IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 3, October 2024

Detection and Tracing of Wild Animals using MachineLearning

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Abstract: *Animals are important part of our ecosystem. Animals are very critical to our ecosystem. Due to increase in animal trafficking many wild animals are becoming endanger and also their population is decreasing. Because of this human have created zoo, national park and sanctuaries which can work as safe heaven for this animal to avoid extinction. There can be scenario where animals are ill or poor health condition which can be an also cause of the death. Many people visit national park and sanctuaries where they are not able to see all animal. This project will be implemented inpython and will implement RCNN algorithm to detect animals. Once animal is detected it will send name and GPS co- ordinates of the animal. These GPS co- ordinates will display on mobile and tourist can find animal at given location. This project can also be placed in farm land where human and animal conflict are common. If animal is detected it can send alert or sound can be generated to distract it. This project will help detection on wild animal using camera and deep learning technology. Android app will be used to locate the animal on google map.*

Keywords: GPS, RCNN, Android App, Animal

I. INTRODUCTION

Advanced Wild Animal Detection and Alert system using you look only once version 5 (RCNN V5) model is a proposed examine the pic and hit upon the presence of untamed animals. If the machine detects the presence of any wild animal, it sends an alert to the government via an alarm or message. The proposed system is anticipated to provide an effective approach to prevent any capacity damage due to wild animals and help maintain wildlife by using lowering human -animal war. The superior Wild Animal Detection and Alert gadget is a software of the you best appearance once version5 (RCNN v5) gadget that pursuits to discover and alert the presence of untamed animals in a precise region using superior pc vision techniques. This machine is designed to provide an effective and green method to discover the presence of wild animals and alert the authorities to take important precautions. The machine utilizes you best look as soon as version5 (RCNN V5) version, that's one of the extensively used and famous deep learning fashions for object detection, to locate wild animals. The proposed gadget is ready with superior sensors and cameras which can be set up on drones or different surveillance devices, which seize real- time. images and transmit them to a significant processing unit for detection and evaluation. The RCNN V5 model is then used to item detection algorithm designed to hit upon wild animals and alert humans approximately their presence in real- time. This device uses a camera to seize live video feed from the encompassing environment and tactics it uses the handiest appearance as soon as version5 (RCNN v5) set of rules to discover the presence of wild animals. Once an animal is detected, an alert is dispatched to the person interface and a notification is sent to the user's mobile tool to warn them approximately the animal's presence. This device is specifically useful for folks that live in regions with high populations of untamed animals, such as national parks, flora and fauna reserves, or rural regions, as it could offer an early warning system to prevent dangerous encounters with wild animals. Wildlife monitoring is essential for conserving biodiversity, studying animal behaviour, and managing ecosystems effectively. Traditional methods for tracking animals, like GPS collars or human surveillance, have limitations such as high costs, invasive techniques, and limited coverage. With advancements in machine learning and computer vision, automated detection and tracking of wild animals using cameras and sensors have emerged as powerful alternatives. In this project, we leverage machine learning algorithms to accurately detect and trace wild animals in various environments. Our approach combines object detection models, like Convolutional Neural Networks (CNNs), with tracking algorithms,

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such as Simple Online and Realtime Tracking (SORT), to continuously identify and follow animals across video frames. This automated solution offers real-time insights with high accuracy, minimizing human intervention and making it feasible for large-scale wildlife studies. The system can assist conservationists and researchers by providing data on animal movement patterns, population density, and habitat use, which are crucial for informed decision-making and effective wildlife management.

II. MOTIVATION AND OBJECTIVES

Motivation

The motivation behind the project "Detection and Tracing of Wild Animals Using Machine Learning" is rooted in the need for effective, non-invasive wildlife monitoring tools that can enhance conservation efforts, improve ecological research, and reduce human-wildlife conflicts. Here's a detailed breakdown:

- To minimize financial losses, human casualties, and harm to livestock.
- To study repeated intrusions and provides insights to develop preventive measures against furtherencroachment by wild animals.

Objective

The primary objectives of this project are as follows:

- Detecting animals accurately and quickly in complicated outdoor settings is important for getting work done efficiently.
- But it's not easy because the places where animals live have complicated environmental conditions.
- This project proposes a novel animal detection method that uses RCNN to overcome these challenges.
- Animal tracking is a critical aspect of wildlife conservation, ecological studies, and even pet management. With advancements in computer vision and machine learning, tracking animals in real-time has become more feasible.
- This project aims to leverage the RCNN (You Only Look Once) algorithm to develop an Android application that can detect and track animals in live video feeds. RCNN is known for its speed and accuracy, making it an ideal choice for real-time applications on mobile devices.

III. METHODOLOGY

Existing System

Current methods for wild animal detection and tracking generally fall into three main categories: traditional monitoring techniques, basic camera trap usage, and early machine learning and computer vision approaches. Each of these methods has strengths but also notable limitations in terms of scalability, cost, accuracy, and non-invasiveness.

By identifying and addressing these limitations, the proposed methodology using R-CNN aims to enhance the accuracy, scalability, and real-time capabilities of wildlife detection and tracking systems, enabling effective conservation and ecological monitoring in diverse and challenging environments.

Proposed System

This proposed system aims to develop an animal detection system for traffic monitoring using the RCNN algorithm deployed on a Raspberry Pi. The system utilizes a pre-trained RCNN model to detect animals in real-time video streams captured by a camera module or USB webcam connected to the Raspberry Pi. Through a series of steps including setting up the Raspberry Pi, installing dependencies, configuring RCNN, writing detection code, optimizing for the Raspberry Pi's limited computational resources, and testing in controlled and real-world environments, the project aims to create an efficient and accurate solution for detecting animals in traffic scenarios

The proposed system addresses the shortcomings of existing systems by providing a non-invasive, scalable, and real-time solution for detecting and tracking wild animals. Through advanced deep learning techniques, this system is poised to offer significant benefits for wildlife conservation, research, and management

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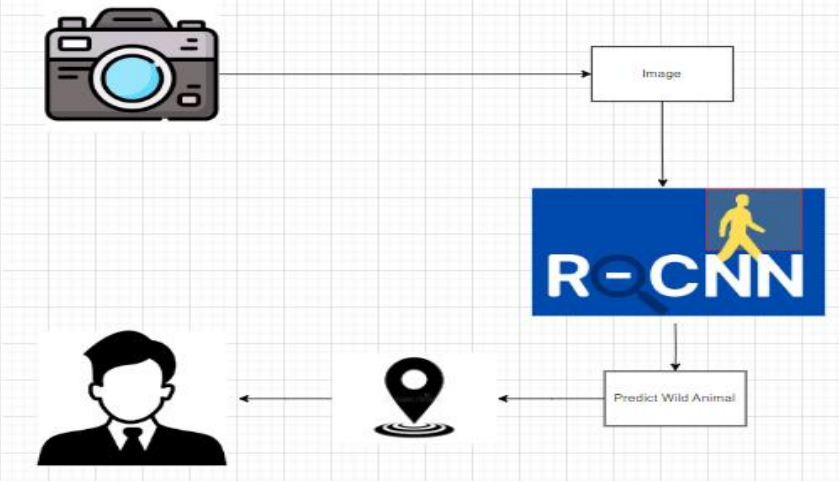

Fig 1. System Architecture

Flowchart

We will capture a video from the camera. Once capture we will extract one frame from video and will try to detect moving object from the frame. We will apply RCNN algorithm to detect animal**.**

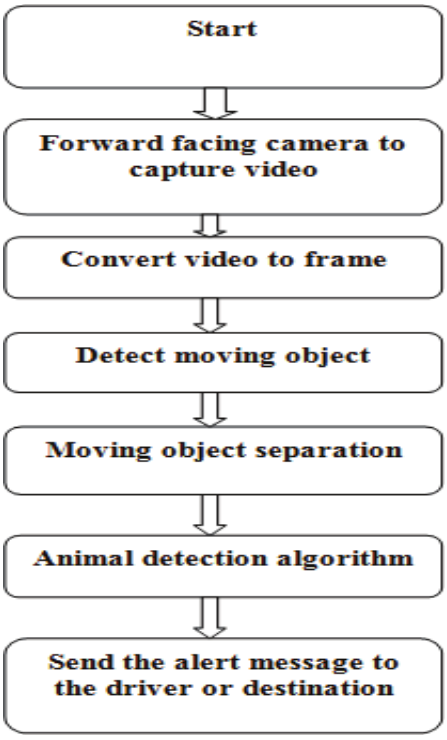

Fig.2 Flowchart

IV. LITERATURE SURVEY

[1] Redmon, Joseph, et al. "You only look once: Unified, real-time object detection." Proceedings of the IEEE conference on computer vision and pattern recognition. 2016. Redmon et al.'s 2023 paper "You Only Look Once" (YOLO) revolutionized object detection by introducing a unified, single-stage framework. Unlike traditional methods

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with separate proposal and classification stages, YOLO directly predicts bounding boxes and class probabilities in one pass through the image, enabling real-time object detection. This shift towards a single-stage approach paved the way for significant advancements in the field.

[2] Redmon, Joseph, and Ali Farhadi. "Yolov3: An incremental improvement." arXiv preprint arXiv:1804.02767 (2022). Redmon and Farhadi's 2022 paper, "YOLOv3: An Incremental Improvement," likely explores advancements to this real-time approach. YOLO v3 focuses on further refining this foundation. The paper might delve into specific areas of improvement, such as modifications to the convolutional neural network architecture used in YOLO. These enhancements could aim to boost accuracy, speed, or memory efficiency. Additionally, the paper might discuss optimizations to the training process, including utilizing different data augmentation techniques or hyperparameter tuning to enhance network performance. Finally, the authors might compare YOLOv3's performance on benchmark dataset against the original YOLO and other leading object detection algorithms, highlighting the achieved improvements.
Tao, Jing, et al. "An object detection system based on YOLO in traffic scene." 2022 6th International Conference Computer Science and Network Technology (ICCSNT). IEEE, 2022 This study by Tao et al. For instance, real-time object detection can be used to warn drivers of potential hazards, such as pedestrians crossing the road unexpectedly. Additionally, the data collected through object detection can be employed to optimize traffic light timings and identify bottlenecks within traffic networks, ultimately promoting smoother traffic flow and reducing congestion. Overall, Taoet al.'s research on object detection in traffic scenes holds promise for advancements in traffic safety and management.

[3] Zhao Lulu, Wang Xueying, Zhang Yi, Zhang Meiyue, "Research on Vehicle target Detection Technology based on YOLOv5s fusion SENet", Journal of Graphics, vol. 43, no. 05, pp. 776-782, 2022 Zhao et al. tackle the challenge of inaccurate vehicle detection in traffic monitoring videos during congested periods. The authors propose an enhanced YOLOv5s network to address this issue. SE modules, known for emphasizing important details, are incorporated into key parts of the YOLOv5s network – the Backbone, Neck, and Head. These SE modules effectively guide the model to focus on critical vehicle characteristics, filtering out irrelevant background information. By incorporating these modules, Zhao et al. aim to significantly improve the accuracy of vehicle detection in traffic monitoring scenarios. This is achieved by enabling the model to prioritize crucial vehicle features and minimize the influence of distracting background elements, leading to a reduction in both false and missed detections.

[4] "Animal Detection using Inception-v3 and you only look once version2 (YOLO V2) "by Abdulaziz Alwadani and Abdulrahman Al- Salman (2020) This paper by Alwadani and Al- Salman (2020) tackles animal detection in images or videos using deep learning approach. The first line of defense is Inception-v3, a powerful image classification model. Essentially, it acts as a sieve, separating animal- containing regions from the background clutter.
– not just classifying objects but also predicting their exact location and size within the image using bounding boxes. It meticulously analyzes these sections and precisely pinpoints the animals' locations by drawing bounding boxes around them. YOLOv2's object localization, this approach strives to achieve high accuracy in animal detection. In essence, it leverages the best of both worlds: Inception-v3's ability to identify animals and YOLOv2's talent for pinpointing their exact location.

[5] Kamali, M., & Tahir, M. (2020). You only look once version3 (YOLO V3): It likely dissects the YOLOv3 architecture, explaining its deep learning core and concepts like bounding boxes and class probabilities. The guide aims to empower users by providing practical instructions for utilizing YOLOv3 in real-world applications, including setting up the environment, training the model, and making object detections on new images.

[6] "Real-Time Wild Animal Detection and Alert System using Deep Convolutional Neural Networks and Raspberry Pi" by Ankit Pandey and Ramendra Singh (2019) In their 2019 paper, "Real-Time Wild Animal Detection and Alert System using Deep Convolutional Neural Networks and Raspberry Pi," Pandey and Singh proposea system for real-time wild animal detection and alerting. This system leverages deep convolutional neural networks

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(CNNs), known for their image recognition capabilities. This allows for deployment in remote areas where traditional monitoring methods might be impractical. The paper likely details the chosen CNN architecture, the training process, and the integration with the Raspberry Pi. Additionally, it might discuss the system's performance and its potential applications in wildlife conservation or mitigating human wildlife conflicts.

V. PROJECT FEASIBILITY AND SCOPE

Project Feasibility

1. Technical Feasibility

Availability of Technology:

- The project relies on established deep learning models like Faster R-CNN, which are widely supportedby open-source frameworks (e.g., TensorFlow, PyTorch). Additionally, object tracking algorithms such as SORT and DeepSORT are also accessible and well-documented.
- Hardware resources required for the model include GPUs or cloud computing platforms, making it feasible for both on-premises and cloud-based deployment.

Data Collection:

- High-quality datasets of wild animals, such as camera trap footage or wildlife images, are increasinglyavailable. Furthermore, images and videos collected from existing wildlife monitoring setups can serve as training data, making data collection achievable within feasible limits.
- For real-time applications, data can be collected directly from camera traps, drones, or surveillance networks, which are commonly used in wildlife conservation.

Integration with Existing Tools:

- The proposed system can integrate with camera traps, surveillance networks, and mobile devices, allowing for seamless implementation in field settings. Additionally, the model can run on edge devices for real-time monitoring, which supports on-site processing with low latency.

2. Operational Feasibility

Deployment in Remote Areas:

- Edge computing makes the project suitable for remote deployment in areas with limited internet connectivity. By running models on edge devices, the system can detect and track animals on-site, reducing reliance on central servers.
- Real-time alert systems can notify rangers or conservationists immediately when animals are detected near human-populated areas, helping mitigate potential human-wildlife conflicts.

Ease of Use:

- The system's automated detection and tracking capabilities minimize the need for manual intervention.It can be managed by field staff with basic training, making it easy to use for non-technical personnel.
- Data storage and dashboard tools can make tracking and detection data accessible and easy to interpret for researchers and conservationists.

3. Financial Feasibility

Costs and Resources:

- The initial costs for model training and equipment, such as GPUs, camera traps, or drones, may be high, but the benefits and savings over time (e.g., reducing the need for manual data collection and human resources) justify the investment.
- For larger-scale projects, cloud computing services can be used on a pay-as-you-go basis, providing scalable computing power without the need for costly infrastructure.

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Sustainability and Long-term Savings:

- Once the system is deployed, the need for frequent manual observation and intervention is significantlyreduced, decreasing labour costs and operational expenses.
- Maintenance costs are mainly limited to hardware upkeep, which can be managed with routine checks, especially for field equipment such as drones or camera traps.

Project Scope

1. Wildlife Conservation and Research

Behaviour Analysis:

- The system enables continuous tracking of individual animals, allowing researchers to study behaviour, migration patterns, social interactions, and habitat utilization in unprecedented detail.
- Insights from this data can inform conservation efforts by identifying critical habitats and migrationcorridors that need protection.

Species Monitoring and Population Studies

- The system can be configured to track specific species or provide general animal detection. This is useful for population studies, helping researchers monitor endangered species and detect population trends over time.

2. Human-Wildlife Conflict Prevention

Real-Time Alerts:

- The system can trigger real-time alerts when animals are detected near human settlements or agricultural land, helping to mitigate conflicts and protect both humans and wildlife.
- It can aid in early intervention by notifying rangers or authorities, who can take preventive actions, thereby reducing the risks of harm or property damage.

Applications in Eco-Tourism:

- In controlled environments like eco-tourism sites, the system can be used to track animal locations, enhancing visitor experiences while ensuring their safety. Real-time animal location updates can guide tourists on animal viewing without disturbing the animals.

3. Expansion to Different Ecosystems and Species

Scalability and Adaptability:

- The model can be expanded to various ecosystems and animal types by training it on region-specific datasets. This adaptability makes the system versatile across diverse environments such as savannas, rainforests, and grasslands.
- With some modifications, the project can extend to marine environments for tracking aquatic animals or aerial environments to monitor bird migration.

Integration with Multi-modal Data:

- Beyond visual data, the system can be enhanced with multi-modal inputs, such as audio or thermal data, to improve accuracy in challenging environments (e.g., dense forests with poor visibility).
- This opens up new possibilities for detection in adverse weather conditions or at night, broadening the project's applicability.

VI. CONCLUSION

Identifying and classifying species is an essential first step in determining the long-term viability of animals and how our actions may affect them. It aids people in recognizing predators and non- predatory animals, both of which might pose a significant threat to local species and humans. This can potentially reduce the number of traffic accidents in various regions since some animals are regularly spotted on roadways, resulting in several collisions with automobiles.

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