

## Model Optimization and Tuning Phase Template

Date	14 December 2024
Team ID	739696
Project Title	Plant seedling classification using Deep learning
Maximum Marks	10 Marks

### Model Optimization and Tuning Phase

The Model Optimization and Tuning Phase involves refining neural network models for peak performance. It includes optimized model code, fine-tuning hyperparameters, comparing performance metrics, and justifying the final model selection for enhanced predictive accuracy and efficiency.

### Hyperparameter Tuning Documentation (8 Marks):

Model	Tuned Hyperparameters
CNN Base Model (VGG16)	Categorical Crossentropy, Metrics, Optimizer.  <pre> # Freeze all layers in the base model for layer in xception.layers:     layer.trainable = False  # Add custom layers x = Flatten()(xception.output) prediction = Dense(12, activation='softmax')(x)  # Create the final model model = Model(inputs=xception.input, outputs=prediction)  # Compile the model model.compile(     loss='categorical_crossentropy', # Loss function     optimizer='adam',               # Optimizer     metrics=['accuracy']            # Evaluation metrics )  # Model summary (optional) model.summary()</pre>

## Fine Tuning

## Unfreezing Layers, Learning Rate, Number of Epochs.

```
# Unfreeze some layers in the base model for fine-tuning
for layer in xception.layers[-4:]: # Unfreeze the last 4 layers (adjust as needed)
    layer.trainable = True

# Recompile the model with a lower learning rate for fine-tuning
from tensorflow.keras.optimizers import Adam

model.compile(
    loss='categorical_crossentropy',
    optimizer=Adam(learning_rate=1e-5), # Smaller learning rate for fine-tuning
    metrics=['accuracy']
)

# Fine-tuning the model
r_fine_tune = model.fit(
    training_set,
    validation_data=test_dataset,
    epochs=5, # Fine-tune for fewer epochs
    steps_per_epoch=steps_per_epoch,
    validation_steps=validation_steps
)
```

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**Final Model Selection Justification (2 Marks):**

Final Model	Reasoning
Fine Tuning	We have selected the Fine Tuning model for its accuracy which is greater than other models.