

## Tuning Document

Date	4 july 2025
Team ID	SWTID1750170729
Project Name	Deepfruitveg: Automated Fruit And Veg Identification
Maximum Marks	8 Marks

### 1. Objective of Tuning

To improve the performance (accuracy, generalization) of the EfficientNetB3 model for fruit and vegetable classification by optimizing key training parameters, addressing class imbalance, and preventing overfitting.

### 2. Tuning Strategy

Category	Parameter	Final Choice	Reason
<b>Model</b>	Base Architecture	EfficientNetB3	Balanced performance, lower memory footprint, pretrained on ImageNet
<b>Trainable Layers</b>	Fine-tune entire model	Yes (Unfrozen all)	Allowed model to learn domain-specific features
<b>Image Size</b>	Input Dimensions	300×300	Native to EfficientNetB3, ensures performance without resizing overhead
<b>Optimizer</b>	Type	Adam	Adaptive optimizer, works well with transfer learning
	Learning Rate	1e-5	Prevents large updates during fine-tuning
<b>Loss Function</b>	Type	Categorical Crossentropy	Suitable for multi-class classification
<b>Class Imbalance</b>	Technique	Class Weights	Computed with sklearn to balance training focus across classes
<b>Data Augmentation</b>	Applied	Yes	To improve generalization & mitigate overfitting
	Techniques Used	Horizontal flip, rotation (20°), zoom (0.2), shift (0.1), shear (0.1)	
<b>Regularization</b>	Dropout	0.4	Reduces overfitting on dense layer
<b>Early Stopping</b>	Monitor Metric	val_accuracy	Stops training when performance plateaus
	Patience	5 epochs	Prevents premature stopping
<b>Model Checkpoint</b>	Save Best Model	Yes	Only best validation accuracy model is saved
<b>Batch Size</b>	Value	32	Balanced performance and memory usage

Category	Parameter	Final Choice	Reason
Epochs	Value	15	Controlled with early stopping

#### 4. Final Configuration Used for Deployment

python

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```
model.compile(
    optimizer=tf.keras.optimizers.Adam(learning_rate=1e-5),
    loss='categorical_crossentropy',
    metrics=['accuracy', tf.keras.metrics.TopKCategoricalAccuracy(k=3)]
)

callbacks = [
    EarlyStopping(patience=5, monitor='val_accuracy', restore_best_weights=True),
    ModelCheckpoint(MODEL_PATH, save_best_only=True, monitor='val_accuracy')
]
```

#### 5. Results Summary

- ☒ **Validation Accuracy:** ~90.67%
- ☒ **Top-3 Accuracy:** ~98.22%
- ☐ Overfitting signs were minimized with dropout + augmentation
- ☒ Final model saved and evaluated successfully