relies on good-quality pre-trained CNN features |
| [8] | 2018 | Supervised Learning | 1,200 controlled images of 7 produce types | 3 | Gray-Level Cooccurrence Matrix,  SVM, KNN | Interpretable, small dataset, multi-class, 92–94% accuracy | Hand-crafted features limit generalization; controlled conditions only; modest dataset size |
| [9] | 2022 | supervised | Custom: 6 fruits | 6 | YOLOv3 | Detection and grading | Private dataset, per-fruit models, limited fruit scope. |

**References**

1. Fischer-Brandies, L., Müller, L., Riegger, J. J., & Buettner, R. (2025). Fresh or Rotten? Enhancing Rotten Fruit Detection With Deep Learning and Gaussian Filtering. *IEEE Access*.
2. Sattar, A., Ridoy, M. A. M., Saha, A. K., Babu, H. M. H., & Huda, M. N. (2024). Computer vision based deep learning approach for toxic and harmful substances detection in fruits. *Heliyon*, *10*(3).
3. Choi, T., Would, O., Salazar-Gomez, A., & Cielniak, G. (2022, May). Self-supervised representation learning for reliable robotic monitoring of fruit anomalies. In *2022 International Conference on Robotics and Automation (ICRA)* (pp. 2266-2272). IEEE.
4. Zhang, L., Liu, J., Wei, Y., An, D., & Ning, X. (2025). Self-supervised learning-based multi-source spectral fusion for fruit quality evaluation: A case study in mango fruit ripeness prediction. *Information Fusion*, *117*, 102814.
5. Shu, Y., Zhang, J., Wang, Y., & Wei, Y. (2025). Fruit Freshness Classification and Detection Based on the ResNet-101 Network and Non-Local Attention Mechanism. *Foods*, *14*(11), 1987.
6. Liu, Y., Zhou, S., Wan, Z., Qiu, Z., Zhao, L., Pang, K., ... & Yin, Z. (2023). A self-supervised anomaly detector of fruits based on hyperspectral imaging. *Foods*, *12*(14), 2669.
7. Yuan, Y., & Chen, X. (2024). Vegetable and fruit freshness detection based on deep features and principal component analysis. *Current Research in Food Science*, *8*, 100656.
8. Bhargava, A., & Bansal, A. (2021). Fruits and vegetables quality evaluation using computer vision: A review. *Journal of King Saud University-Computer and Information Sciences*, *33*(3), 243-257.
9. Fu, Y., Nguyen, M., & Yan, W. Q. (2022). Grading methods for fruit freshness based on deep learning. *SN computer science*, *3*(4), 264.