

Automated Wildlife Species Classification Using Deep Neural Networks- Assignment 6

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1. Project Dataset Description

The dataset to be used for training the proposed model will consist of labeled images of wildlife species, including mammals, reptiles, birds, and amphibians. The primary source will be publicly available datasets from camera trap repositories such as:

- Snapshot Serengeti Dataset (approx. 1.2 million images)
- Caltech Camera Traps (CCT)
- iNaturalist (curated subset for wildlife monitoring)

Each image is annotated with species labels, and metadata includes location, time, and environmental conditions. To ensure balanced representation:

- A subset of approximately 20,000 images will be selected, covering at least 15–20 species.
 - The data will be filtered for quality, resized to 224x224 pixels, and augmented using flipping, rotation, brightness adjustments, and normalization.
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2. Literature Review Insights and Next Steps

Insights from Literature:

- CNN architectures such as VGG16 and ResNet50 have shown high performance in wildlife classification (accuracy >85%).
- Pre-trained models with transfer learning outperform custom-built models when data is limited.
- Key challenges include class imbalance, species similarity, and generalization to new environments.

Next Steps Based on Literature:

1. Use transfer learning with VGG16 and ResNet50 as baseline models.
 2. Apply data augmentation to handle dataset imbalance and increase diversity.
 3. Implement cross-validation to improve generalization.
 4. Prepare a custom test dataset for performance benchmarking on unseen environments.
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3. Proposed Model and Architecture

The proposed model is based on the ResNet50 architecture, a deep convolutional neural network composed of 50 layers with residual connections.

How ResNet50 Works:

- Utilizes skip connections to prevent vanishing gradient issues.
- Learns hierarchical features: edges → shapes → textures → species-specific traits.
- Trained using transfer learning: the base layers are pre-trained on ImageNet, and top layers are fine-tuned using our wildlife dataset.

Advantages:

- High accuracy in image classification tasks.
- Efficient convergence with fewer overfitting issues.

4. Project Timeline (Academic Semester – 12 Weeks)

Week	Task
1–2	Finalize dataset selection and clean/annotate images
3	Implement preprocessing pipeline and data augmentation
4–5	Train baseline model (VGG16/ResNet50) with transfer learning
6	Evaluate baseline performance and refine parameters
7–8	Train improved model (fine-tuned ResNet50)
9	Test model on custom evaluation set
10	Performance comparison and error analysis
11	Prepare visualizations and project documentation
12	Final report and presentation preparation

5. Model Evaluation Metrics

To assess the effectiveness of the model, the following metrics will be used:

- Accuracy: Overall correct predictions vs. total predictions.
- Precision: Correct positive predictions vs. all positive predictions.
- Recall (Sensitivity): Correct positive predictions vs. all actual positives.
- F1-Score: Harmonic mean of precision and recall.
- Confusion Matrix: Insight into model performance across all classes.

Additionally, evaluation will include:

- Top-1 and Top-5 accuracy (especially for similar species)
- Inference speed (FPS) on test devices (desktop vs. mobile edge hardware)
- Generalization testing on new unseen datasets