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SPECIES CLASSIFICATION FOR FOREST SURVEY AND MONITORING

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Abstract:It is an important tool in applications in animal detection, wildlife conservation, agriculture and public safety. In recent y ears, advances in computer vision and hardware have made it possible to increase the accuracy and efficiency of animal detection that can be used in the field. This article presents a new animal detection method using OpenCV, Raspberry Pi and Coding in Con text (COCO) dataset. The system uses the YOLOv3 object detection algorithm trained on the COCO dataset to detect animals in r eal time. Detected animals are divided into different groups using deep learning models trained on the COCO dataset.
The system has been tested on various test images and videos demonstrating accuracy and efficiency. The system can be used in t he field to monitor wildlife, detect and prevent crop damage, and increase public safety. The proposed animal detection method is an important step for the development of efficient and accurate animal detection systems with applications in many fields.

***Index Terms* – Datasets, Algorithms, Detection, Accuracy, Data storage**

I. INTRODUCTION

In recent years, computer vision technology has been instrumental in detecting objects, including wild animals. With advances in deep learning algorithms and the availability of low-cost hardware like the Raspberry Pi, animal detection has become an important area of research for biologists, conservationists, and wildlife managers. Animal research using OpenCV and Raspberry Pi is a new approach that has the potential to revolutionize wildlife management. OpenCV is a computer vision library with many tools and functions for image processing and analysis. The Raspberry Pi is a small credit card computer that provides a low-cost, low-power system for visual computing. There are many advantages to using OpenCV and Raspberry Pi for animal research. First, OpenCV provides a variety of image processing and analysis tools that are ideal for detecting animals in photos and videos. Second, the Raspberry Pi offers a low-cost, low-power computer vision system, making it the perfect platform for using animal testing tools in the wild.

II. CHARACTERISTICS

Fact: Object detection tools must be able to identify and locate objects in images or videos.

Efficiency: Object detection algorithms must be able to work efficiently and in a timely manner, especially in applications such as driverless cars, robotics and surveillance systems.

Scale Invariance: Object detection algorithms should be able to detect different objects and sizes and under different lighting conditions.

Object Coverage: Objects in photos or videos can be partially or completely covered by other objects, making it difficult to focus and position objects.
Object variability: Objects in a group can vary greatly in size, shape, and appearance, making it difficult to accurately identify and classify them.

Robustness: Object detection algorithms must withstand changes in the environment, such as lighting, weather, or camera position.

Object Recognition: Object detection algorithms should be able to identify and classify different objects.

Real-time performance: Object detection algorithms must be able to run in real time, especially in applications such as robotics, surveillance systems, and self-driving cars.

Hardware Requirements: Object detection algorithms need to be optimized for specific hardware (eg GPU or FPGA) to perform well.

Dataset Size: Object detection algorithms need large datasets to train good models and make them accurate in real-world conditions.

III. LITERATURE REVIEW

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IV. EXISTING SYSTEM

Before the advent of deep learning and neural networks, computer vision techniques were used to detect objects. This technique combines manual techniques such as SIFT (Scale Invariant Feature Transform) or HOG (Oriented Gradints Histogram) with machine learning such as SVM (Support Vector Machine) or Random Forest. Today's methods have limitations in accuracy and speed, especially in complex situations involving background and mock objects. They also require a lot of manual work for infrastructure and measurement, making them less flexible and adaptable to new administrators. In recent years, deep learning-based methods such as YOLO (You Only See One), Faster R-CNN (Region-based Convolutional Neural Network) and SSD (Single Shot Detector) have updated detection.These systems can learn to discriminate from data and handle complex situations with high accuracy and real-time performance. Overall, existing object detection tools have changed significantly with the advent of deep learning and continue to evolve with the development of new technologies and building construction.

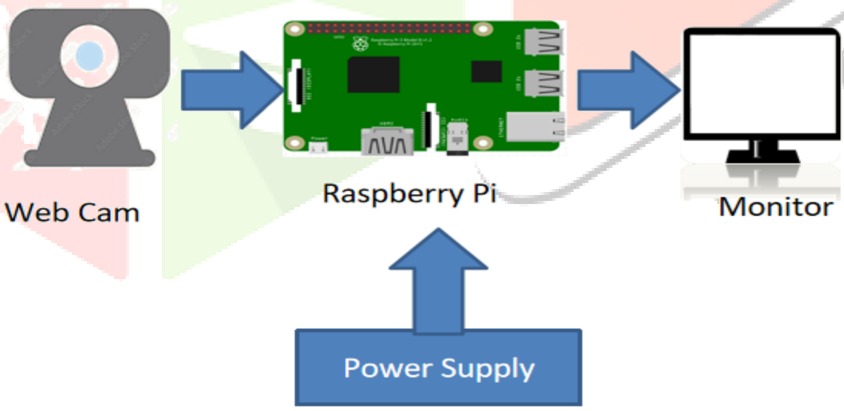


Fig 1: Block diagram of smart camera for wildlife monitoring

V. METHODOLOGY

Hardware installation: Connect the camera module to the Raspberry Pi board, make sure the camera works normally.Data Collection: Use the camera module connected to the Raspberry Pi to record images or videos of the event to be analyzed.Image Preprocessing: Use OpenCV to preprocess images or videos by resizing, normalizing and converting them to a format suitable for introduction to object detection algorithms.Object Detection: Use advanced deep learning models such as YOLOv3 to pre-detect objects in images or videos. The YOLOv3 algorithm is optimized for real-time performance and can capture multiple objects simultaneously. Similarly, custom data can be used to train deep learning models for animal classification if the related species is not included in the COCO dataset.

VI. FLOWCHART:

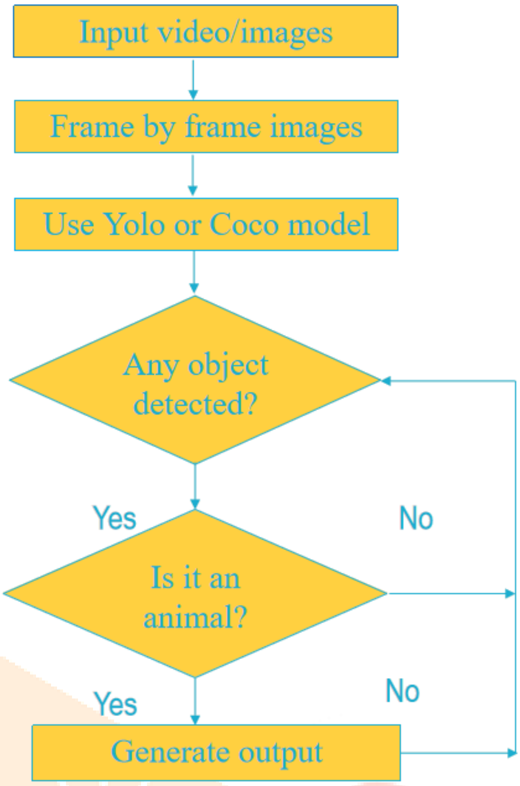


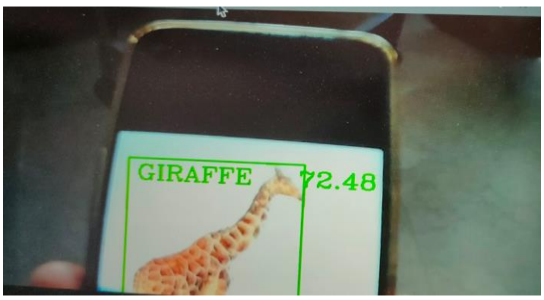
Fig. 1: Flowchart for animal detection and real time monitoring

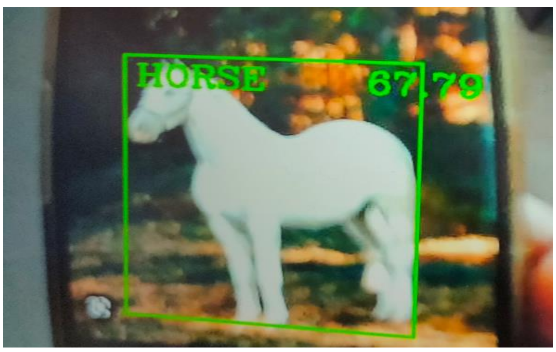
VII. WORKING

Animal testing is done in a few steps using Raspberry Pi with OpenCV and COCO model. The first step is to take a photo or video of the event to be analyzed using the camera module connected to the Raspberry Pi. The captured image or video is preprocessed using OpenCV, which includes operations such as resizing, normalizing and converting the image from input to object into a format suitable for detection algorithms. Next, pass a previous image or video from a previous deep learning model, such as YOLOv3, trained on the COCO dataset. The model can capture multiple objects simultaneously and provide matching boxes and confidence scores.

After target detection, post-processing techniques such as maximum thresholding and box optimization are used to eliminate redundant detections and increase the accuracy of local target. Once the animals have been identified and located, a deep learning model can be trained on the COCO dataset to separate the detected animals into different groups. Finally, the results of the animal search are displayed on a monitor or other output device connected to the Raspberry Pi. Overall, animal detection using Raspberry Pi with OpenCV and COCO model is efficient and accurate in real-time identification and classification of animals. By training deep learning models on specific data, the system can be developed and extended to manage different types and environments.

VIII. OUTPUT





IX. CONCLUSION

In summary, animal research using Raspberry Pi with OpenCV and COCO model is a powerful technique that has the potential to revolutionize wildlife conservation and research. Providing real-time, accurate and accurate animal tracking and distribution, technology can help scientists and environmentalists monitor and protect animals and their habitats. Using advanced deep learning models such as YOLOv3 and COCO dataset training, it is easy to learn how to detect multiple animals in a single pass, and using post-processing tools increases the accuracy and efficiency of testing. Additionally, the ability to adapt and expand the system by training deep learning models on specific data provides greater flexibility and usability for different species and environment.

Also, the use of Raspberry Pi as a low cost, portable and energy efficient device makes this device accessible to a wide variety of users and applications, especially in remote or restricted areas. Overall, animal studies using Raspberry Pi and OpenCV and COCO models hold great promise for the future of wildlife conservation and research. As it continues to be developed and improved, this technology could play an important role in protecting endangered species for future generations.

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