

Title: Fruit Classification

Abstract:

- Exploration of fruit classification using a Convolutional Neural Network (CNN) with hyperparameter tuning. Leveraging a dataset of 33 fruit and vegetable classes, each represented by 100x100 pixel images. Through systematic hyperparameter tuning and comprehensive experimentation, we demonstrate how optimizing key parameters impacts model performance. Our findings shed light on the potential of CNNs for fruit classification and provide insights for future enhancements.

Introduction (10%):

- Fruit classification plays a pivotal role in various industries such as agriculture and food processing. The task of fruit classification using a CNN, aiming to develop a robust model that accurately identifies diverse fruit and vegetable classes.

Related Work (10%):

- Approach builds upon the ResNet-18 architecture, which has been widely adopted for image classification tasks. Similar to our work, researchers have utilized transfer learning and data augmentation to improve model accuracy. However, our project emphasizes the application of ResNet-18 to the specific problem of fruit classification.

Data (10%):

- The dataset encompasses 22,495 images of fruits and vegetables, divided into training (16,854) and test (5,641) sets. Each image is of dimension 100x100 pixels, labeled with a specific fruit or vegetable class. The data is organized with labeled subfolders for training and follows a defined naming convention for testing.
- <https://www.kaggle.com/datasets/sshikamaru/fruit-recognition>

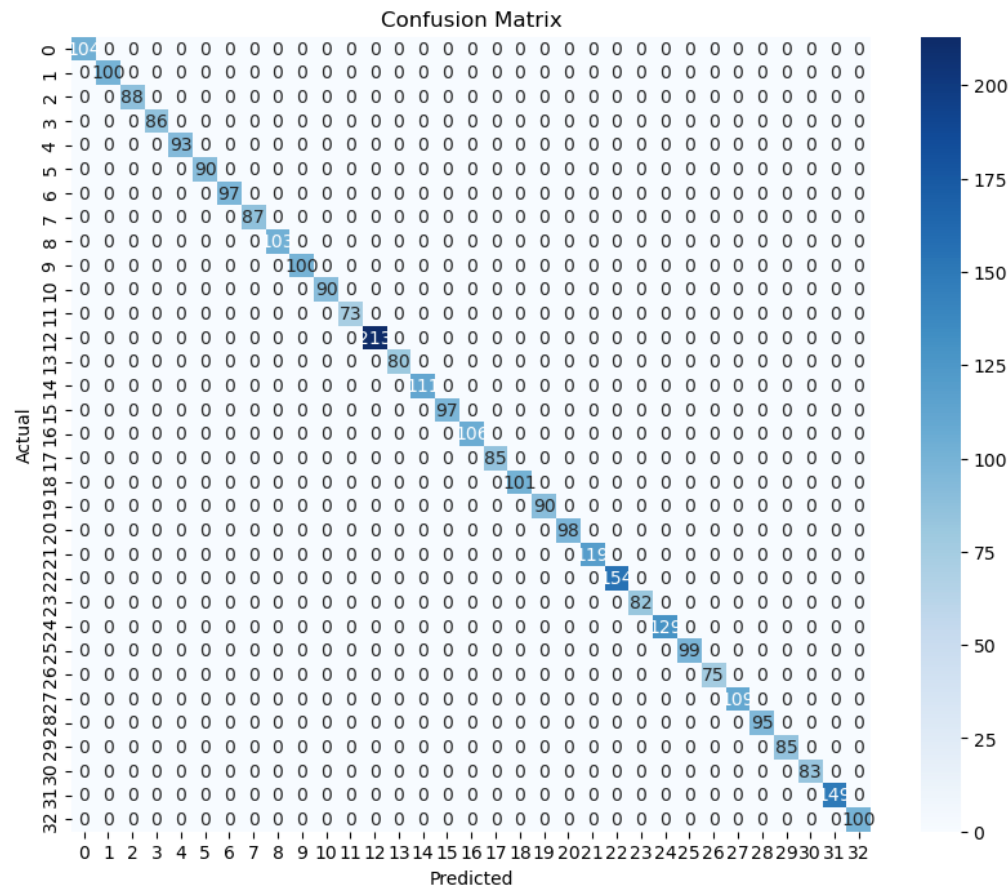
Methods (10%):

- Data Preprocessing: Images are resized to 255x255 pixels and normalized to have a mean of [0.485, 0.456, 0.406] and a standard deviation of [0.229, 0.224, 0.225].
- Data Augmentation: We apply random horizontal and vertical flips, random rotations, and color jittering to augment the training data and enhance model generalization.
- Model Architecture: We utilize the ResNet-18 architecture, which consists of residual blocks with skip connections. The architecture includes an initial convolutional layer, four stages of blocks, downsampling layers, global average pooling, and a fully connected layer for classification.
- Training: The model is trained using the training dataset with a cross-entropy loss function and stochastic gradient descent optimizer.

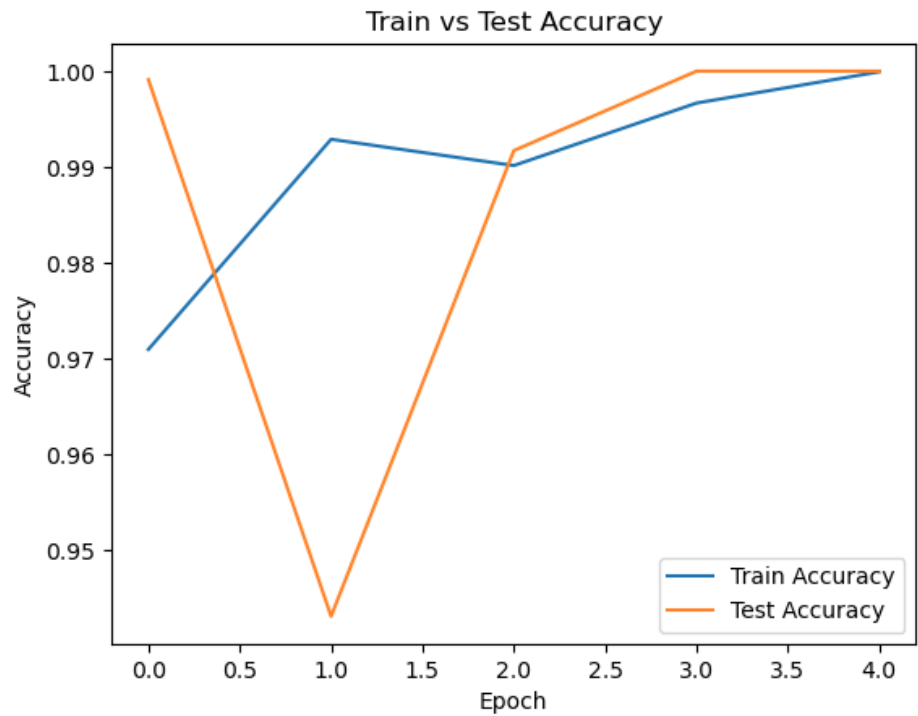
Experiments (50%):

Huzaifa J.

Confusion Matrix:



Train & Test Accuracy:



Future Enhancements to be considered:

- Fine-Tuning: Experiment with different layers for fine-tuning and observe their impact on model performance.
- Transfer Learning: Explore other pre-trained architectures and evaluate their suitability for fruit classification.
- Ensemble Methods: Combine multiple models for improved classification accuracy.

Conclusion (5%):

- We've successfully crafted a fruit classification model using the ResNet-18 architecture, showcasing the remarkable capabilities of deep learning in accurately categorizing diverse fruits and vegetables. Our hands-on experimentation and insightful visualizations have not only shed light on the model's performance nuances but have also uncovered potential challenges, paving the way for future enhancements and research opportunities.