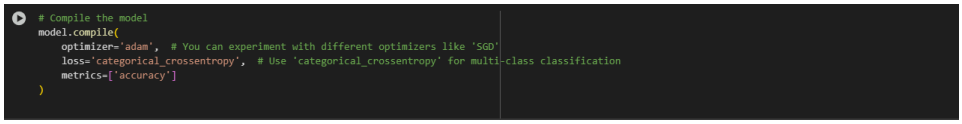
Model Optimization and Tuning Phase Template

Date	01 May 2025
Team ID	739870
Project Title	CovidVision: Advanced COVID-19 Detection From Lung X-Rays With Deep Learning Using IBM Cloud
Maximum Marks	10 Marks

Model Optimization and Tuning Phase

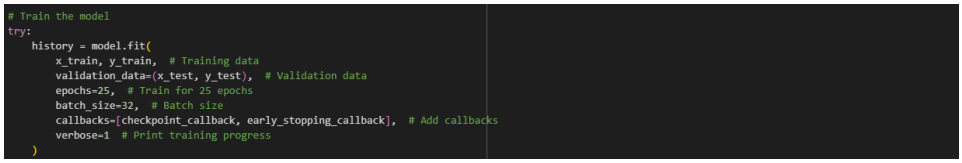
The Model Optimization and Tuning Phase involves refining neural network models for peak performance. It includes optimized model code, fine-tuning hyperparameters, comparing performance metrics, and justifying the final model selection for enhanced predictive accuracy and efficiency.

Hyperparameter Tuning Documentation (8 Marks):

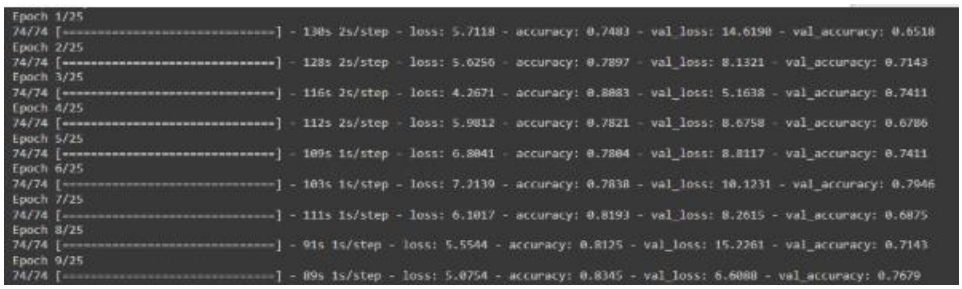
Model	Tuned Hyperparameters
Vgg16_Model 1	**Batch size**: Set to 32 for efficient training  **Epochs:** Set to 25 epochs for good balance under fitting and overfitting. **Augmentation Parameters:** Shear range, Zoom range, and horizontal flipping used to improve generalization

```
# Compile the model
model.compile(
    optimizer='adam',  # You can experiment with different optimizers like 'SGD'
    loss='categorical_crossentropy',  # Use 'categorical_crossentropy' for multi-class classification
    metrics=['accuracy']
)
```

```
# Compile the model
model.compile(
    optimizer='adam',  # Use Adam optimizer
    loss='sparse_categorical_crossentropy',  # For integer labels
    metrics=['accuracy']  # Track accuracy
)
```



```
# Train the model
try:
    history = model.fit(
        x_train, y_train,  # Training data
        validation_data=(x_test, y_test),  # Validation data
        epochs=25,  # Train for 25 epochs
        batch_size=32,  # Batch size
        callbacks=[checkpoint_callback, early_stopping_callback],  # Add callbacks
        verbose=1  # Print training progress
    )
```



```
Epoch 1/25
74/74 [==============================] - 130s 2s/step - loss: 5.7118 - accuracy: 0.7483 - val_loss: 14.6190 - val_accuracy: 0.6518
Epoch 2/25
74/74 [==============================] - 128s 2s/step - loss: 5.6256 - accuracy: 0.7897 - val_loss: 8.1321 - val_accuracy: 0.7143
Epoch 3/25
74/74 [==============================] - 116s 2s/step - loss: 4.2671 - accuracy: 0.8883 - val_loss: 5.1638 - val_accuracy: 0.7411
Epoch 4/25
74/74 [==============================] - 112s 2s/step - loss: 5.9812 - accuracy: 0.7821 - val_loss: 8.6758 - val_accuracy: 0.6786
Epoch 5/25
74/74 [==============================] - 109s 1s/step - loss: 6.8041 - accuracy: 0.7804 - val_loss: 8.8117 - val_accuracy: 0.7411
Epoch 6/25
74/74 [==============================] - 103s 1s/step - loss: 7.2139 - accuracy: 0.7838 - val_loss: 10.1231 - val_accuracy: 0.7946
Epoch 7/25
74/74 [==============================] - 111s 1s/step - loss: 6.1017 - accuracy: 0.8193 - val_loss: 8.2615 - val_accuracy: 0.6875
Epoch 8/25
74/74 [==============================] - 91s 1s/step - loss: 5.5544 - accuracy: 0.8125 - val_loss: 15.2261 - val_accuracy: 0.7143
Epoch 9/25
74/74 [==============================] - 89s 1s/step - loss: 5.0754 - accuracy: 0.8345 - val_loss: 6.6088 - val_accuracy: 0.7679
```

Final Model Selection Justification (2 Marks):

Final Model	Reasoning
VGG16 (Transfer Learning)	Selected because it achieves high accuracy with fewer epochs, uses pretrained "ImageNet" features effectively, avoids overfitting (due to augmentation and freezing initial layers), reduces training time compared to building CNN from scratch, and is suitable for medical image classification