

ABSTRACT

Food waste, particularly from fruits, is a major contributor to household waste in Indonesia. Consumers often struggle to accurately assess the freshness of fruits, leading to premature disposal of edible items or consumption of spoiled ones. This research proposes the development of a fruit freshness detection system based on image recognition using a Convolutional Long Short-Term Memory (ConvLSTM) architecture. The model is trained on image sequences captured every 6 hours over a 7-day period, enabling it to learn progressive visual changes such as color, texture, and shape. A multitask learning approach is implemented to perform both classification of freshness labels and regression to estimate the remaining shelf-life in days. The dataset consists of 5600 images labeled with ground truth shelf-life data. The development process follows the Knowledge Discovery in Databases (KDD) methodology, involving data collection, preprocessing, sequence transformation, model training, and evaluation. The final model achieves a classification accuracy of 98.06%, an F1-Score of 98%, and regression performance with a Mean Absolute Error (MAE) of 0.86 days. The simulated model demonstrates strong robustness against variations in lighting and background conditions, making it feasible for real-world household usage. This study has potential to contribute for reducing food waste, improving household consumption efficiency, and hopefully support Sustainable Development Goals (SDGs), particularly goals 2 (Zero Hunger) and 12 (Responsible Consumption and Production).

Keywords: *ConvLSTM, food waste, freshness detection, image recognition, KDD, multitask learning, sequence data*