

Wild Animal Activity Detection using Hybrid Deep Neural Networks

M.Yazhini¹, Mr. S.Srinivasan²

PG Student, Master of Computer Application, AVS Engineering College, Salem, Tamil Nadu, India¹

Assistant Professor, Master of Computer Application, AVS Engineering College, Salem, Tamil Nadu, India²

ABSTRACT: Animal attacks pose growing risks to rural communities and forest workers, creating a need for effective wildlife monitoring systems. Modern approaches use surveillance cameras and drones, but require efficient models to accurately detect animal species, track movement, and provide location data. A real-time system based on YOLOv12 addresses these challenges by performing well in complex environments and low-light conditions, while sending instant alerts to forest authorities via email. Tested on large datasets, the model achieves over 98% accuracy and precision, making it a reliable and efficient solution for improving human safety and wildlife monitoring.

I. INTRODUCTION

Wildlife monitoring is essential for maintaining ecological balance and ensuring human safety, especially as human activities increasingly disrupt natural habitats. Traditional methods of tracking and identifying animals are time-consuming and inefficient, particularly with large volumes of data from camera traps and surveillance systems. With the advancement of deep learning and computer vision, automated models like YOLO have enabled accurate and real-time detection of wild animals, even in challenging conditions. These systems help reduce human effort, improve monitoring efficiency, and support timely actions such as preventing animal attacks and conserving biodiversity.

II. OBJECTIVES

- To develop an efficient system for detecting and classifying wild animals from images or video.
- To monitor animal movement and behavior in real time.
- To provide accurate location information of detected animals.
- To reduce human effort and time required for manual wildlife monitoring.
- To enhance safety by sending timely alerts to prevent human–wildlife conflicts.

III. LITERATURE SURVEY

1. B. Natarajan, R. Elakkiya And R. Bhuvaneswari (2023) The issue of animal attacks is increasingly concerning for rural populations and forestry workers. To track the movement of wild animals, surveillance cameras and drones are often employed. However, an efficient model is required to detect the animal type, monitor its locomotion and provide its location information. Alert messages can then be sent to ensure the safety of people and foresters.

2. Zhi Zhang, Zhihai He, and Guitao Cao (2016) proposed a method for detecting animals in highly cluttered natural scenes using spatiotemporal object region proposals and patch verification. Their approach focuses on improving detection accuracy in challenging environments where animals are difficult to distinguish from complex backgrounds. The model combines deep learning features with traditional techniques like histogram of oriented gradients and uses temporal information across video frames to reduce false detections. Experimental results show that their method outperforms existing techniques, including Faster R-CNN, by improving detection accuracy in camera-trap images.

3. Chunshen Long, Wei Li And Pengfei Liang(2023) The identification of underlying differences is crucial for understanding the embryogenesis of species specificity. In this paper, a comparative transcriptome analysis of multi-species (CTAMS) was first developed to detect the genome activation differences of embryogenesis among human, mouse, and bovine. The annotation of intra-species and the detection of inter-species difference were separately to

avoid potential batch effects. The profile clusters and Pearson correlation showed the human and bovine embryos displayed a high similarity in genome activation with a dramatic maternal to zygotic transition between 4–8 cell stages.

4. **Guruh Fajar Shidik, Ricardus Anggi Pramunendar And Pulung Nurtantio Andono (2024)** proposed a deep learning-based approach for bird species classification using an Adaptive Inertia Weight Particle Swarm Optimization (AIWPSO) technique. Their work focuses on improving classification accuracy by optimizing data augmentation strategies, which helps overcome challenges such as image variability and limited datasets. The model dynamically selects the best augmentation combinations to enhance generalization and reduce overfitting. Experimental results show significant improvements in both training and validation accuracy, demonstrating the effectiveness of their method in complex image classification tasks

5. **Istiak Mahmud, MD. Mohsin Kabir and Jungpil Shin(2023)** proposed a deep learning-based system titled “Advancing Wildlife Protection: Mask R-CNN for Rail Track Identification and Unwanted Object Detection.” Their work focuses on detecting animals and other obstacles on railway tracks to prevent accidents and protect wildlife. The system uses the Mask R-CNN model to accurately identify objects in real time and alert authorities or train operators. This approach reduces dependency on human monitoring, improves detection accuracy, and enhances safety by minimizing animal deaths and railway accidents.

IV. EXISTING & PROPOSED SYSTEM

1 EXISTING SYSTEM

Existing wildlife monitoring systems primarily rely on traditional methods such as manual observation, camera traps, and basic computer vision techniques, which are often time-consuming, costly, and less efficient when handling large volumes of data. Although machine learning and deep learning models have improved animal detection and classification, many existing approaches struggle with challenges like low-light conditions, occlusions, complex backgrounds, and varying animal poses. Additionally, some systems require high computational resources and lack real-time alert mechanisms, limiting their practical application in preventing human–wildlife conflicts. Therefore, there is a need for more accurate, cost-effective, and real-time solutions to enhance wildlife monitoring and safety.

2 PROPOSED SYSTEM

The proposed system introduces a real-time wildlife monitoring solution using advanced deep learning techniques, specifically based on the YOLO model, to accurately detect and classify wild animals from images and video streams. It is designed to perform effectively in challenging conditions such as low light, complex backgrounds, and varying animal poses. The system not only identifies animal species but also tracks their movement and provides location details. Additionally, it integrates an alert mechanism that sends notifications to forest authorities via email, enabling quick response to potential threats. This approach improves accuracy, reduces manual effort, and enhances both human safety and wildlife conservation efforts.

V. BLOCK DIAGRAM

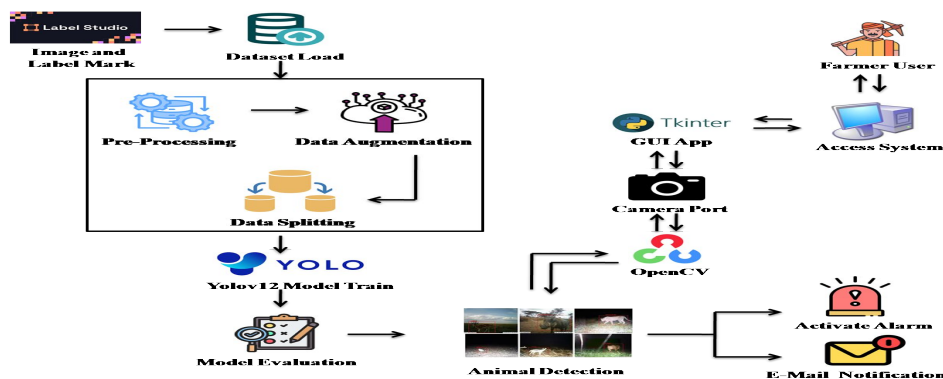


Fig No: 1 Software block diagram

VI. SOFTWARE REQUIREMENTS

1. Operating System

The project can be implemented on Windows 10 or 11, Linux (such as Ubuntu 20.04 or later), or macOS. A 64-bit operating system is recommended to ensure compatibility with deep learning libraries and efficient memory utilization. Linux is often preferred for large-scale training due to better GPU and driver support.

2.



Fig No: 2 Operating System

3. Programming Language

Python 3.8 or above is used as the primary programming language for this project. Python is widely used in Natural Language Processing and Machine Learning because of its simplicity, readability, and vast ecosystem of libraries. It provides strong support for implementing transformer-based models efficiently.



Fig No: 3 Programming Language

4. Development Environment / IDE The project can be developed using Integrated Development Environments (IDEs) such as Jupyter Notebook, Visual Studio Code (VS Code), or PyCharm. Jupyter Notebook is especially useful for experimentation and visualization, while VS Code and PyCharm provide structured project development features. Anaconda can also be used for managing virtual environments and dependencies.



Fig No: 4 Development Environment / IDE

5. Backend Framework

Flask is a lightweight and flexible web framework used as the backend foundation of the AI-Driven Banking Security System. It is written in Python and is designed to be simple, modular, and easy to integrate with various libraries and tools. Flask follows a minimalistic approach, providing essential components for web development while allowing developers to customize additional features as required. In this project, Flask is used to handle routing, API creation, request processing, and communication between the frontend dashboard and backend security logic.



Fig No: 5 Backend Framework

6. Frontend Technologies

The frontend of the AI-Driven Banking Security System is developed using HTML5, CSS3, and Vanilla JavaScript to create an interactive and responsive user interface. HTML5 is used to structure the login page and real-time monitoring dashboard, ensuring clear organization of components such as login forms, attack control buttons, statistics panels, and threat level indicators. It provides semantic elements that improve readability and maintainability of the application



Fig No: 6 Frontend Technologies

VII. RESULT

As technology continues to advance, there are many future enhancements that can be made to wildlife intrusion detection systems. The use of drones can greatly enhance the effectiveness of wildlife intrusion detection systems by providing a bird's eye view of wildlife habitats. By combining data from multiple types of sensors, such as cameras, microphones, and temperature sensors, wildlife intrusion detection systems can provide a more complete picture of animal behavior and activity. This can improve the accuracy and reliability of intrusion detection and classification. By integrating with social media platforms, wildlife intrusion detection systems can harness the power of citizen science to monitor wildlife activity. For example, members of the public could report sightings of animals or other suspicious activity, which could be verified and integrated into the overall system.



Fig no:7 GUI page

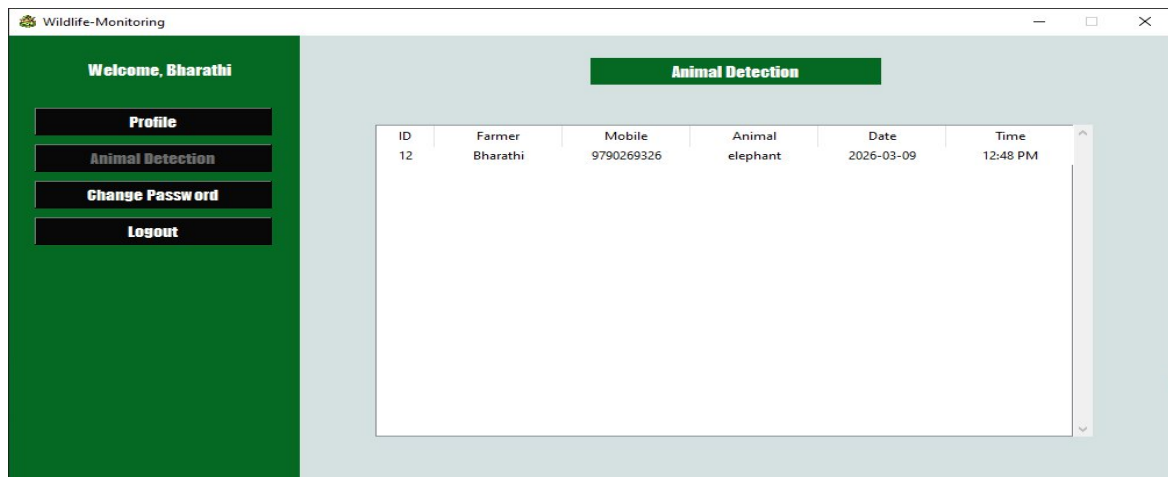


Fig no:8 Farmer view screen

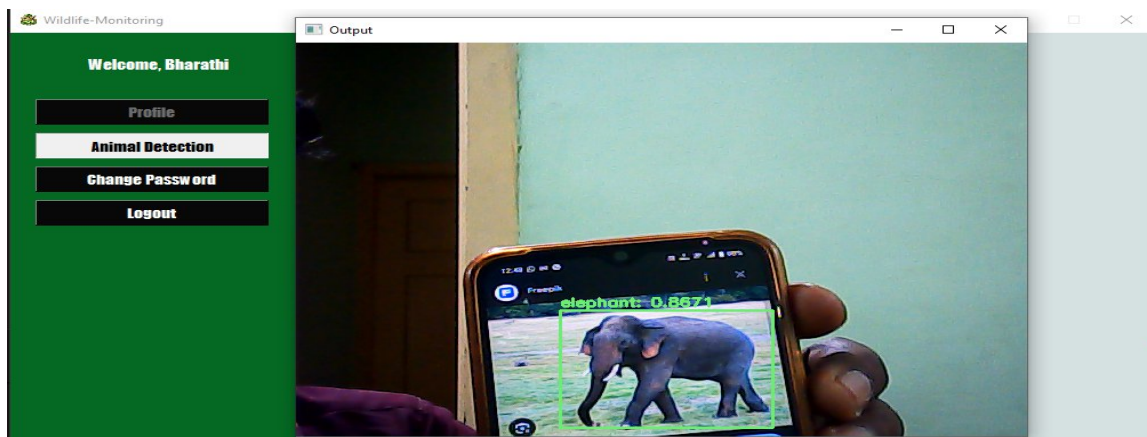


Fig no:7 Output screen

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