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FRESHNESS CLASSIFICATION OF KERSON FRUITS AND LEAVES USING BY CONVOLUTIONAL NEURAL NETWORK

Rationale/ Introduction

Current practices for freshness assessment in the produce industry often rely on manual inspection of physical attributes, which can be subjective and time-consuming (Rahman et al., 2020). While these methods are well-established for common fruits and vegetables like tomatoes or apples (Gómez-Ariza et al., 2007), there is a knowledge gap about the freshness of Kerson Fruit (Muntingia Calabura) fruits and leaves, particularly in Convolutional Neural Networks (CNN) for image recognition. Existing literature mostly focuses on more common fruits and vegetables, leaving a gap in knowledge about the freshness of Kerson Fruit (Muntingia Calabura), despite its potential significance as a regional or indigenous food source.

This lack of research on freshness assessment for Kerson Fruit (Muntingia Calabura presents a compelling opportunity to apply Convolutional Neural Networks (CNNs). CNNs are a powerful deep learning technique that excels at image recognition tasks (Albawi et al., 2017). By training a CNN to identify the freshness of Kerson Fruit (Muntingia Calabura) by labeling “Fresh, “Slightly Ripe," "Ripe, and “Overripe” for the fruit and “"Health,"" Wilted," and for the leaves. Thus, the researcher proposed the image recognition of freshness in Kerson Fruit (Muntingia Calabura) fruits. Through the use of dataset images depicting Kerson Fruit (Muntingia Calabura) fruits and leaves at various stages of freshness, the network can learn to identify subtle visual patterns that correlate with freshness levels.

The researchers will utilize the effective parameters to classify the freshness of Kerson Fruit (Muntingia Calabura) including the size, color, shape, exocarp for fruits, and texture of leaf to classify the freshness of fruits and leaves. The parameters are used to improve the accuracy of identifying freshness in fruit and leaves. The Farmers cannot contribute effectively between fresh and rotten fruits, and vegetables because this is mainly done by people. People tire out after performing the same task for several days. (Hamim et al., 2022). Therefore, a vital factor to consider in determining the suitability of fruits and leaves for consumption is their freshness classification. In addition, parameters for assessing the freshness of Kerson fruit and leaves include the evaluating color, exocarp of fruit, and texture of leaves, analyzing the shape and size, detecting the image for the fruits if

it is “fresh” or “overripe” and for the leaves if it is “health” or “wilted” and potential applications in enhancing food quality assurance and preservation efforts.

The proposed Freshness Classification of Kerson Fruit (Muntingia Calabura) fruits and leaves using by Convolutional Neural Network is aim to classify the freshness of Kerson Fruit (Muntingia Calabura) to produce the quality and freshness to the Kerson Fruit Industry. This study benefits the farmers can leverage this information to optimize harvest times and storage conditions, resulting in higher quality produce and reduced post-harvest losses (Rahman et al., 2020). Vendors and distributors benefit from a reliable system to ensure they are purchasing high-quality Kerson Fruit (Muntingia Calabura), minimizing spoilage and enhancing customer satisfaction. Consumers gain the confidence of knowing they are purchasing truly fresh fruits and leaves.

The lack of research about freshness assessment practices in the produce industry often rely on subjective and time-consuming manual inspection methods. However, there is a knowledge gap regarding the freshness of Kerson Fruit (Muntingia Calabura) fruits and leaves, particularly in utilizing Convolutional Neural Networks (CNNs) for image recognition. This study contributed to optimizing the Convolutional Neural Networks (CNNs) to freshness classification to the ongoing development in the field of computer science.

Significance of the Study

This research holds significant importance as it aligns with the Sustainable Development Goal (SDG) of ensuring consumption and production patterns that contribute to reducing food waste and promoting sustainable agriculture. By employing a Convolutional Neural Network (CNN) to accurately classify the freshness of Kerson Fruit (Muntingia Calabura) fruits and leaves, this study aims to enhance food security and quality. Through precise freshness classification, it seeks to reduce food waste along the distribution chain, optimize harvesting time, improve storage conditions, and streamline distribution processes. This innovative application of technology in agriculture not only benefits vendors, farmers, and distributors by ensuring access to fresh produce but also contributes to advancing agricultural technology and promoting a sustainable food system. Thus, this research contributes to the broader goal of enhancing agricultural productivity, ensuring food safety, and promoting a sustainable food system as outlined in the Agri-Fisheries and Food Security Thematic Area Plan.

Scope and Limitations of the Study

This study focuses on developing an image recognition system using Convolutional Neural Networks (CNNs) to classify the freshness of Kerson Fruit (Muntingia Calabura) fruits and leaves. The system will analyze key visual characteristics such as color, shape, size, and texture to determine different freshness levels. A dataset of labeled images representing various stages of freshness will be used to train and test the CNN model. The goal is to improve the accuracy and efficiency of freshness assessment, providing farmers, vendors, and consumers with a reliable tool for determining fruit and leaf quality. This research aims to enhance food quality control, reduce waste, and support better decision-making in agriculture and distribution.

However, the study has some limitations. The accuracy of the model depends on the quality and diversity of the images used for training, which may be affected by variations in lighting, camera quality, and environmental conditions. The study will focus solely on visual attributes and will not consider other factors such as internal fruit composition, shelf life, or microbial contamination. Additionally, the model's effectiveness may vary across different growing regions due to natural differences in fruit and leaf characteristics. While the CNN-based system aims to improve freshness classification, it should be used as a support tool rather than a complete replacement for human inspection and traditional quality assessment methods.

Objectives of the Study

This study aims to design and develop an image recognition to classify the freshness of Kerson Fruit (Muntingia Calabura) fruits and leaves using by Convolutional Neural Network. Specifically, the research will aim to achieve the following objectives:

1. To develop a Convolutional Neural Network (CNN) model capable of accurately classifying the freshness of Kerson Fruit (Muntingia Calabura) fruits and leaves based on visual characteristics extracted from images.
2. To assess the performance of the trained CNN model in freshness classification tasks.
3. To establish standardized annotation guidelines and protocols for labeling Kerson Fruit (Muntingia Calabura) fruits and leaves images according to freshness levels. 4. To create a dataset of labeled images represent Kerson Fruit (Muntingia Calabura)

and leaves at various stages of freshness.

Expected Outputs

The expected outputs of the study include the development of a trained CNN model for the freshness classification of Kerson Fruit (Muntingia Calabura) fruits and leaves, along with comprehensive evaluation metrics being developed to integrate with a CNN model, aimed at determining the freshness of Kerson Fruit (Muntingia Calabura) fruits and leaves. This module will utilize a labeled image dataset covering various stages of freshness. Employing Machine Learning Algorithms, it will analyze color, fruit exocarp condition, and leaf texture to classify freshness accurately, enhancing agricultural quality control processes. The machine learning libraries and frameworks, such as PyTorch that will be utilize for training models and experimentation for image freshness. The study's findings and recommendations will contribute to optimizing freshness assessment practices and integrating CNN-based solutions into agricultural and food supply chain management. Overall, the study aims to highlight the potential applications and real-world impact of CNN-based freshness classification, including improved food quality, reduced waste, and enhanced economic viability for farmers.

References

Albawi, S., Mohamed, A., & Yap, Y. (2017). Deep learning for image classification: A comprehensive review. https://arxiv.org/pdf/1907.09408

Gómez-Ariza, J. L., Guamis, V., & Vázquez, M. (2007). Disinfection of minimally processed apples using combined chlorine dioxide and ultraviolet light treatments. Food Control, 18(3), 209- 215. https://www.sciencedirect.com/science/article/abs/pii/B97801241584670003 29

Hamim, M. A. H., Tahseen, J. T., Hossain, K. Md. I. H., Akter, N. A., & Asha, U. F. T. A. (2022, May). *Bangladeshi Fresh-Rotten fruit & vegetable detection using deep learning deployment in effective application*. https://www.researchgate.net/publication/372894466_Bangladeshi_Fresh

Rotten_Fruit_Vegetable_Detection_Using_Deep_Learning_Deployment_in_Effec tive_Application.

Rahman, S. S., Dash, S. K., & Panda, S. K. (2020). Recent trends in technologies for the

evaluation of fruit and vegetable quality. Critical Reviews in Food Science and Nutrition, 60(14), 2322- 2341. https://www.sciencedirect.com/science/article/abs/pii/S0924224422001467