Animal Classification Using Deep Learning

Leveraging ResNet50 for Accurate Animal Image Classification
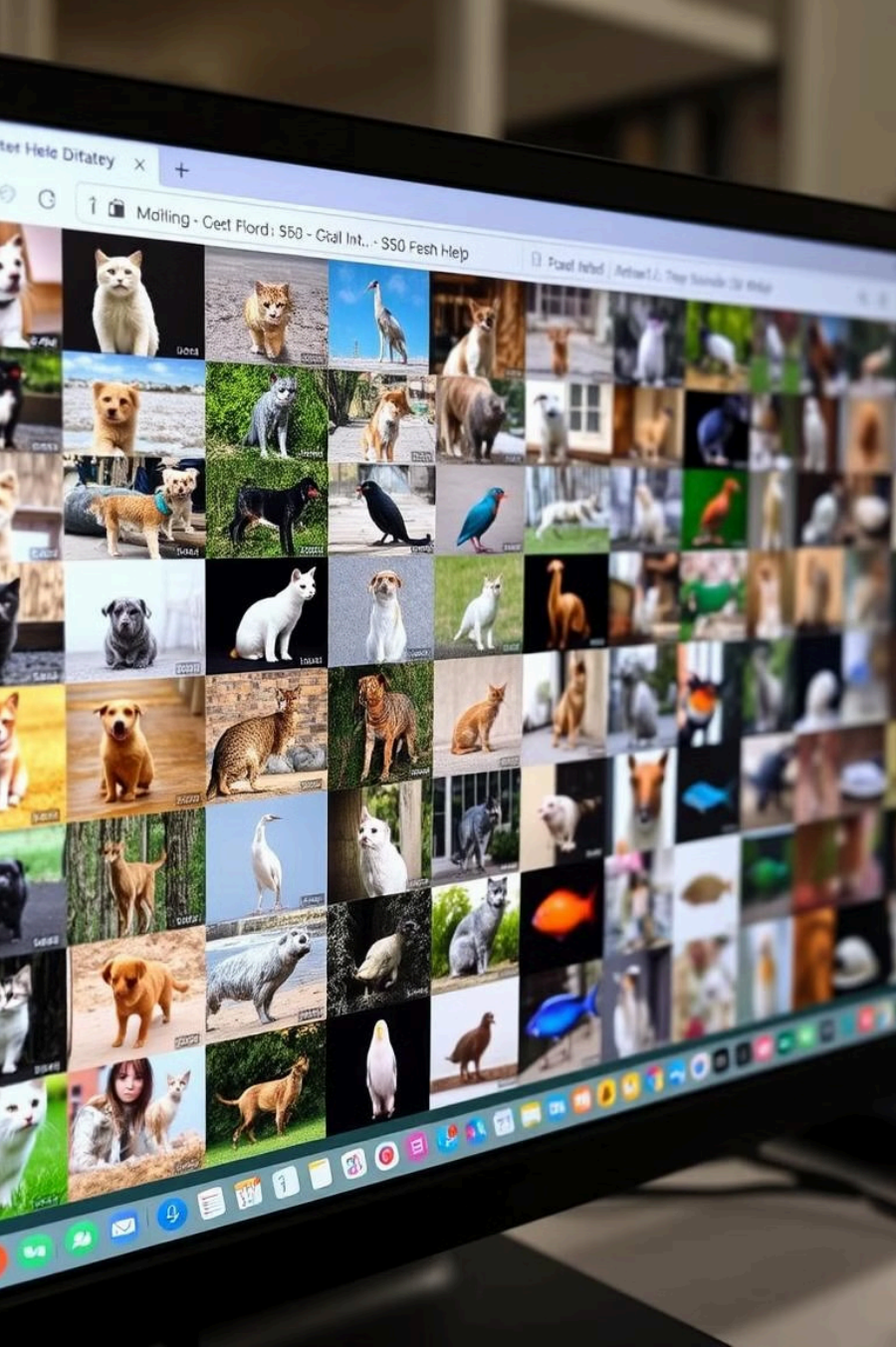
Project Overview

Objective

Classify images of animals into 57 categories using transfer learning and fine-tuning.

Key Features

- Pre-trained ResNet50 model with fine-tuning.
- Two-phase training: Initial top-layer training and ResNet fine-tuning.
- Advanced data augmentation techniques for better generalization

Dataset Details

Source	Kaggle dataset with animal images
Classes	57 total
Images per class	60 images per class
Total Images	2736
Validation Images	684
Image Size	224x224 pixels

Model Architecture

Base Model

- ResNet50 pre-trained on ImageNet

Additional Layers

- Global Average Pooling Layer.
- Fully Connected Dense Layers with ReLU Activation.
- Dropout Layers for Regularization.
- Final Dense Layer with 57 Neurons (Softmax Activation for Classification).

Training Phases

Phase 1

- Train only the custom layers with the ResNet50 backbone frozen.
- Optimizer: **Adam**, Learning Rate: **1e-3**.
- Loss: **Categorical Crossentropy**.

Phase 2

- Fine-tune the last 30 layers of ResNet50.
- Optimizer: **Adam**, Learning Rate: **1e-5**.

Data Preprocessing and Augmentation

Preprocessing

- **Resizing:** Images resized to **224x224** pixels.
- **Normalization:** Pixel values scaled to **0-1**.
- **Standardization:** Preprocessing using **ResNet50** weights

Data Augmentation

- **Rotation, Shifts, Shear, Zoom:** Applied with **±20%** range.
- **Horizontal Flip:** 50% probability.

Purpose

- **Increase Dataset Variety** and **Reduce Overfitting** by introducing random transformations.

Training Strategy

1

Phase 1

Training Top Layers

- Freeze the base of **ResNet50**.
- Train only the top layers (fully connected layers) with **new data**.

2

Phase 2

Fine-tuning ResNet50

- Unfreeze some **ResNet50** layers.
- Fine-tune the entire model for better accuracy.

Results and Evaluation

Final Evaluation

- **Accuracy**: 91.21%
- **Loss**: 0.3312

Validation Performance

- **Accuracy**: 92.25%
- **Loss**: 0.2883

The model demonstrated solid performance with a validation accuracy above 90%, reflecting its ability to generalize effectively.

The loss value indicates good convergence during training.

Challenges and Solutions

- **Challenges**:
  - Overfitting during training.
- **Solutions**:
  - Data augmentation for better generalization.
  - Fine-tuning only select layers of ResNet50.

Conclusion

1	**Key Takeaways**

2	**Transfer Learning** Powerful technique for image classification.

3	**Fine-tuning** Enhances performance and reduces overfitting.

4	**Data Augmentation** Key for robust model generalization.

Thank You!

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