


## Final Model Selection Justification Report

Date	5 july 2025
Team ID	SWTID1750170729
Project Name	Deepfruitveg: Automated Fruit And Veg Identification
Maximum Marks	2 Marks

### 1. Objective

To justify the selection of the most optimal deep learning model architecture and configuration used for deployment based on empirical results, performance, scalability, and robustness.

### 2. Models Considered

Model Name	Description	Status
<b>Simple CNN</b>	Custom-built CNN with Conv-Pool-Dense layers	Discarded due to underfitting and limited accuracy
<b>ResNet50</b>	Transfer learning model with skip connections	Moderate results, slightly heavier, not chosen
<b>EfficientNetB3</b> 	Pretrained ImageNet model optimized for performance and parameter efficiency	<b>Selected for final deployment</b>

### 3. Selection Criteria

Criteria	Description
<b>Accuracy</b>	High validation accuracy and generalization across unseen data
<b>Top-K Accuracy</b>	Reliable top-3 predictions improve usability for ambiguous classes
<b>Model Size</b>	EfficientNetB3 is more lightweight compared to ResNet50 for similar accuracy
<b>Training Time</b>	Moderate training time on Colab GPU; efficient compared to deeper models
<b>Scalability</b>	Capable of being deployed to web/mobile platforms due to low size & latency
<b>Robustness</b>	Performs well under various image conditions (lighting, occlusion, noise)
<b>Ease of Fine-tuning</b>	EfficientNet offers modular training with better convergence characteristics

## 4. Final Model Summary

Parameter	Value
<b>Base Model</b>	EfficientNetB3 (from tensorflow.keras.applications)
<b>Input Size</b>	300×300×3
<b>Pooling</b>	Global Average Pooling
<b>Custom Layers</b>	Dense(256, ReLU) → Dropout(0.4) → Dense(num_classes, Softmax)
<b>Optimizer</b>	Adam (LR=1e-5)
<b>Loss Function</b>	Categorical Crossentropy
<b>Metrics</b>	Accuracy, Top-3 Accuracy
<b>Class Imbalance Handling</b>	Class weights (computed using sklearn)
<b>Data Augmentation</b>	Rotation, Flip, Zoom, Shift, Shear
<b>Callbacks</b>	EarlyStopping, ModelCheckpoint

## 5. Performance Comparison (Summary)

Model	Validation Accuracy	Top-3 Accuracy	Notes
Simple CNN	~65%	~80%	Lacked complexity to handle fine classes
ResNet50	~82%	~93%	Good, but training slower and model heavier
<b>EfficientNetB3</b> ✓	~90.67%	~98.22%	Best trade-off between speed, accuracy, and size

## 6. Conclusion

EfficientNetB3 was selected as the final model due to its:

- Superior accuracy and top-3 accuracy
- Efficient architecture with fewer parameters
- Ability to generalize well under augmented image scenarios
- Compatibility with real-time and mobile deployment

This model serves the project's goals of building a scalable, robust, and accurate fruit/vegetable classification system suited for agricultural and food processing industries.