

PHASE 5: PROJECT DEVELOPMENT

The objective of this phase is to build the project components and ensure their seamless integration into a functional, user-friendly system. The development leverages a robust technology stack including Python as the core programming language, with Keras and TensorFlow for implementing deep learning models. OpenCV is used for image preprocessing, while Flask serves as an optional lightweight backend for the web interface. Development and experimentation are conducted in Jupyter Notebook for better visualization and control.

◆ Dataset Overview

The process begins by labeling and organizing the dataset, which is sourced from Kaggle:

<https://www.kaggle.com/datasets/muhmuddinmuxiddinov/fruits-and-vegetables-dataset>

This dataset provides a variety of fruit and vegetable images, which are essential for model training. The development stages include implementing a MobileNetV2-based classification model using transfer learning, followed by training and evaluation on the preprocessed image data. Once validated, the model is integrated with a front-end interface using a Flask API, enabling real-time classification and result display. Finally, the complete system is prepared for local or cloud deployment depending on performance and access needs.

◆ Challenges & Solutions

During development, several challenges were encountered. One major issue was overfitting due to the limited dataset size. This was mitigated by applying data augmentation techniques, along with regularization and dropout layers to improve generalization. Another challenge involved UI lag when processing high-resolution images. This was resolved by resizing images before processing and loading the model asynchronously to enhance responsiveness.

Through these methods, the system was successfully developed and integrated into a cohesive, efficient solution.