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**Model Optimization and Tuning Phase Template**

| Date | 24 April 2024 |
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| Team ID | 739942 |
| Project Title | Freedom of world classification |
| 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** |
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| KNeighbors Classifier | The provided code demonstrates hyperparameter tuning for a K-Nearest Neighbors (KNN) classifier using GridSearchCV. It defines a parameter grid (knn\_param\_grid) with different values for the number of neighbors (n\_neighbors), the weight function (weights), and the algorithm used to compute the nearest neighbors (algorithm). GridSearchCV is configured with 5-fold cross-validation (cv=5) and evaluates model performance based on accuracy (scoring='accuracy'). The best hyperparameters and the best KNN model are determined by fitting the model to the training data."). |
| SVM | The code demonstrates hyperparameter tuning for a Support Vector Machine (SVM) classifier using GridSearchCV. It defines a parameter grid (svm\_param\_grid) with various values for the regularization parameter (C), kernel type (kernel), and kernel coefficient (gamma). GridSearchCV is configured with 5-fold cross-validation (cv=5) and evaluates model performance based on accuracy (scoring='accuracy'). The best hyperparameters and the best SVM model are determined by fitting the model to the training data (x\_train, y\_train). |

| **Final Model** | **Reasoning** |
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| KNeighbors Classifier | K-Nearest Neighbors (KNN) is chosen for its simplicity and effectiveness in classification tasks, particularly in scenarios where the relationship between features is non-linear. KNN is advantageous due to its intuitive nature and its ability to handle multi-class classification problems without significant modifications.  Above two models, KNN has the highest accuracy among the models.  4o |

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