Poacher Detection using YOLO Algorithm

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Abstract—Illegal trade of wild animals is a merciless offence as various species of animals like elephants, rhinos and tigers are being killed for their valuable possessions like ivory, horn, skin, etc. The forest rangers conduct patrols with the aim of preventing poaching activities that are killed by poachers. Hence, the task is automated. Yolo algorithm which is currently state-of-the-art algorithm can be used to locate these poachers from a distant place. Also, it is comparatively faster than its competitors and hence better option for detection of poachers.

Keywords—YOLO, poacher detection, drone monitoring, Wildlife Conservation, UAV

I. INTRODUCTION

The illegal wildlife trade is the 4th largest illegal trade in the world. The world is dealing with an unprecedented spike in illegal wildlife trade.Wild animals are being poached on a massive scale, with millions of individual animals of thousands of species over worldwide are killed or captured from their native habitat Many animals like elephants, tigers, and rhinos are poached for their ivory skin and horns wildlife trade is major black market that has increased. Effects of which is 100000 African elephants were killed between 2014 to 2017 and Rhino 10000 killed 2014 to 2016[1].
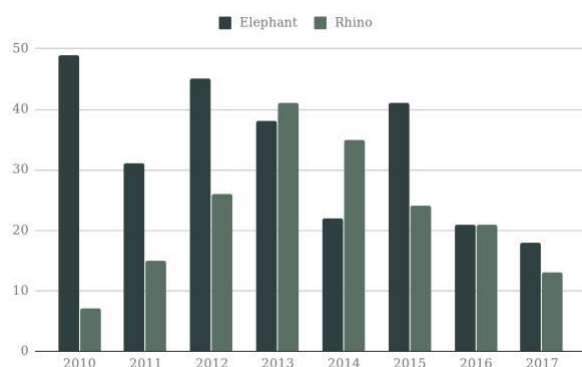

Fig. 1. Statics of poaching in India

In 2018 a few rangers were murdered by poachers at Kruger national park in South Africa. Since 2009 some 871 rangers have been killed while protecting wild life according to the report of the International Ranger Federation (IRF) [2]. Hence it is important to automate the process to save animals as well as humans from the threat. A lot of organizations have come up with devices equipped with cameras to be placed in various locations. But it will not be feasible to actually implement it on the widespread land of the reserved areas. Hence a more reliable method is needed. Hence by using UAVs, which are unmanned aerial vehicles also known as drones can be used to monitor these poachers. These drones will be flown over high altitudes of reserved areas. These reserved areas are restricted for humans from entering. When any such unusual activity is detected data can be sent to the work station where they will be notified when a poacher is detected.

II. LITERATURE REVIEW

Carrio et al.[3] have stated that Unmanned Aerial Vehicles (UAVs) are being widely used for several types of military as well as civilian applications from security, surveillance, and disaster rescue.The review was implemented on recently reported applications of deep learning for UAVs, including the most recent developments as well as their performances and limitations. Images acquired from UAVs are currently the existing type of information being exploited by deep learning, mainly due to the low cost, low weight, and low power consumption of image sensors in UAVs. This noticeable fact explained the dominance of CNNs among the deep learning algorithms used in UAV applications, given the excellent capabilities of CNNs in extracting useful information from images

Klein et al. [4] stated that the technological advancement in sensors,big data processing and machine intelligence as well can provide affordable and effective measures of conservation of wildlife.This system can be used to monitor the endangered species and ecosystem. A strategic vision for how data-driven approaches to conservation can drive iterative

improvements through better information and outcomes-based funding has been presented.The approach to biodiversity monitoring involves periodically sending observers to a predetermined set of survey sites to collect data over relatively short survey windows. Logistical hurdles, personnel costs, and time constraints made it difficult to scale these traditional surveys to meet the increasing demands of global conservation.

Redmon et al.[5] in their research on YOLO algorithm for object detection stated that YOLO is used to predict the object in image and to determine where they locate and what objects are present. Convolution network was used for simultaneous prediction of images. The image is run over the network at the time of making predictions. In this algorithm the number of background errors reduces as the entire image is observed at the time of testing and training.Features from the entire image were used to predict the bounding boxes. This design enables end to end training and real time speed while maintaining precision. The input image is divided into S*S grid and if the centre of objects fall into one of the grids then that particular grid will be responsible for detection of objects.Out of 5 predictions(x,y,w,h and confidence)by Each bounding box, centre of box is represented by "x" and "y" coordinates, width(w) and height(h) are relative to whole image, and the confidence is represented by IOU(Intersection Over Union) between predicted box and ground truth box.

Bondi et. al.[6] have proposed a system to assist rangers with poaching activities in national park and conserved areas by detecting poaching incidents and predicting future incidents. The aerial vehicles had been used to create a dataset of 70 historical thermal infrared videos. It was done by flying the drones at night on a preprogrammed path. After labelling the videos, individual frames had been used to train for animal and poacher detection. AirSim-W has been used which includes African savanna environment in Unreal Engine. Python API has been used to make the UAV fly in a zig-zag pattern and get back to objects of interest such as poachers to make sure the object is in frame. The captured RGB images were converted to infrared images. The segmentation map created from RGB simulation specified the object captured in each image.

III.   METHODOLOGY

Fig. 2. Proposed solution Architecture

UAV can be a remote controlled aircraft which can be flown by pilot at ground control station or else it can be a pre-programmed flight plans or more complex dynamic automation systems. UAVs with automatic recognition which is the solution for manual monitoring. Automatic recognition requires animal detection and animal counting so that data can be collected which may possible threats on animal, Conservation work can start by using small UAVs for both animal abundance and to obtain data on their threats. These drones can fully fly automatically to obtain images and videos. These can be used to track large animals, snares and signs of poachers. Fixed drones cover the large land mass and are playing a big part in reduction of illegal destruction.
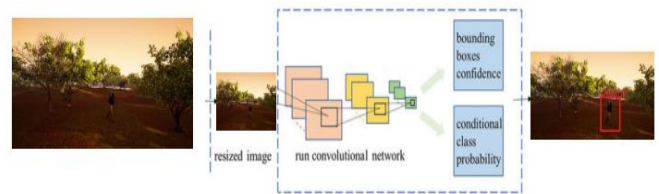

Fig. 3. Yolo algorithm applied on poacher detection
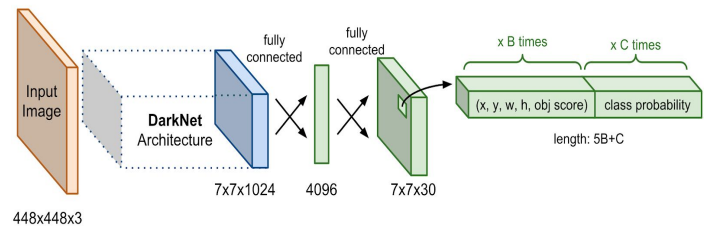
IV.   WORKING OF YOLO ALGORITHM

Fig. 4. The network architecture of YOLO.

YOLO is the state-of-the-art algorithm which has outperformed all the algorithms because as the name says yolo you look you look only once. UAV can be a remote controlled aircraft which can be flown by pilot at ground control station or else it can be a pre-programmed flight plans or more complex dynamic automation systems. UAVs with automatic recognition which is the solution for manual monitoring.Automatic recognition requires animal detection and animal counting so that data can be collected which may possible threats on animal, Conservation work can start by using small UAVs for both animal abundance and to obtain data on their threats.

A.   How it work

- Prior detection system repurpose classifies or localize to perform detection

- Apply model to image at multiple locations and scales

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- The network divides the image into regions and predicts bounding boxes and probabilities for each region.

- The model has several advantages over the Classifier based system. It also makes predictions with a single network evaluation, unlike systems like R-CNN which require thousands for a single image. This makes it extremely fast, more than 1000x faster than R-CNN and 100x faster than Fast R-CNN.

- The network predicts 4 coordinates for each bounding box. YOLO predicts an objectness score for each bounding box by using logistic regression.

- Each box then predicts the classes the bounding box contains using multi label classification. This formulation helps when we move to the more complex domains such as overlapping labels in Open Image Dataset.

- System extracts the feature from the predicted scales and using similar concept to feature pyramid network

- This network can be used for performing feature extraction. Darknet neural network is used for training and testing Multi-scale training, lots of data argumentation, batch normalization, all the standard stuff which is required.

- Darknet prints the object which is detected and how long it took to find them, Darknet is not compiled with openCV so it can display results directly.

The working of yolo is compared to the human perception YOLO(you only look once) is an Unifies Object Detection which presents end to end solution to object detection. YOLO algorithm can be used to train to detect directly from the input image and differentiate among them. Yolo predicts the present object by looking up into the image, where they are actually present in the image by using detection and classification methods. The input image has to be passed from a bunch of layers and final output is given accordingly.IT resizes the image and divides it into the cells. It is then run to convolution neural network. There are 24 layers. After going through all the layers, Binding boxes having confidence greater than 85% are marked the conditional class probability will select only object (poachers) and mark bounding boxes around them.

V. RESULTS

Fig. 5. Screenshot of the YOLO Working on Savanna environment

We demonstrated the YOLO V3 algorithm on multiple drone view videos of african savanna and it successfully detected the required objects with 72.9% accuracy. GPU laptops provided consistent detection speeds with slow networks with the help of CUDA .These can be used to track large animals, snares and signs of poachers. With the help of YOLO we can accelerate the process of Poacher detection and provide better results as YOLO is faster than Faster-RCNN. Drones cover the large land mass and are playing a big part in reducing illegal destruction.

VI. CONCLUSION

This paper encourages the reader to understand the need to espy methods for wildlife conservation. Animals are integral part of the ecosystem and their survival is important for maintaining the ecological balance. However, merciless poaching has endangered their existence. Hence it is important to reach out to a larger community to carry out research to detect and prevent poaching. A simulation environment will provide a platform to involve more people in carrying out research on a crucial issue of detecting poaching activities that are carried out in unreachable lands. Since it is difficult to carry out real time monitoring and detection of poaching due to various factors like dense forests, environmental conditions, insufficient data, and terrain. Furthermore, the use of aerial vehicles can aid easy monitoring of wildlife and poaching activities. Use of simulation environments can enhance ability and ease of training and testing of algorithms do develop a sound approach for real time monitoring and detection of poaching activities.

VII. FUTURESCOPE

These drones are capable of flying autonomously followed by planned based GPS which can be programmed before flight to detect the animals. Along with the anti poaching drones can fulfill the following such as animal counting, camera trap image retrieval, anti poaching management , species Identification The flying drone will help to determine the poaching activities in areas where unknown poachers are strictly prohibited.

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