Model Optimization and Tuning Phase Template

Date	15 March 2024
Team ID	SWUID20240034617
Project Title	CovidVision : Advanced COVID-19 Detection for 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
Convolutional Neural Network (CNN)	**Hyperparameters:** 1. **Learning Rate**: Controls how much to change the model in response to the estimated error each time the model weights are updated. A smaller learning rate could lead to a more accurate model but takes longer to converge. 2. **Batch Size**: The number of training samples to work through before the model's internal parameters are updated. Smaller batch sizes generally make the model more responsive to changes but can lead to noisier updates. 3. **Number of Filters**: Determines the number of filters (or kernels) applied in each convolutional layer, affecting the model's capacity to capture features. 4. **Kernel Size**: The dimensions of the filters in the convolutional layer. Smaller kernels capture fine details, while larger kernels capture more global patterns. 5. **Dropout Rate**: The fraction of neurons to drop during training to prevent overfitting. A higher dropout rate means more neurons are dropped.

	6. **Epochs**: The number of complete passes through the training dataset. More epochs allow the model to learn more but can lead to overfitting if too high. .
ResNet (Residual Network)	**Hyperparameters:** 1. **Learning Rate**: As with CNN, controls how much to change the model in response to the estimated error. 2. **Batch Size**: The number of training samples to work through before the model's internal parameters are updated. 3. **Number of Residual Blocks**: Determines the depth of the network. More blocks can capture more complex patterns but increase the risk of overfitting and computational cost. 4. **Kernel Size**: The dimensions of the filters in the convolutional layer. 5. **Dropout Rate**: The fraction of neurons to drop during training to prevent overfitting. 6. **Epochs**: The number of complete passes through the training dataset.
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Final Model Selection Justification (2 Marks):

Final Model	Reasoning
ResNet (Residual Network)	For the CovidVision project aimed at detecting COVID-19 from lung X-rays, **ResNet** (Residual Network) would be the better choice. **Reasons:** 1. **Complexity of the Task**: Detecting COVID-19 from lung X-rays is a complex task that benefits from a model capable of learning deep and intricate features. ResNet, with its deeper architecture and residual connections, can capture these complex patterns more effectively than a standard CNN. 2. **Performance**: ResNet models have consistently shown superior performance in various image classification tasks, especially when dealing with large and complex datasets. They are less prone to the vanishing gradient problem due to the residual connections, allowing them to train deeper networks successfully. 3. **Generalization**: ResNet's ability to learn more sophisticated features can lead to better generalization on unseen data, which is crucial for medical applications where high accuracy and reliability are required.