**Model Optimization and Tuning Phase Template**

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| Date | 20 August 2025 |
| Team ID | Sneha S |
| Project Title | mushroom |
| 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):

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| **Model** | **Tuned Hyperparameters** |
| CNN with BatchNormalization | **Learning Rate:** Tried 0.001, 0.0005, 0.0001; best at 0.0005 for stable convergence. **Batch Size:** Compared 16, 32, 64; 32 balanced speed and accuracy. **Epochs:** Grid search from 10–30; best validation accuracy (~95 %) at **20 epochs**. **Dropout Rate:** Tested 0.3, 0.5; **0.5** minimized overfitting. **Augmentation Strength:** Rotation ±20°, width/height shift ±10 %, zoom 0.2; tuned to avoid under/over-augmentation. |

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

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| **Final Model** | **Reasoning** |
| CNN with BatchNormalization | Chosen for its **high accuracy (~95 %)**, **fast training**, and **smaller parameter count**, which make it efficient to deploy on limited hardware (e.g., edge devices). Model 2 was slightly more accurate but significantly heavier and slower, offering little practical gain for the added complexity. |