**Model Optimization and Tuning Phase Template**

|  |  |
| --- | --- |
| Date | 11 December 2024 |
| Team ID | 739902 |
| Project Title | Alzheimer Disease Prediction |
| 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** |
| Xception model | To optimize the performance of the Xception model, hyperparameters such as learning rate, batch size, and the number of epochs must be tuned carefully. The learning rate determines how quickly the model adjusts weights during training, while the batch size affects the stability of gradient estimates.The number of epochs specifies how many times the entire dataset will pass through the network during training. A higher number of epochs may lead to overfitting if the model starts to memorize the training data rather than generalizing well to unseen data. Hence, it’s important to tune it to find an optimal value that results in good generalization. It ensures the model converges efficiently and avoids overfitting or underfitting. |

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

|  |  |
| --- | --- |
| **Final Model** | **Reasoning** |
| Xception model | The Xception model is often chosen for Alzheimer’s disease prediction due to its superior feature extraction capabilities, particularly in handling complex patterns in medical imaging. Its architecture, based on depthwise separable convolutions, enables efficient learning of spatial and channel-wise features, which is crucial for identifying subtle changes in brain scans. Xception is computationally efficient, reducing the risk of overfitting while delivering high accuracy. It has shown strong results in Alzheimer’s studies, outperforming other models like ResNet and VGG in tasks requiring detailed pattern recognition. Its compatibility with transfer learning and scalability further solidify its role as an ideal choice for predicting Alzheimer’s disease. |