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Enhancing Wild Life Conservation: Employing Yolo V5 Algorithm For Primate Identification

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ABSTRACT

This project pioneers a monkey detection system, merging Google Colaboratory, MakeSense plotting tool, Roboflow dataset library, and the YOLOv5 object detection algorithm. Its primary goal is safeguarding fields by detecting and deterring monkey intrusions. Leveraging machine learning and computer vision technologies, the system swiftly identifies monkeys, preserving agricultural lands and ensuring productivity. Through Google Colaboratory's computational power, MakeSense AI's precise image annotation, specific and accurate dataset from Roboflow library, we designed a monkey detection model using the YOLOv5's detection algorithm that offers instant detection against monkey encroachment. This innovative approach not only utilizes modern technology against animal control, but also protects crops and minimizes economic losses typically associated with such intrusions.

Keywords: YOLOv5, Repellant, Machine learning

1. INTRODUCTION

The proposed system encompasses a comprehensive approach that integrates machine learning models with practical deterrent mechanisms. By combining image recognition capabilities with automated repellent deployment (future developments), this system aims to provide a seamless and effective solution to protect agricultural fields from monkey intrusions, ensuring crop preservation and ecosystem sustainability.

1.1 Existing Technologies for Animal Deterrence: A review of existing technologies reveals a shift towards leveraging AI and computer vision for animal deterrence. Case studies documented by the National Institute of Agricultural Technology (INTA) in Argentina showcased the successful deployment of computer vision-based systems to detect and deter wildlife, including monkeys, from crop fields. These systems demonstrated increased accuracy and adaptability compared to traditional methods. Moreover, the incorporation of AI-driven solutions, as evidenced by projects like "FarmBeats" by Microsoft Research, showcases the potential of machine learning algorithms in wildlife detection and repulsion. This initiative utilized IoT devices and AI-powered cameras to identify and deter animals, significantly reducing crop damage and human-wildlife conflict.

1.2 Overview of YOLOv5 Algorithm and Roboflow Library: The YOLOv5 algorithm, introduced by Ultralytics, represents a significant advancement in object detection with improved speed and accuracy.Research conducted by Bochkovskiy et al. (2020) demonstrated its efficiency in various object recognition tasks, indicating its suitability for real-time applications, including wildlife detection. Roboflow, a popular data preprocessing and model training platform, streamlines the process of preparing datasets and training models. Case studies from agricultural research institutes utilizing Roboflow highlighted its effectiveness in simplifying the data annotation and model training pipeline, significantly reducing the time and effort required for these tasks. Overall, these studies and case examples illustrate a shift towards more advanced technological solutions in animal deterrence, showcasing the potential of AI-driven systems like YOLOv5 integrated with platforms such as Roboflow to address the challenges of wildlife intrusion in agriculture effectively.

2.METHODOLOGY: There are a series of steps and pre-requisites required to be setup in order to make a functional object detection model. We begin with literature survey on services similar to our project model, as discussed in Chapter: 2. The methodology has been divided into three sub-sections – Data collections and Preprocessing and Implementing Make Sense AI tool and Training the YOLO v5 model to identify the subject, in our case monkeys. Data collection and preprocessing plays a pivotal role in the success of any object detection project, influencing the model's accuracy and generalization capabilities. In this study, the process begins with the acquisition of a diverse and representative dataset containing images of monkeys in various environments, postures, lighting conditions, orientations and induced noises into the pictures.The methodology begins with meticulous data collection involving diverse images of monkeys in various settings resembling field conditions. This process ensures a comprehensive dataset for training the model. Platforms like Kaggle and academic repositories like ImageNet offer extensive datasets, providing a foundational resource for this project. We chose to collect it from the Roboflow library due to the availability of the exact required dataset. This particular dataset collected includes over 3000 different images, out of which roughly 1500 are for testing and the rest for validation. Due to limited processing time, 120 images were selected for testing and 50 images for validation. The collected images undergo preprocessing stages, including resizing, normalization, and labeling, ensuring uniformity and

2.1 Implementation of MakeSense AI Tool: MakeSense, a powerful and user-friendly annotation tool, plays a pivotal role in the project's workflow by streamlining the annotation process and facilitating the creation of a meticulously labeled dataset for monkey detection. This phase involves active collaboration with MakeSense AI to perform accurate labeling, ensuring the dataset's adequacy for training the YOLOv5 model. MakeSense provides an intuitive interface that simplifies the annotation of images. Its user-friendly design allows researchers, even those without extensive computer vision expertise, to effortlessly mark bounding boxes around monkey instances in the images.MakeSense enforces consistency and standardization in the annotation process, which is essential for the model's robustness, as it learns patterns based on the annotated data. The tool helps maintain uniformity across the dataset, preventing any kind of quality degradation that could adversely affect the model's performance during training and inference. The annotations created in MakeSense seamlessly integrate with the subsequent steps in the workflow, as would be discussed in the subsequent chapters. Roboflow utilizes these annotations for preprocessing tasks, and the formatted dataset is then used to train the YOLOv5 model. This end-to-end integration ensures a smooth transition from annotation to model implementation, optimizing the entire pipeline for monkey detection.

3. RESULT OF THE TRAINING MODEL

The completion time of the training period can vary depending on the device it is being executed on, the batch size, the number of epochs, the size of each individual image and various other hyper parameters. In this particular case, 100 epochs took roughly 40 minutes to complete. The results are as follows:

3.1 Testing the model on a sample video:

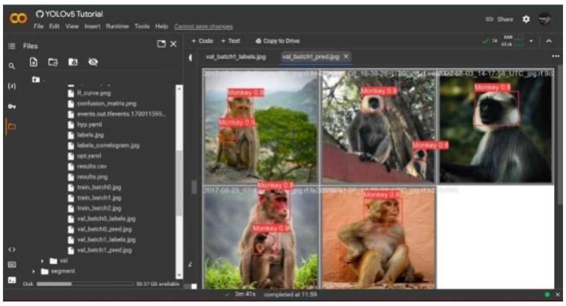

Figure 1: Model Training result

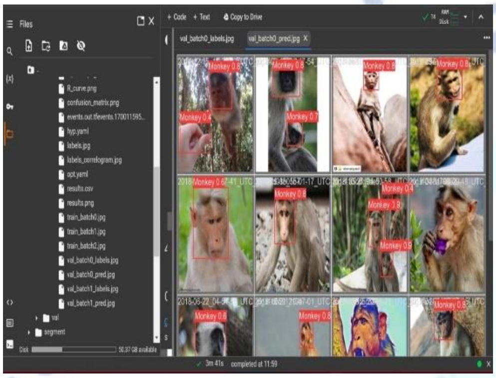

Figure 2: Code snippet to begin testing on the sample video

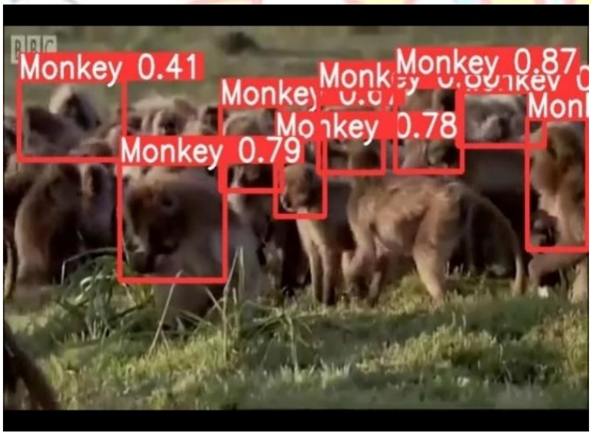

Figure 3: An instance in the sample video.

4. CONCLUSION

The conclusion reflectson the project's achievements, acknowledges its limitations, and propels a vision for continual improvements, highlighting the project's significance in reshaping agricultural protection methodologies through advanced technology integration and ethical considerations. By encapsulating the project's findings, contributions, and future directions, the conclusion presents a comprehensive overview of the developed monkey detection system and its future plans on its implementation towards a better agriculture monitoring and wildlife monitoring.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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