Model Optimization and Tuning Phase Template

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Team ID	SWTID1720433291
Project Title	CovidVision: Advanced COVID-19 Detection From Lung X-Rays With 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	```python
	model=tf.keras.Sequential([
	    data_augmentation,
	    tf.keras.layers.Conv2D(8, (3,3), activation='relu', input_shape=IMAGE_SHAPE),
	    tf.keras.layers.MaxPooling2D(pool_size=(2, 2), strides=None, padding="valid"),
	    tf.keras.layers.Conv2D(16, (3,3), activation='relu'),
	    tf.keras.layers.MaxPooling2D(pool_size=(2, 2), strides=None, padding="valid"),
	    tf.keras.layers.Flatten(),
	    tf.keras.layers.Dense(32),
	    tf.keras.layers.Dropout(.2, input_shape=(32,)),
	    tf.keras.layers.Dense(1, activation='sigmoid')
	])
	
	from tensorflow.keras.optimizers import Adam
	
	model.compile(optimizer=Adam(learning_rate=0.0001),
	              loss='binary_crossentropy',
	              metrics = ['accuracy'])
	`` The optimizer used is Adam with a learning rate of 0.0001. The loss function is binary cross-entropy. The input size is 256, 256, 3. The model was trained for 25 epochs.

| XCEPTION | ```python
inputs = tf.keras.layers.Input((150,150,3))
base_model=tf.keras.applications.xception.Xception(include_top=False, weights="imagenet",input_shape=(150,150,3), pooling='avg')
x=base_model(inputs)
output=layers.Dense(2, activation='sigmoid')(x)
model=tf.keras.models.Model(inputs=inputs, outputs=output)

model.compile(Adamax(learning_rate=1e-4), loss='binary_crossentropy',metrics=['accuracy'])
history = model.fit(train_images, validation_data=val_images, epochs=30)
```<br><br>The activation function used is Adamax with a learning rate of 1e-4. The loss function is binary cross-entropy. The input shape is 150,150,3. The base model used is Xception with ImageNet weights. The model was trained for 30 epochs, and after 30 epochs, the accuracy was 99.76% with a validation accuracy of 98.67%, which was the highest achieved. |

Final Model Selection Justification (2 Marks):

Final Model	Reasoning
XCEPTION	The training process of the Xception model demonstrates strong performance, with high accuracy and low loss on both the training and validation datasets. The validation accuracy reaches around 98%, and the loss decreases significantly over the training epochs, suggesting that the model is able to generalize well to unseen data. The use of transfer learning allows the Xception model to fine-tune its already powerful feature extraction capabilities, which were initially developed for general image classification tasks, to the specific problem of COVID-19 detection from chest X-ray images. This approach leverages the model's pre-existing knowledge and adapts it to the target domain, enhancing the model's effectiveness for the given task.