



WILD ANIMAL DETECTION AND ALERTING SYSTEM

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Abstract : This study presents a system for detecting and alerting to the presence of wild animals, aimed at proactively mitigating the increasing challenges posed by human-animal interactions. Utilizing the You Only Look Once version 7 (YOLOv7) model, a cutting-edge deep learning algorithm for real-time object recognition, the system analyzes live video streams to accurately identify wild animals within a defined area. Upon detection, it immediately triggers alerts, notifying relevant parties through alarms and messaging systems, facilitating rapid intervention and preventative measures. The system employs sophisticated sensors and cameras, suitable for deployment on drones or within surveillance infrastructure, to capture real-time visual data. This data is then processed by a central unit, where the YOLOv7 model performs object identification and analysis. The results demonstrate the system's effectiveness in accurately identifying and classifying both domesticated and wild animals, generating timely alerts and notifications. Beyond immediate conflict resolution, future development will focus on integrating animal health monitoring through wearable technology and enhancing educational experiences in wildlife parks and zoological gardens. This system offers a dependable solution for wildlife management and enhancing human safety.

IndexTerms - Object Detection, YOLO v7, Animal Intrusion, Machine Learning, Animal Detection, Single Stage Object Detection Algorithm.

INTRODUCTION

The Advanced Wild Animal Detection and Alert System uses the YOLOv5 (You Only Look Once version 5) model for real-time detection of wild animals. When the system detects a wild animal, it sets off an alarm or a message to the authorities. This proactive approach is an effort to prevent human-wildlife conflicts, reduce the possibility of harm, and promote wildlife management. This smart detection system is developed based on YOLOv5, one of the most popular deep learning frameworks for object detection. The system is intended to assist in the identification and notification of the presence of wild animals in an area using the latest computer vision approaches. The system is fitted with high-resolution cameras and sensors that can be deployed on drones or other types of surveillance equipment to capture real-time video footages. The YOLOv5 model is then used to process this data and detect any wild animals in the area. Once a wild animal is identified, an alert is sent to a user interface and a notification is sent to users' mobile devices to keep them informed of the situation in real time. It is essentially beneficial to people who are located in areas that are susceptible to wildlife, including national parks, wildlife sanctuaries, and even rural areas where encounters with wild animals can be dangerous. Thus, this technology plays a crucial role in increasing safety and improving the mechanisms of controlling the relationships between humans and wildlife.

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) brought about a paradigm shift in object detection by optimizing for speed. Rather than using sequential processes for identifying and classifying objects, it performs these tasks concurrently in a single scan of the image. This efficient design facilitates real-time capabilities, which are crucial for many modern applications. Research into YOLO often investigates its network structure, training procedures, and how it measures up against other models, demonstrating its power in handling various detection challenges. The adoption of this single-stage strategy has been a key factor in advancing object detection technology.

- [2] **Redmon, Joseph, and Ali Farhadi. "Yolov3: An incremental improvement." arXiv preprint arXiv:1804.02767 (2022).** Redmon and Farhadi detailed enhancements to their established real-time object detection methodology. The original YOLO introduced a paradigm shift by concurrently determining object locations and classifications within a single image analysis, resulting in substantial speed advantages. Building upon this, YOLOv3 aimed to refine this fundamental concept. The paper likely investigates specific refinements, potentially including alterations to the convolutional network structure employed by YOLO. These adjustments could be geared towards improving precision, processing speed, or reducing memory footprint. Furthermore, the researchers may have explored optimizations to the learning process, such as the implementation of varied data expansion strategies or strategic hyperparameter adjustments to elevate network efficacy. It is also probable that the authors presented a comparative analysis of YOLOv3's performance against the initial YOLO iteration and other prominent object detection algorithms using standardized datasets, emphasizing the realized advancements. Through these progressive modifications, YOLOv3 likely sought to reinforce its status as a robust and efficient framework for instantaneous object recognition across a spectrum of applications.
- [3] **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** Tao et al.'s 2022 research, presented at the 6th International Conference Computer Science and Network Technology, focuses on the application of YOLO-based object detection to traffic scenarios. Their work explores how this technology can contribute to improved traffic flow, streamlined operational procedures, and a decrease in accident rates. It is probable that they developed a system designed to recognize and monitor entities, such as vehicles and pedestrians, within traffic settings by leveraging computer vision techniques. This type of system could be utilized in numerous ways to bolster road safety. For example, by providing immediate hazard alerts to drivers, such as detecting unexpected pedestrian crossings. Furthermore, the information obtained from object detection can be used to refine traffic signal synchronization and pinpoint areas of congestion within road networks, leading to more efficient traffic movement. In essence, Tao et al.'s investigation into traffic scene object detection presents a pathway towards enhancements in both traffic safety and management.
- [4] **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** In their 2022 research, published in the Journal of Graphics, Zhao et al. addressed the problem of unreliable vehicle recognition in traffic surveillance footage, particularly during periods of heavy congestion. This issue stems from frequent vehicle occlusion. To combat this, they introduced a modified version of the YOLOv5s network. Specifically, they integrated Squeeze-and-Excitation (SE) modules—recognized for their ability to highlight salient features—into the core components of the YOLOv5s architecture: the Backbone, Neck, and Head. These SE modules function by directing the model's attention to essential vehicle attributes, thereby diminishing the impact of extraneous background data. By implementing these modules, Zhao et al. sought to substantially increase the precision of vehicle identification within traffic monitoring applications. This was accomplished by enabling the model to prioritize key vehicle characteristics and minimize the influence of disruptive background elements, ultimately resulting in fewer instances of both incorrect and overlooked detections.
- [5] **"Animal Detection using Inception-v3 and you only look once version2 (YOLO V2) " by Abdulaziz Alwadani and Abdulrahman Al- Salman (2020)** Al-Salman and Alwadani's work in 2020 on the topic of animal detection in visual data deals with a deep hybrid learning approach and utilizes Inception-v3, as well as YOLOv2. The input is initially detected with a strong image identification model, which breaks down the input image into elementary constituents in an attempt to detect whether fauna are present within it. This is just applying a filter to the image to exclude the parts where animals are likely to exist. YOLOv2, being equipped with object localization capability, is then applied across the area localized by Inception-v3. YOLOv2, besides detecting the class of objects in those spaces, also yields accurate bounding box coordinates, stating the position and dimensions in space of the animals. This two-step procedure takes advantage of the complementing capabilities of the two models: Inception-v3's capability for animal identification and YOLOv2's capability for precise object localization. This combined method seeks to achieve maximum accuracy of animal detection through, first, partitioning the areas in which the relevant information is and then clearly bounding the area of the animal within these areas.
- [6] **Kamali, M., & Tahir, M. (2020). You only look once version3 (YOLO V3):** A Kamali and Tahir's 2020 arXiv preprint is more of a tutorial than an entire research undertaking. Their article presents a step-by-step explanation of the YOLOv3 architecture, describing its deep learning fundamentals and basic components like bounding box prediction and class probability estimation. The primary aim of this paper is to guide users with the ability to implement YOLOv3 in real-time applications. This is done by providing step-by-step guides on how to configure environments, train models, and implementing the model on new images for object detection.
- [7] **"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, Pandey and Singh, in their 2019 publication, introduced a system designed for immediate identification and notification of wild animals, utilizing deep convolutional neural networks (CNNs) and a Raspberry Pi. Their approach employs CNNs, recognized for their efficacy in visual recognition, to analyze live video feeds. By training these networks on a database of wildlife images, the system achieves real-time animal detection through the use of a Raspberry Pi, a small and economical computing device. This setup facilitates deployment in isolated regions where conventional surveillance techniques may be challenging. The research likely outlines the specific CNN

structure employed, the training methodologies, and the implementation on the Raspberry Pi platform. Furthermore, the authors may have examined the system's operational efficiency and its prospective uses in environmental protection or in the reduction of conflicts between humans and wildlife.

- [8] **You Only Look Once: Unified, Real-Time Object Detection, by Joseph Redmon.** Joseph Redmon developed the YOLO algorithm, a complete and real-time object detection method, from his previous work with regression-based detection. In parallel, Juan Du's research sought to present a broad overview of CNN-based object detection families, such as R-CNN, and debuted YOLO as a more effective option. Du's research contrasts the effectiveness of various object detection algorithms. Redmon's research, in "[1]", seeks to improve accuracy and quality of prediction.
- [9] **Learning to Localize Objects with Structured Output Regression, by Matthew B. Blaschko.** This paper is about **Object Localization**. Object Localization is discussed in this paper. Object localization is the work of Matthew B. Blaschko on structured output regression. In avoidance of the limitations of the sliding window approach, the research uses bounding box methods for object localization. A new method for barcode decoding, binarization-free, is also given. The technique applies flexible templates and makes use of the entire grayscale data available at every pixel. By parameterizing these templates, the system facilitates efficient maximum likelihood estimation of individual digits and imposition of spatial consistency thereafter. Experimental evidence, from difficult UPC-A barcode images from five databases, shows that this technique outperforms existing algorithms. Applied to a Nokia N95 mobile phone, the algorithm accurately localizes and decodes a barcode from a VGA image resolution (640x480, JPEG compressed) in an average processing time of 400 to 500 milliseconds.

PROPOSED SYSTEM

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

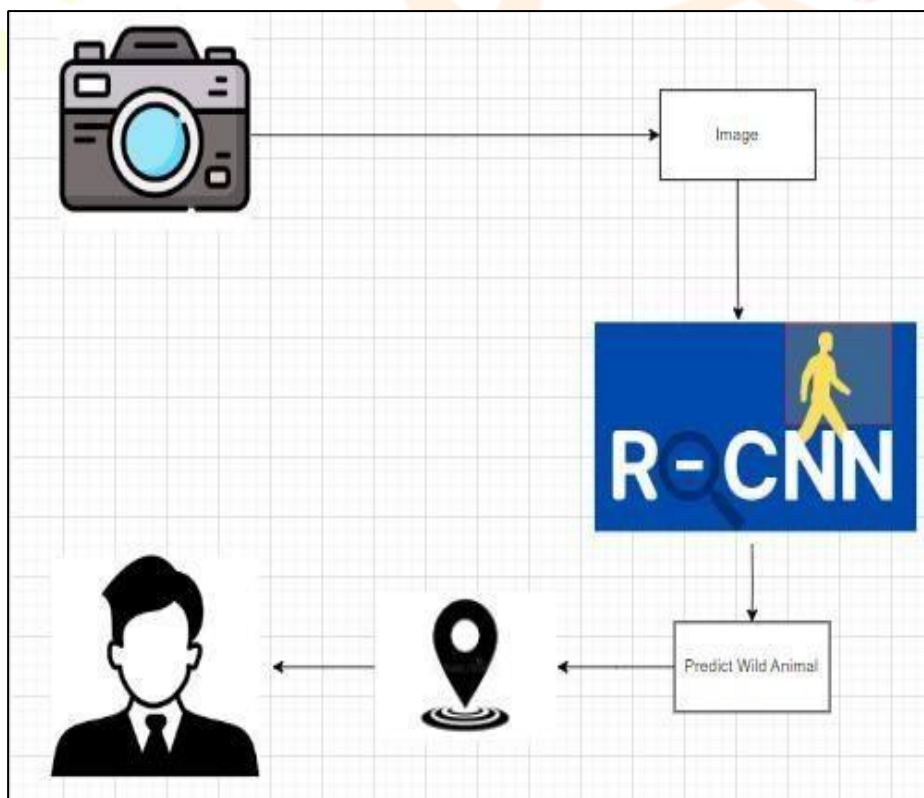


FIGURE 1 - SYSTEM ARCHITECTURE

FLOWCHART

Once the video or Photos are provided to the Application it will extract one frame from video and will try to detect moving object from the frame. This System will apply RCNN algorithm to detect animal.

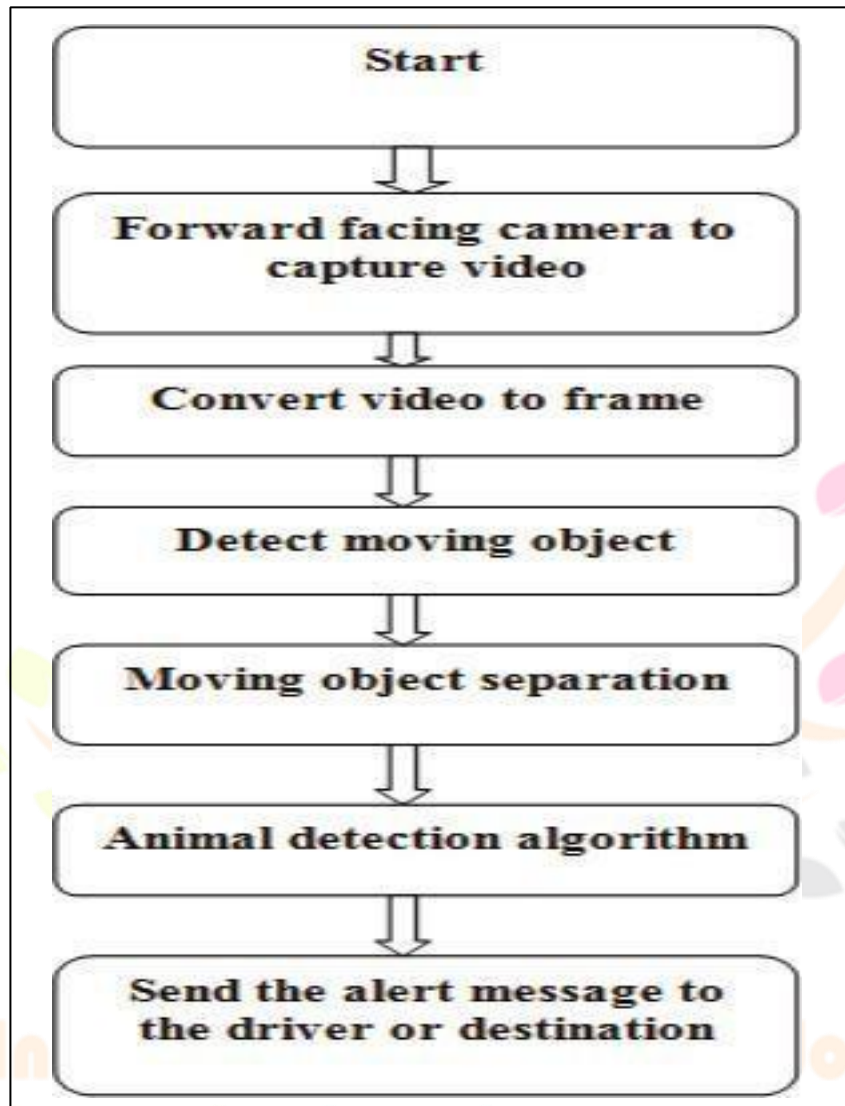


Figure 2- Flowchart

CONCLUSION AND FUTURE SCOPE

Essentially, we've developed an effective automated animal detection platform that significantly contributes to the safety of both humans and wildlife. Picture it as a virtual guardian, promptly issuing alerts upon animal sightings. We've successfully implemented this system on a compact device, enabling its deployment in diverse locations. Our testing has validated the system's ability to consistently identify animals, which is particularly beneficial in areas prone to wildlife encounters. However, we aim to expand its capabilities. We are exploring the integration of miniature health monitoring devices to track animal's well-being. Envision its application in zoological settings, transforming wildlife education into an engaging and interactive experience. Furthermore, we are considering incorporating behavioural analysis to anticipate animal movement, which would be invaluable for conservation efforts. Ultimately, our goal is to create a technology that fosters a more intelligent, secure, and harmonious coexistence between humans and wildlife.

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