

PROJECT: 5

Animal Image Classification

Name: Mani P

Email: maniprabu991@gmail.com

Program: Unified Mentor ML Internship Program

1. Problem Statement

Image classification is a fundamental computer vision task with applications in wildlife monitoring, agriculture, zoological studies, and security systems. Manually identifying animals from images is time-consuming and error-prone. This project aims to build an automated deep learning system capable of accurately identifying animals from images using convolutional neural networks.

2. Objective

The objective of this project is to develop a deep learning-based image classification system that can correctly identify the animal present in a given image from a set of predefined animal categories.

3. Tech Stack Used

- **Programming Language:** Python
- **IDE:** Spyder
- **Deep Learning Framework:** TensorFlow, Keras
- **Model:** ResNet50 (Transfer Learning)
- **Libraries:** NumPy, Matplotlib, OpenCV
- **Domain:** Computer Vision / Deep Learning

4. Project Architecture / Workflow

1. Dataset loading and directory-based labeling

2. Image resizing and preprocessing
3. Data augmentation
4. Transfer learning using pre-trained ResNet50
5. Adding custom classification layers
6. Model training and validation
7. Model evaluation
8. Image prediction and confidence output

5. Implementation Details

- Dataset contains **15 classes of animals** with images resized to **224 × 224 × 3**
- Used **ResNet50 pre-trained on ImageNet** as the base model
- Added custom layers:
 - Global Average Pooling
 - Dense layer
 - Dropout layer
 - Softmax output layer
- Applied **data augmentation** to improve generalization
- Used **categorical cross-entropy loss** and **Adam optimizer**
- Implemented **Early Stopping** and **Model Checkpointing** to avoid overfitting
- Project was implemented and executed using the **Spyder IDE**

6. Output / Results

- The trained model accurately classified animal images
- Successfully predicted unseen test images

Sample Prediction:

- **Input Image:** Cat
- **Predicted Class:** Cat
- **Prediction Confidence:** 99.46%

7. Challenges Faced

- Managing large image datasets
- Preventing overfitting with limited training data
- Ensuring compatibility of image dimensions with pre-trained models

8. Future Enhancements

- Increase dataset size for better generalization
- Apply advanced fine-tuning of deeper ResNet layers
- Deploy the model as a web application using Flask or Streamlit
- Extend to real-time animal detection using video streams

9. Conclusion

This project demonstrates the effectiveness of transfer learning for image classification tasks. By using a pre-trained ResNet50 model, high accuracy was achieved with reduced training time. The system successfully identifies animals from images and can be extended for real-world applications.