Real Time Drone Detection System

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I. *ABSTRACT*— **The development of drone technology over the past few years has given drones the potential to carry out much more complicated tasks on their own thanks to the integration of artificial intelligence, computer vision, and object avoidance technologies. However, the improper usage of drones, such as the drone incident at Gatwick Airport, led to significant disruptions that affected about 140,000 travellers. Drone surveillance is absolutely essential to prevent this from happening again. This will be accomplished by first detecting drones, then tracking them. The usage of a deep learning object detector called YOLOv3 with pretrained weights and transfer learning to train YOLOv3 to specifically recognize drones is presented and examined in this research. We showed how computer vision can be used in accomplishing this desired result in real time.**

Keywords—Drone Detection, YOLOv3, Deep learning, Confidence value, Precision, Machine learning.

I. INTRODUCTION-

Drones, also known as unmanned aerial vehicles (UAVs), have captivated the curiosity of hobbyists and investors in recent years. Due to their small size and ability to fly autonomously, such drones have a wide number of commercial applications, including agriculture, photography, and a variety of public services. Simultaneously, they can be used to carry out chemical, and biological attacks, or to assist in the smuggling of drugs or illegal immigrants across the border, posing security risks to public safety due to their small size and ability to fly low enough to evade conventional radar detection. Drones have been widely deployed in both military and civilian environments, and their use has surged in recent years as a result of their low cost and ease of operation. Drones are difficult to detect in the air. Small drones transmit very limited electromagnetic signals, making them difficult to detect with conventional radar. The problem of recognizing "unmanned aerial vehicles (UAVs)" in the sky focuses on both the items that may appear in the sensing region as well as the UAVs themselves. One of the most distinguishing visual characteristics of a UAV is its shape. Within the framework, each type of "UAV (from the tricopter to the octocopter)" appears strikingly similar.

II. LITERATURE REVIEW

1. **Human-Drone Interaction**: state of the art, open problems and challenges: within the relationship between users and a specific class of robots, that square measure distinguished by peculiar options, it's showing however it's attention-grabbing to investigate a lot of regarding the users' expertise. Therefore, the interaction with these devices is turning into in style and that they shall examine however they'll be manipulated across the interfaces completely different from various users and with different mechanisms of interaction. during this paper, within the data of social drone interactions, they gift Associate in Nursing analysis of the state of the art so as to check and address the key open queries and challenges.
 Autonomous Detection of Malicious Events victimization

2. **Machine Learning Models in Drone Networks**: Associate in Nursing autonomous intrusion detection system is planned during this paper to get advanced and complex cyberattacks that concentrate on drone networks. to

assemble legitimate and malicious observations and verify the potency of machine learning in real time, a workplace was designed to initiate malicious events against a drone network. the info collections were trained and assessed victimization machine learning algorithms, together with call tree, k-nearest neighbors, naive mathematician, support vector machine and deep learning multi-layer perceptron, with promising ends up in terms of detection accuracy, warning rates, and process times.

3. **A Deep Learning Approach to economical Drone quality Support:** They counsel a completely unique relinquishing system during this analysis to supply economical support for quality and secure wireless communication to drones served by a terrestrial cellular network. they're planning a deep Q-learning rule victimization tools from deep reinforcement learning to dynamically optimize relinquishing selections to make sure strong communication for drone users. However, the simulation results showed that the planned framework well decreases the number of handovers compared to the baseline situation, at the price of a small loss in signal strength, whereas a drone continually connects to a base station that has the best signal strength obtained.

4. **Detection client Drones from Static Infrared pictures by Fast-saliency and HOG Descriptor**: Detection of client drones plays a very important role in applications for Counter-terrorism, intelligent protection and airway safety, together with administration. during this paper, they gift Associate in Nursing economical method for salience detection of client drones from static infrared pictures mapping and learning by machine. Crucially, a fast salience is usually recommended model with an easy convolution of the 5x5 kernel to get the input image salience diagram, within which targets square measure improved, whereas it suppresses the context. Candidate regions that will contain drones square measure extracted by adaptive thresholding and connected domain filtering from the salience map, followed by the HOG descriptor operate expression for every space. Finally, the actual fact of those candidates is discriminated against by the coaching of the support vector machine from two hundred samples of drones and four hundred background samples. Experiments on four actual sequences of over 600 infrared pictures show that our planned rule has smart performance in each the preciseness of detection and also the potency of computation.

III. METHODOLOGY

YOLOv3, which stands for You Only Look Once version 3, is a cutting-edge open-source real-time object detector improved and developed by Joseph Redmon from YOLOv1. When using a graphic processing unit (GPU), NVIDIA Pascal Titan X, YOLOv3 can process images in real time at 30 Frames Per Second (FPS). YOLOv3 predicts bounding boxes using dimension clusters as anchor boxes, which improves YOLOv3 accuracy by nearly 5% when combined with directly predicting the bounding box centroid location.

YOLOv3's pre-trained weights of various classes did not include a class to detect drones. As a result, machine learning is required to train this deep learning object detector to detect drones specifically and to share the results, which is the goal of this research paper.

Drones, hexacopters, quadcopters, and unmanned aerial vehicles (UAVs) have been photographed. To improve the dataset, several experiments were conducted to collect drone images using camera and 360 cameras at various times of the day to simulate sunny and cloudy conditions. Drone images were also captured at various altitudes ranging from 10m to 50m with a 10m increment as required to capture small drones. 1500 drone images were manually sorted to remove irrelevant images, and 1435 images were prepared. This is done to ensure the accuracy of the dataset that was prepared.

The selection of a model's training and validation parameters is a critical step in machine learning to ensure optimal performance while avoiding overfitting. This is accomplished by splitting the dataset into two parts: training and validation.

The training and validation parameters were chosen, and the probability was set to 0.8. A probability of 0.8 indicates that 80% of the images will be tagged for training and the remaining 20% for validation. The reason for selecting 0.8 is due to the Pareto principle, also known as the 80/20 rule, which states that roughly 80% of the effects will result from 20% of the causes.

The 1007 image dataset was divided into training and validation, with 19.5% of the dataset tagged as validation and the remaining 80.5% tagged as training.

The model was trained using google colab and a tensorflow library. Each image was passed through the YOLOv3 algorithm and it got tested and divided into the classes.

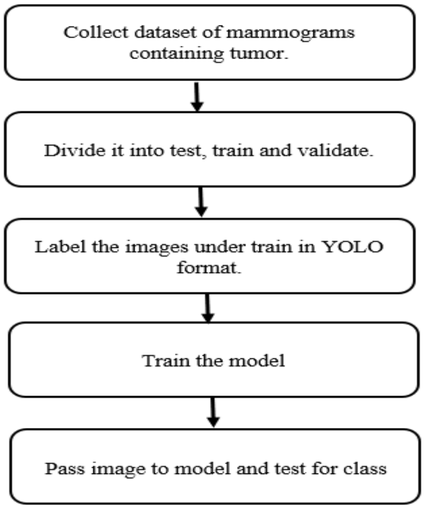

Fig 3.1. Project flow diagram

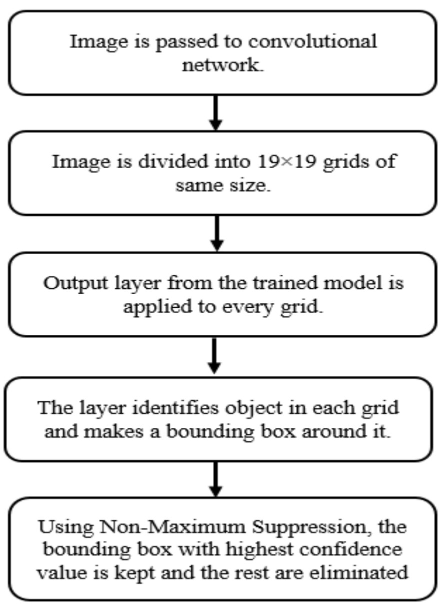

Fig 3.2. YOLOv3 Algorithm

IV. RESULTS

One of the most well-known and effective object detection models is called "You Only Look Once," or YOLO. YOLO is the first option for every real-time identification of objects. The YOLO algorithms divide both input images into the SXS grid structure. Object detection can be done by any grid. Now, these grid cells predict the border boxes of the observed objects. Each box has five key characteristics, including x and y coordinates, the width and height of the object, and a prediction as to whether the box will really contain the object.

Fig 4.1. Confidence value of detected drone class.

Fig 4.2. Drone detected in video.

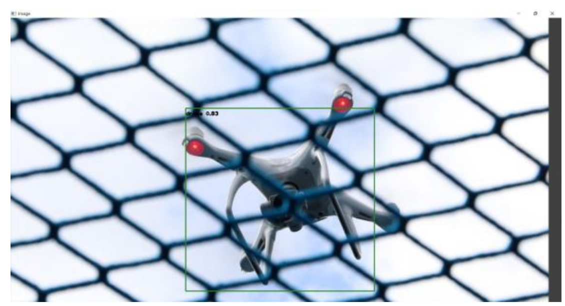

Fig 4.3. Drone detected with a confidence value of 0.83 in the presence of background noise.

V. FUTURE SCOPE

In future drone detection are accustomed stop black use of drones so as to forestall security breaches and to make sure public safety. The drone business is increasing speedily. they're growing a lot of} more accessible to the general public and at cheaper costs. per their payload capability, drones will be used for numerous functions, like scrutiny, delivery, monitoring, photography, and among alternative uses. every now and then drones may also be ill-used resulting in safety considerations. there's AN increasing potential for little drones to be ill-used, particularly by hobbyists, in addition as for black activities like drug importing, terrorist attacks, or perhaps intrusive in emergency services like fireplace interference and disaster response. Drones may also be reborn into dangerous weapons by loading them with explosive materials. However, they're tough to sight once within the air. little drones transmit terribly restricted magnetic attraction signals, creating it terribly tough for standard {radar |microwave radar |radio sighting and ranging |radiolocation |measuring instrument |measuring system |measuring device} to detect them. Conversely, object detection mistreatment deep learning has achieved substantial success because of its high accuracy and out there computing power. In fact, the "You solely Look Once" (YOLO) formula has surpassed alternative object detection algorithms like the Region-Based Convolutional Neural Network (R-CNN) and therefore the Single-Shot Multibox Detector (SSD) owing to its extremely precise real time detection capability. YOLO is superior in terms of each accuracy and speed.

VI. CONCLUSION

In this research, YOLOv3 was trained to detect drones and drone-like objects (i.e., birds). Our model performed better than those of previous similar studies. Drone detection is necessary, considering that drone intervention is frequent in unauthorized and emergency tasks. 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. Drone and bird image databases were compiled in this research by collecting images from available public resources. Using those collected images, a YOLOv3 model was trained and evaluated via our own drone videos. This study was limited to YOLO implementation only since various object detection algorithms require datasets to be labeled in certain formats, which is time consuming. In addition, speed was one of our considerations while choosing algorithms.

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