Country211 Image Classification Using ResNet-18

# 1. Introduction

The objective of this project was to classify images from the Country211 dataset using a deep learning model, specifically ResNet-18. Image classification is a crucial task in various applications, including object recognition, facial recognition, and geographical identification. The challenge lies in developing an accurate and efficient model that can distinguish between classes, especially when the differences are subtle.

# 2. Dataset Description

The Country211 dataset consists of images from 211 countries. It was divided into training, validation, and test sets to train and evaluate the model effectively.

Dataset Structure:

- Training Set: Used to train the model.  
- Validation Set: Used for hyperparameter tuning and to avoid overfitting.  
- Test Set: Used to evaluate the model's final performance.

Examples of images from the dataset are provided in the presentation slides.

# 3. Model Architecture

ResNet-18 was selected for its proven ability to handle complex image classification tasks. The architecture includes residual connections, which help in training deep networks by mitigating the vanishing gradient problem.

# 4. Training Process

The model was trained for 10 epochs with a batch size of 32, using the Adam optimizer with a learning rate of 0.001. Early stopping was implemented to prevent overfitting, but challenges such as significant training time and managing large datasets were encountered.

# 5. Evaluation Results

The model achieved a validation accuracy of 45% and a test accuracy of 48%. The accuracy could be improved by further tuning, data augmentation, and potentially using a more complex model or leveraging transfer learning.

The evaluation metrics, including precision, recall, and F1-score, were calculated for each class. A confusion matrix was generated to visualize the model's performance.

# 6. Insights and Conclusion

The project successfully applied deep learning techniques to classify images in the Country211 dataset. The ResNet-18 model demonstrated fair performance, but challenges such as similar classes and image quality limitations impacted the model's performance.

The use of data augmentation and early stopping contributed to the model's ability to generalize well to the validation set. However, the model may still struggle with very similar classes or images with poor quality.

# 7. Future Work

Future work could involve exploring deeper architectures like ResNet-50 or EfficientNet, experimenting with transfer learning, and applying advanced augmentation techniques to further enhance the model’s accuracy.