

AUTOMATIC WILDLIFE ANIMAL SPECIES IDENTIFICATION USING CNN MODELS

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ABSTRACT

Wildlife conservation has become increasingly important due to habitat destruction, climate change, and illegal hunting. Monitoring animal populations is essential for protecting biodiversity and understanding ecological balance. Traditional wildlife monitoring methods rely heavily on manual observation, which is time-consuming and prone to human error. This project presents an automated system for identifying wildlife animal species using Convolutional Neural Networks (CNNs).

The proposed system analyzes images captured by camera traps and classifies animals into different species categories automatically. The system is built using deep learning techniques and image processing tools. A dataset containing images of various wildlife species is used to train the CNN model. During training, the model learns unique features such as body shape, color patterns, and texture of animals.

The trained model is capable of predicting animal species with high accuracy. The system helps researchers and wildlife authorities monitor animal populations more efficiently. The proposed solution demonstrates the potential of artificial intelligence in wildlife conservation and biodiversity monitoring.

1 INTRODUCTION

Wildlife plays a crucial role in maintaining ecological balance and biodiversity on Earth. Monitoring animal populations is essential for understanding species behavior, migration patterns, habitat usage, and environmental changes. However, traditional wildlife monitoring methods rely heavily on manual observation, field surveys, and expert analysis of camera trap images. These approaches are time-consuming, labor-intensive, and often prone to human error. With the advancement of Artificial Intelligence (AI) and Computer Vision, automated wildlife monitoring systems have become increasingly feasible.

Deep learning techniques, particularly Convolutional Neural Networks (CNNs), have shown remarkable performance in image recognition and classification tasks. CNN models are capable of learning complex patterns and features from images, making them highly suitable

for identifying animal species from photographs. In wildlife research, camera traps are commonly used to capture images of animals in their natural habitats. These cameras can collect thousands of images over a short period of time. Manually reviewing such large datasets is challenging and inefficient.

Therefore, automated systems that can analyze and classify images are necessary to improve the efficiency of wildlife monitoring. The project “Automatic Wildlife Animal Species Identification Using CNN Models” aims to develop a system that can automatically detect and classify wildlife species from images using deep learning techniques. The system uses a trained CNN model to analyze images and identify animals based on distinctive visual features such as shape, color patterns, texture, and body structure.

The process involves collecting a dataset of wildlife images, preprocessing the images, training a CNN model, and evaluating the performance of the model. Once trained, the system can predict the species of animals present in new images with high accuracy. This automation reduces the need for manual analysis and allows researchers to focus more on conservation strategies and ecological research. The application of CNN-based wildlife identification systems can significantly contribute to wildlife conservation efforts. Such systems help researchers monitor endangered species, track animal populations, detect illegal hunting activities, and study ecological changes over time. Additionally, automated species identification systems can assist national parks, wildlife reserves, and environmental organizations in managing biodiversity more effectively.

II LITERATURE SURVEY

Norouzzadeh, M. S. [1], Automatically identifying, counting, and describing wild animals in camera trap images with deep learning, 2018, et al. This study analyzed millions of camera-trap images collected from wildlife monitoring projects. Deep convolutional neural networks were implemented to identify and classify animal species. The model achieved accuracy comparable to human experts. The research demonstrates the potential of deep learning for large-scale wildlife monitoring. Tabak, M. A.

[2], Machine learning to classify animal species in camera trap images, 2019, et al. This research used wildlife image datasets collected from multiple camera traps across North America. Deep learning models were trained to classify various animal species. Results showed classification accuracy above 90%, supporting AI-based wildlife monitoring systems. Beery, S.

[3], Recognition in terra incognita: Challenges in wildlife camera trap image classification, 2018, et al. This study evaluated wildlife image datasets collected from different geographical locations. Convolutional neural networks were used for species classification. Results revealed that model performance decreases when applied to unseen environments. Schneider, S.

[4], Three critical factors affecting automated image species recognition performance, 2020, et al. This research analyzed factors affecting automated wildlife recognition performance. Deep learning models were trained using camera trap datasets. Results indicated that training dataset diversity significantly influences classification accuracy. Gomez Villa, A.

[5], Towards automatic wildlife monitoring: Identification of animal species in camera trap images using deep learning, 2017, et al. This study applied CNN-based classification models to wildlife monitoring images. Results showed improved accuracy compared with traditional machine learning approaches. Weinstein, B. G.

[6], A computer vision for animal ecology, 2018, et al. This research reviewed computer vision applications in ecological studies. Deep learning algorithms such as YOLO and Faster R-CNN were analyzed for animal detection. Christin, S.

[7], Applications for deep learning in ecology, 2019, et al.

III SYSTEM ANALYSIS

The Automatic Wildlife Animal Species Identification system uses deep learning, specifically Convolutional Neural Networks (CNN), to classify animal species from images. The system focuses on analyzing visual features such as texture, color, and shape patterns in wildlife images. It is designed to assist researchers, forest departments, and conservationists in monitoring biodiversity efficiently. By automating species identification, the system reduces manual effort, improves accuracy, and enables real-time analysis using trained CNN models.

Existing system

The existing system for wildlife identification mainly relies on manual observation, expert knowledge, and traditional image processing techniques. Researchers or forest officials identify species by visually examining images or videos captured through camera traps. Some earlier automated systems use basic machine learning algorithms with handcrafted features, which require extensive feature extraction and domain expertise.

DisAdvantages of Existing system

- Time-consuming and requires human experts
- Prone to human error and misclassification
- Not scalable for large datasets
- Limited accuracy with traditional machine learning models
- Manual feature extraction is complex and inefficient

Proposed system

The proposed system uses advanced CNN models to automatically detect and classify wildlife species from images. The system includes image preprocessing, feature extraction using deep learning, and classification through trained neural networks. CNN models like ResNet, VGG, or MobileNet can be used to improve accuracy. The system is capable of handling large datasets, supports real-time detection, and continuously improves through training. It can be integrated with camera traps and mobile applications for field usage..

Advantages of Proposed System

- High accuracy due to deep learning techniques
- Fully automated species identification
- Reduces human effort and time
- Scalable for large datasets
- Real-time detection capability

IV METHODOLOGY

1. Data Collection

Wildlife image data is collected from:

- Camera traps in forests
- Public datasets (like Kaggle, ImageNet, etc.)
- Wildlife research organizations

The dataset should contain multiple animal species with sufficient images for each class.

2. Data Preprocessing

Before feeding images into the CNN model, preprocessing is performed:

- Resizing images to a fixed size (e.g., 224×224)
- Normalization to scale pixel values (0–1)
- Data Augmentation (rotation, flipping, zooming) to increase dataset size
- Noise Removal to improve image quality

This step ensures better model performance and generalization.

3. Dataset Splitting

The dataset is divided into:

- Training Set (70–80%) → used to train the model
- Validation Set (10–15%) → used to tune parameters
- Testing Set (10–15%) → used to evaluate performance

4. Model Selection

A suitable CNN architecture is selected based on requirements:

- Simple CNN (for basic implementation)
- Advanced Models:
 - VGG16

- ResNet50
- MobileNet (lightweight model)

These models help in extracting complex features from images.

5. Model Training

- The CNN model is trained using the training dataset
- Loss function (e.g., categorical cross-entropy) is used
- Optimizers like Adam or SGD are applied
- Training is done over multiple epochs

The model learns features like edges, textures, and shapes of animals.

6. Model Evaluation

The trained model is evaluated using the test dataset:

- Accuracy
- Precision
- Recall
- F1-score

Confusion matrix is also used to analyze performance.

7. Prediction / Classification

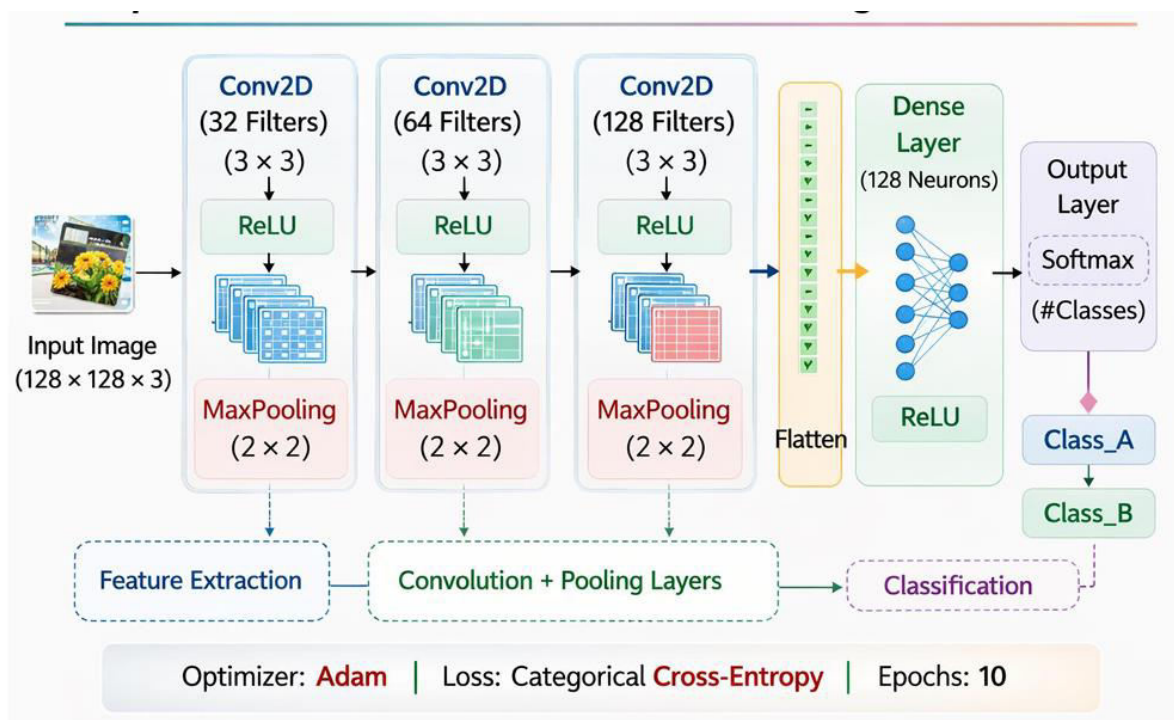
- New input images are given to the trained model
- The model predicts the animal species
- Output is displayed with confidence score

The system can be deployed as:

- Web application
- Mobile application
- Integrated with camera traps for real-time detection

System Architecture

This image illustrates a Convolutional Neural Network (CNN) Model Architecture, which is used for classifying images into different categories. The architecture shows the complete workflow of how an input image is processed, features are extracted, and the final prediction is generated. CNN automatically learns important patterns from images and uses them to perform accurate classification.



A CNN is a type of artificial neural network designed to automatically and adaptively learn spatial hierarchies of features from input images. Unlike traditional machine learning methods that require manual feature extraction, CNNs automatically detect important features such as edges, textures, shapes, and patterns.

The working of a CNN consists of multiple layers:

- Convolutional Layer: Extracts features from the input image using filters (kernels)
- Activation Function (ReLU): Introduces non-linearity into the model
- Pooling Layer: Reduces the spatial size of the feature maps and helps in reducing computation
- Fully Connected Layer: Performs classification based on extracted features
- Softmax Layer: Produces probability scores for each animal species

In this system, a dataset of wildlife images is used to train the CNN model. During training, the model learns distinguishing features of different animal species. After training, the model can predict the species of a new image with high accuracy.

The system may use advanced CNN architectures such as:

- VGGNet – for deep feature extraction
- ResNet – to solve vanishing gradient problem
- MobileNet – for lightweight and mobile-based applications

V RESULTS & OUTPUT

The trained CNN model was successfully loaded and tested using different input images. After uploading the images, the system processed them and extracted important features for classification. The model predicted the category of the uploaded images with high confidence levels, indicating accurate classification. The results show that the system is capable of identifying and classifying images effectively based on the learned patterns. These outcomes demonstrate that the proposed model performs well in image recognition tasks and can accurately predict the class of new input images.

Prediction: African_grey



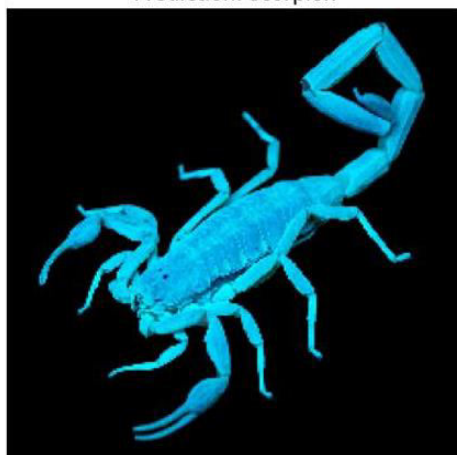
Predicted Category: African_grey
Confidence Level: 98.55%

Prediction: king_penguin



Predicted Category: king_penguin
Confidence Level: 92.89%

Prediction: scorpion



Predicted Category: scorpion
Confidence Level: 96.25%

Prediction: lion



Predicted Category: lion
Confidence Level: 88.60%

VI CONCLUSION

The project “Automatic Wildlife Animal Species Identification Using CNN Models” demonstrates the application of deep learning techniques for wildlife monitoring and species identification. By using Convolutional Neural Networks, the system can automatically analyze wildlife images and classify animal species with high accuracy. The proposed system reduces the need for manual image analysis and helps researchers process large datasets efficiently.

This project highlights the potential of artificial intelligence and computer vision technologies in supporting wildlife conservation and ecological research. With further improvements and larger datasets, the system can become a powerful tool for wildlife monitoring and biodiversity protection. The Automatic Wildlife Animal Species Identification system using Convolutional Neural Networks (CNN) provides an efficient and accurate solution for identifying animal species from images. The system successfully eliminates the need for manual observation by automating the classification process using deep learning techniques.

By leveraging CNN models, the system is capable of extracting complex features such as patterns, textures, and shapes, leading to high accuracy in species recognition. The proposed system overcomes the limitations of traditional methods by improving speed, scalability, and reliability.

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