Capstone Project Report

Scene Classification on Places365

Dataset Summary

We used a subset of the Places365 dataset, filtered to the top 50 most frequent scene classes. From the validation split, 50,000 images were randomly sampled and split into train, validation, and test sets (70/15/15).

Github Link - https://github.com/harshil234/Scene-Classification-with-deep-learning.git

Model Overview

We used ResNet-50 pretrained on ImageNet. The classifier head was modified to handle 50 classes, with dropout and label smoothing added to improve generalization.

Training Strategy

The model was trained with AdamW optimizer, CrossEntropyLoss with label smoothing, learning rate scheduling, and AMP (mixed precision) on a T4 GPU. Early stopping with patience=5 was used.

Evaluation Summary

Evaluation included accuracy, precision, recall, F1-score, confusion matrix, ROC AUC, and Grad-CAM interpretability. Results showed ~88% accuracy on the test set with good generalization considering dataset size.

Insights and Challenges

Grad-CAM visualizations helped interpret predictions. Misclassifications mostly occurred between visually similar classes. Challenges included limited data size and class imbalance.

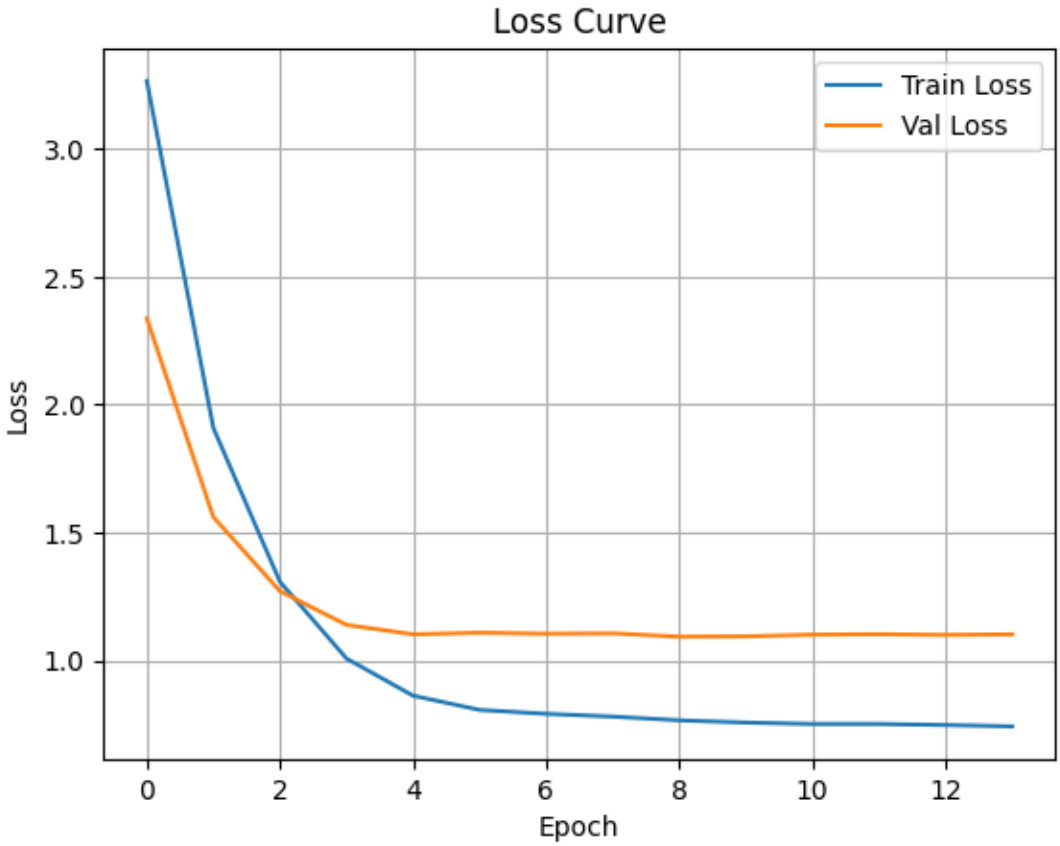
Future Work

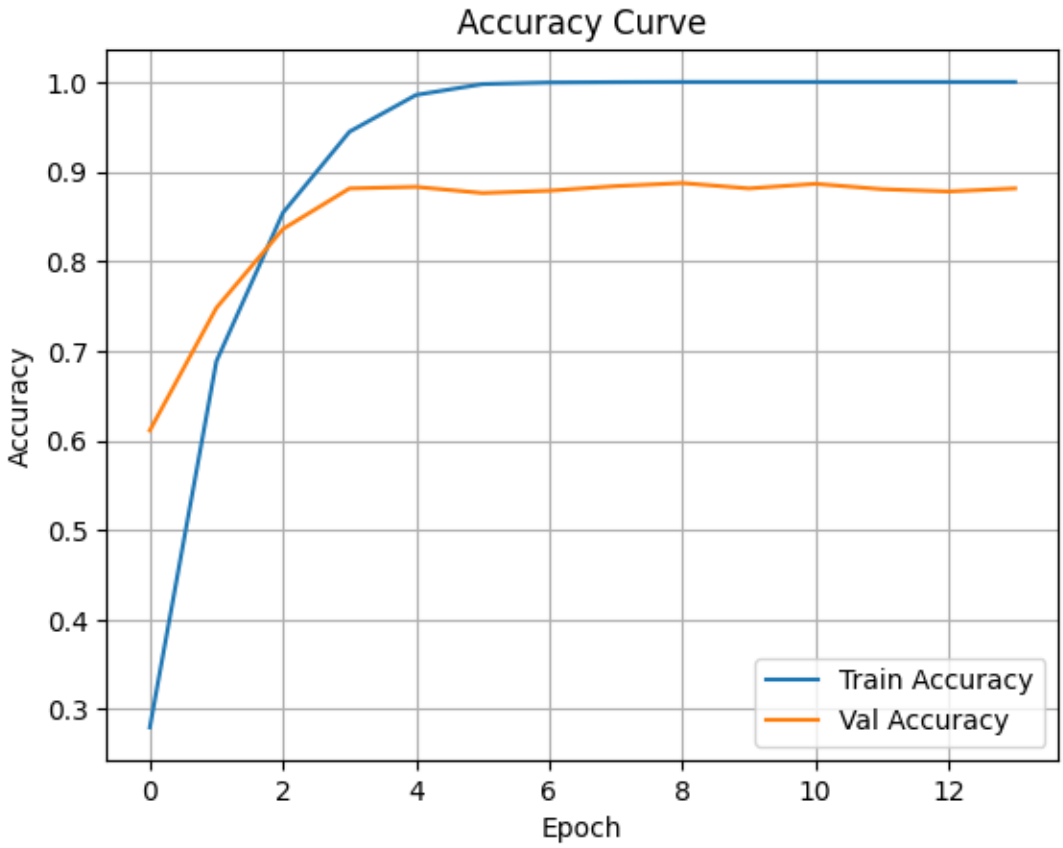
Extend training to full dataset, try ViT or EfficientNet architectures, apply SHAP/LIME for more explainability, and experiment with advanced hyperparameter optimization.

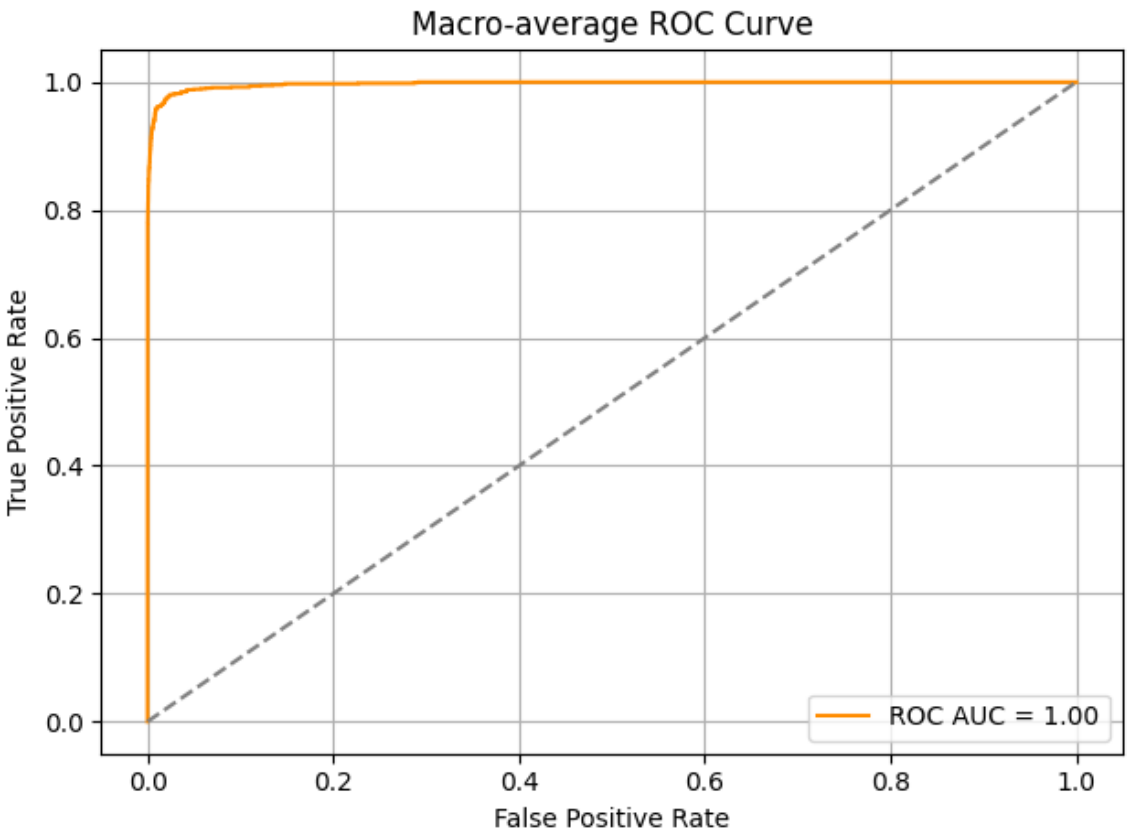
Hyperparameter Tuning

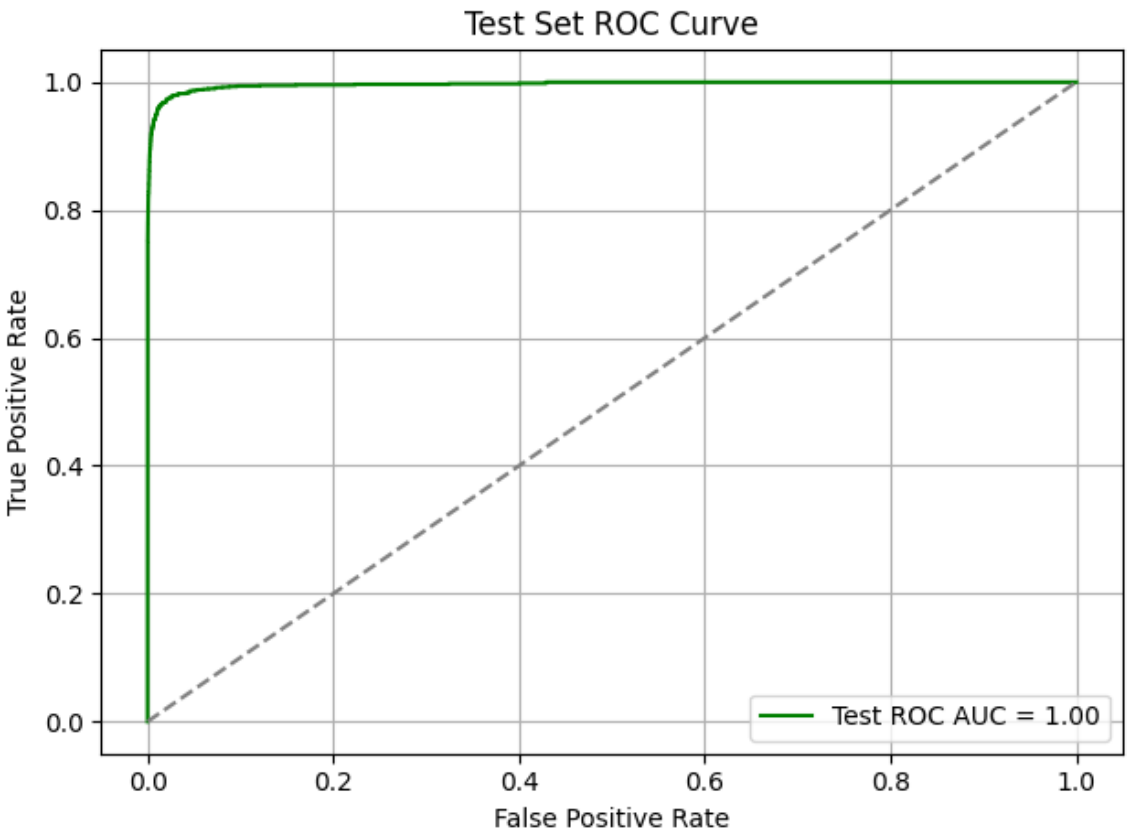
To further improve model performance, we implemented a grid-based hyperparameter tuning approach. The model was trained across combinations of learning rates and batch sizes (e.g., 1e-3, 5e-4, 1e-4 with batch sizes 16, 32, 64). The validation accuracy for each configuration was monitored using early stopping, and the best-performing set of hyperparameters was selected. This helped in identifying an optimal learning configuration without extensive manual tuning.

Evaluation Visualizations




Accuracy Curve
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
Accuracy
0
2
4
6
8
10
12
Epoch
Train Accuracy
Val Accuracy


Macro-average ROC Curve
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
ROC AUC = 1.00


Test Set ROC Curve
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
Test ROC AUC = 1.00

Grad-CAM (Class ID: 7)