Dog Breed Classification using Deep Learning

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Introduction

- Problem Statement: Accurately classifying dog breeds from images
- Importance of dog breed classification (e.g., pet identification, animal shelters)
- Project Goal: Develop a deep learning model for dog breed classification

Dataset

- Stanford Dogs Dataset
  - 120 different dog breeds
  - Large-scale dataset with 20,580 images
  - Image resolution ranging from 100x105 pixels to 2448x3264 pixels.
- Data Preparation
  - Training, validation, and test splits (60-20-20)
  - Data preprocessing (resizing, normalization, augmentation)

Model Architecture

- Pre-trained Models: ResNet50 and VGG19
  - Transfer learning
  - Leveraging pre-trained weights from ImageNet
- Model Modifications
  - Replacing the final classification layer
  - Adapting to the number of dog breeds in the dataset

Training Process

- Loss Function: Cross-entropy loss
- Optimizer: Adam optimizer
- Learning Rate Scheduler: Step decay
- Number of Epochs: 10
- Saving the best model based on validation accuracy

Evaluation Results

- Test Accuracy
  - ResNet50: 82.56%
  - VGG19: 82.19%

Hyperparameter Tuning

- Importance of hyperparameter tuning
- Experiments with different learning rates and batch sizes
- Best hyperparameters for each model
  - ResNet50: Learning rate = 0.001, Batch size = 32
  - VGG19: Learning rate = 0.001, Batch size = 32

Challenges and Lessons Learned

- Challenges faced during the project
  - Visually similar dog breeds
  - Computational resources required for training
- Lessons learned
  - Importance of data preparation and augmentation
  - Effectiveness of transfer learning
  - Significance of hyperparameter tuning

Future Enhancements

- Potential improvements to the project
  - Exploring advanced data augmentation techniques
  - Ensemble methods to combine multiple models
  - Incorporating additional information (breed descriptions, characteristics)

Conclusion

- Recap of project goals and achievements
- Applicability of the dog breed classification system
- Potential impact in real-world scenarios

References

- Stanford Dogs Dataset (http://vision.stanford.edu/aditya86/ImageNetDogs)
- PyTorch Documentation