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AI-BASED SYSTEM FOR BIRD AND DRONE DETECTION USING YOLOV4/V5 OBJECT DETECTION MODEL

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Abstract: Birds are an integral part of our ecosystem and play a key role in maintaining nature. The use of drones poses a serious threat to birds. Drones can disturb bird populations and cause damage and possibly death. Drones have the potential to cause serious damage to the ecosystem and bird habitats. The development of a system capable of accurately identifying and categorizing drones and birds is essential to reducing this risk. The YOLOv4 and YOLOv5 models are going to be utilized in the construction of the model that we intend to develop for this project, which is going to be able to identify drones as well as birds. This is because the use of drones provides a considerable threat to bird populations.

Once the models have been trained, we will first determine how well they did on a test set, and then we will determine how well they did on a validation set. It is of the highest significance to develop a system that is capable of precise detection and classification of both drones and birds in light of the growing frequency of the use of drones, which constitutes a substantial threat to bird populations. The performance of the YOLOv4 and YOLOv5 models will be assessed for the purpose of detecting birds and drones, and the model that has the best overall performance will be chosen as the winner of the competition. The accuracy of this model is 94% it is estimated according to whether an object in question is a bird or a drone.

Keywords: YOLOV4, YOLOV5, CNN.

I. INTROUDCTION

Birds are an essential part of our ecosystem and play a key role in preserving the natural order. Additionally, the growing number of drone flights over their habitats puts them in danger. Drone use, which is on the rise, has several advantages, not the least of which are aerial photography and surveillance. However, the usage of drones poses a serious threat to animals. Drones have the potential to disrupt bird populations, resulting in harm or even death. The ecosystem and bird habitats might be seriously harmed by drones. It's crucial to develop a system that can precisely identify and categorize drones and birds in order to reduce this risk.

The difficult subject of object recognition in computer vision has seen significant progress because to the YOLO (You Only Look Once) family of models. In this research, we'll examine how the YOLOv4 and YOLOv5 models may be used to categories birds and drones. Our model will be created using Convolutional Neural Networks (CNN), which will be trained on a sizable library of bird and drone pictures. Both the protection of birds and the security of drones are significantly affected by our technique. We can lessen the possibility of disturbing bird populations and the ecological effects of drone flights by correctly categorizing and recognizing both birds and drones. The health of ecosystems depends on the presence of birds. They help with a variety of ecological tasks, including as pollination, seed dissemination, pest control and other activities. Understanding bird populations, habits, and habitats will be made easier with proper identification and categorization. These specifics are required for effective bird management and conservation. There are more and more business and leisure activities using drones.

II. LITERATURE SURVEY

1. Automated Drone Detection Using YOLOv4

YOLOv4 algorithm, which follows a one-stage detector architecture comprised of four parts: input, backbone, neck, and head. The input is the set of data we want to detect. The backbone is responsible for extracting features and uses the image dataset to make the object detector scalable and robust. CSPDarknet53. The head uses same strategy as

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YOLOv3. However, detecting drones at various altitudes can be difficult, especially due to their small size and high altitude and speed as well as the existence of drone-like objects. The results will be enhanced by utilizing a wider range of image datasets in future work.

2. Drone Detection Using YOLOv5

Drones are currently one of the most widely used technology and are used in a variety of industries, including engineering, airport security, disaster management, package delivery, and more. In addition to its beneficial uses, their extensive usage in illegal operations has raised significant concerns about the security of physical infrastructure and airport monitoring. Inappropriate usage of drones at airports and interference with airline operations have increased significantly in recent years. In order to address this issue, our research created a deep learning-based method for the efficient detection and identification of two types of drones, birds, and helicopters.

3. Detection of drones with YOLOv4 deep learning algorithm

Unmanned aerial vehicles, sometimes known as drones or UAVs, are quickly gaining popularity for both commercial and personal use in major cities throughout the world. Over the past ten years, the military has also made extensive use of it. As a result, it has become more challenging to keep control over them and the security and privacy threats they provide. Using the most recent YOLOv4 deep learning algorithm and the Darknet as a backbone, we suggest a method in this study to identify drones before they can reach a sensitive location or a dwelling. Our model was trained using a number of images taken at various distances and under various weather circumstances.

4. YOLO v5 Based Drone Detection and Identification

YOLOv5 Deep convolutional neural network. The proposed network has an input, backbone, neck, and head. CSP are used as a backbone. PANet is used as a neck in YOLO v5 to get feature. Convolutional neural network (CNN) are the most effective deep neural networks are the most effective deep neural network for object detection. The ability of these networks to extract features is beneficial in object recognition, which is subsequently aided in object recognition. [citation] The development of drones, as well as the security threats they pose to sensitive locations, and the increasing use of drones in sensitive locations, such as airports, drone detection and recognition has attracted much attention.

5. Drone Detection using Deep Learning

YOLOv3 algorithm in this work. YOLOv3 algorithm was the one with big improvements in detection accuracy and inference speed. YOLOv3 adopted Darknet53 as the backbone, utilized feature pyramid networks (FPN) as the neck. The backbone uses convolution layers to extract features from the input images, and the neck combines the features from previous convolution layers. According to the requirements from Skysense, the model should be fast to run in real-time and be able to locate the drone location in the video stream. YOLOv3 had the best inference speed and overall precision.

6. Bird/Drone Detection and Classification using Classical and Deep Learning Methods

SVM Object Detector and Classification with Combined Data, Set, RF Object Detector and Classification with Combined Data set, Shallow Neural Network. Classification and detection of drones and birds can be subjective depending on the quality and quantity of data sets being used, which determine the classification and detection of drones and birds. SVM proved to be the best in classification compared to the RF and shallow NN.

7. Detection and recognition of drones based on a deep convolutional neural network using visible imagery

This work involves the use of YOLOv4 deep learning network, Feature Map Extractor, Feature Map Collector, al pyramid pooling (SPP), Bag of Freebies (BoF), Bag of Specials (BoS) and proposed an system in Detection and Recognition of Drones Due to the similar behavior and appearance of drones and birds in the sky, high speed and problems are caused, such as crowded backgrounds, the small size of drones at long distances.

8. Application of Image Processing Techniques for UAV Detection Using Deep Learning and Distance-Wise Analysis

YOLOv5 algorithm, performs object classification and localization in a single stage. Object Detectors, Hue Augmentation, Edge Enhancement are used. Based on the results obtained, can infer that YOLOv5 is better than V7 for UAV detection, in terms of consistency of drone detection and obtaining higher confidence scores with very low numbers of false identifications.

9. A Lightweight and Accurate UAV Detection Method Based on YOLOv4

YOLOv4 algorithm in their study, one-stage method, feature extraction network, standard convolution with depth-wise separable convolution, Faster-RCNN, SSD, EfficientDet, PANet. A lightweight and accurate UAV detection method

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is based on YOLOv4 object detection algorithm. A dataset of UAV images was involved for this study. It contains four different types of UAVs. Different deep learning object detection algorithms are used on this UAV dataset to identify UAVs. Optimize detection by enhancing the diversity and richness of the data set.

10. Improving Small Pest Bird Detection in YOLOv5s for Autonomous Bird Deterrent Systems

YOLOv5 uses the architecture of CSPDarknet53, with SPP layer as the backbone, PANet as neck, and YOLO detection head ,improved YOLOv5s network in the project. This paper has discovered architectural modifications to YOLOv5s that lead to a clear increase in performance with a relatively low computational cost, resulting in a significant decrease in computational cost, YOLOv5s model's improvement maintains its ability to perform better in real-time inference and detect small objects better, while also preserving the ability to detect small objects better.

11. Using deep networks for drone detection

The significance of YOLOv2 network, CNN, bag of visual words (BoVW), feature descriptors such as scale invariant feature transform (SIFT), feature descriptors such as scale invariant feature transform (SIFT), support vector machines (SVM) in detecting drones. This study demonstrated that an object detection model based on a CNN can be used to detect and differentiate drones from birds. The trained network generalizes well as it can achieve high precision and recall values at simultaneously.

12. Drone detection and classification using deep learning

YOLOv3 Algorithm, CNN, DarkNet53, RADAR, SVM classifier. Because of the large architecture of the YOLOv3 model and less class, the model is shaped for 150 epoch only. Due to the big architecture of the YOLOv3 model and less class, the model is trained for 150 epoch only. In some cases, the model is unable to detect the correct drone type.

III. METHODOLOGY

3.1 Proposed Methodology

The process of developing the fundamental structure and organisation of a software system is referred to as the architectural design process. This process may be broken down into several steps.

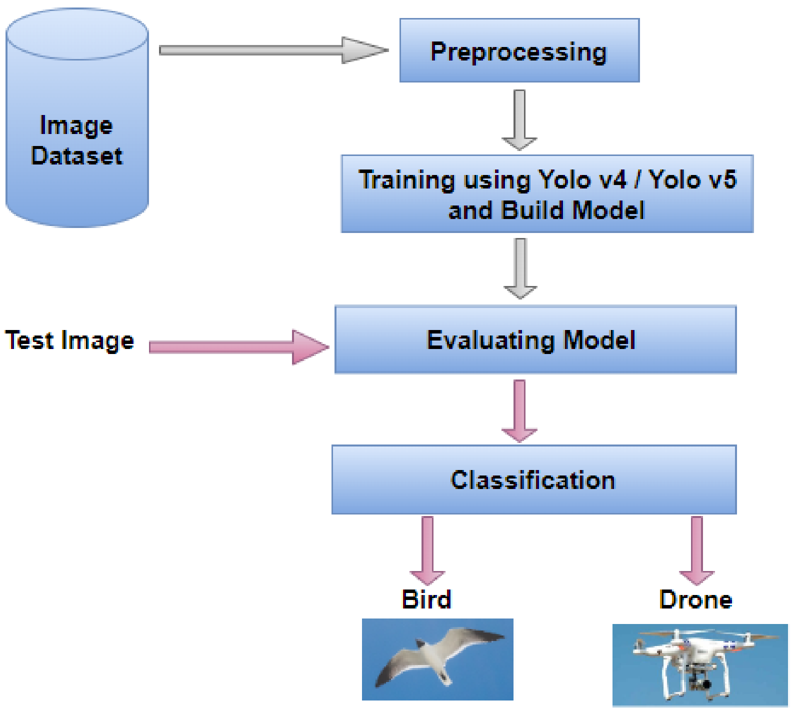

Figure 1. System Architecture

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Tester evaluate the model generated in order to check whether the model working or not in detecting bird and drone. User can upload a drone and bird image and check the classification.

3.2 YOLO Algorithm

YOLO was proposed in 2015 by Joseph Redmond et al. It was offered as a solution to the challenges encountered by object recognition models. You Only Look Once (YOLO) suggests employing an end-to-end neural network to forecast bounding boxes and class probabilities simultaneously. The YOLO algorithm takes an image as input and then uses a simple deep convolutional neural network to detect objects in the image.

YOLO v4 is the fourth edition of Bochkovskiy's YOLO object detection system. The introduction of a new CNN architecture called CSPNet is the key enhancement in YOLO v4. CSPNet stands for "Cross Stage Partial Network" and is a ResNet architecture version built primarily for object detection tasks. It debuted with the concept of BoF (bag of freebies) and BoS (bag of specials) strategies for improving model performance.

BoF: Techniques for improving model accuracy while reducing inference costs (computation or inference durations). Data augmentation, regularization, and normalization are some examples.

BoS: Techniques that enhance accuracy while increasing inference cost marginally. These techniques are typically in the form of plugin modules, which can be added or removed from the model at any time.

YOLO v5 was released in 2020 as an open-source project by the same team that created the original YOLO algorithm and is maintained by Ultralytics. The YOLO network is made up of three major components are Backbone, Neck and Head.

IV. RESULTS & DISCUSSION

For a machine learning project on the detection of birds and drones using YOLOv4 and YOLOv5, the suggested approach includes the steps of collecting datasets of birds and drones, pre-processing the input data, training the models, evaluating the models, developing a user interface, and implementing the approach in the target environment.

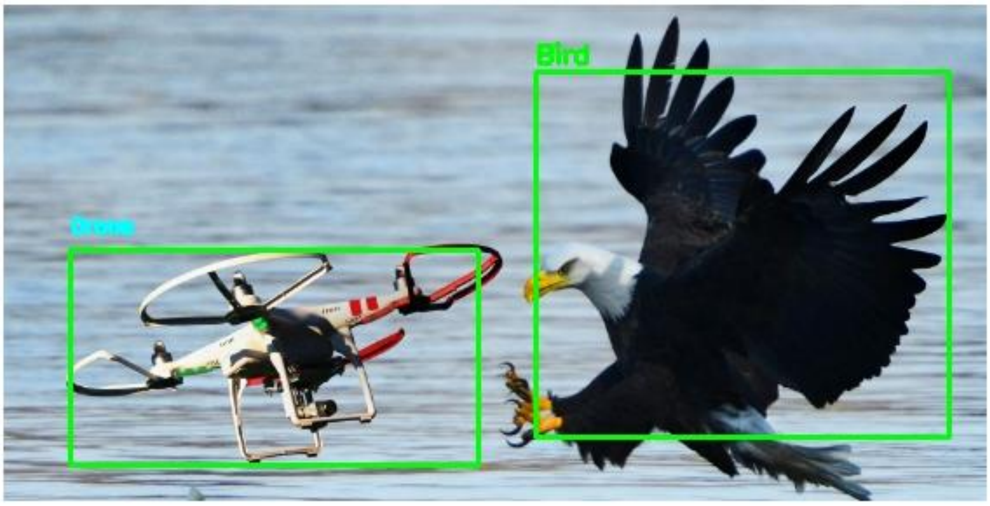

Figure 2. Test Results

This approach involves collecting datasets of birds and drones, pre-processing the input data, training the models, evaluating the models, developing a user interface, and implementing the approach in the target environment for a machine learning project on the detection of birds and drones using YOLOv4 and YOLOv5.

All of these steps must be completed in order. The YOLOv4 and YOLOv5 object identification models have helped the system achieve a high level of accuracy, which has been shown.

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V. CONCLUSION

The goal of this study is to detect bird and drone in order to save birds while also ensuring drone safety. The YOLOv4 and YOLOv5 models are going to be combined in this investigation so that a model may be developed that can distinguish between drones and birds. In order to establish which of our models is superior at differentiating between drones and birds, we will evaluate the performance of each model using metrics such as accuracy, recall, and F1 score. This initiative will have a significant influence not only on the protection of birds but also on the security of drones. By appropriately classifying and distinguishing both birds and drones, we can reduce the likelihood that drone flights will have an adverse impact on bird populations and the ecological repercussions that they will have.

The proposed work can be extended to include other transfer learning networks to automatically warning drone operators when birds are observed close by, integrating a bird and drone detection system with drone control systems can boost safety precautions. By lowering drone-bird collisions, this integration can make drone flights safer and less likely to harm bird populations.

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