Survey about Animal Intrusion Detection Using Computer Vision

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Abstract: *The accidents that happen on highways near forest cover are basically due to the intrusion of roads by wildlife animals. When these acts happen at the night they become very difficult to travels through these roads and the present becomes a major hindrance to the travelers as well as to the nearby villages or human settlements. This causes Human-Animal conflict which may lead to fatal consequences. With the latest developments in AI, we can actively recognize various animals individually from a live feed. This paper studies animal's physical attributes and recognizes them with the help of a neural network. The framework can improve the recognition accuracy by retraining the model with multiple datasets. In this project, we will monitor the highway at regular intervals through a camera that will be recording the highway lanes. With the help of a machine learning model, we can detect the animal entry and transmit a signal to display a particular light to notify the travelers along with an alert to the concerned authorities of this intrusion with the necessary GPS or unique coordinates.*

Key Words: Mobile net SSD, Deep Learning, object detection, Regional proposal method, image processing and YOLO.

I. INTRODUCTION

In recent times the speed of untamed animals being run over by vehicles near forest areas has significantly increased. This has caused several highway blockades and has caused the livesofheany animals also as citizenry . Moreover, this has slowly began to affect the wildlife balance near these highways and has caused severe discomfort for travellers, and has been a headache for the concerned authorities. Big animals like bears, elephants, getting injured or killed thanks to these accidents. This paper deals with developing a sensible and sensitive detection system to stop wildlife-vehicle collisions. an instantaneous effort is required to scale back this occurrence. This has now been the most important concern today, and a drag that innovation and communication are of the utmost importance. If we could devise a way to acknowledge the presence of those wild-life animals beforehand we could actively reduce these events. the traditional approach of sifting through images by eye are often a laborious and expensive task and not effective within the end of the day . Traditional wild animal detection and recognition method mainly use the collected images of untamed animal as a test while a training set for learning and training purpose. These experimental samples got to treated by several screening and pre-processing since they typically contain complete, clear, and low-noise image features. However, traditional detection algorithms cannot effectively process captured animal images during wild animal monitoring mission because of the character of complex background and nonuniform illumination that exist in original images. Therefore, proposing an appropriate and effective detection method may be a crucial prerequisite to solving the prevailing problem and this where we might wish to implement the concepts of machine learning and supply better results.Animal detection could also be an important and rising space thanks to an outsized range of world applications. Numerous animal detection ways and warning systems are used for recognizing the presence of animals on the roads or areas. Applications that square measure vital in world square measure preventing animals bumping into vehicles on roads, preventing dangerous animal intrusion during a residential area , knowing locomotive behavioural of targeted animal etc. of those applications is narrowed right right down to these areas particularly detection, trailing and identification of animals. Now the security of every human and animal is equally vital. we've implemented an inexpensive warning system to make positive human and wild animals awareness to measure safely.

The one method is wherever humans need to get notification whenever wild animal comes on the brink of

a highway or are actively present within the highway lane and notify the travelers through traditional signaling methods. Our project intends to resolve or reduce the human-animal conflict. With the assistance of the newest developments in computer vision, we could actively monitor and supply an alert supported the severity of the threat. These methods will further narrow down the likelihood of human-animal collision near highways. And thereby ensuring the security of both human and animal lives.

We have used machine learning methods for the automated recognition of wildlife. To classify images, image features are required. Hand-crafted image feature methods like the histogram of oriented gradient and scale-invariant feature transform are widely applied Convolutional neural networks have only recently been applied to the automated classification of wildlife images, with limitation in performance reported. microcalcifications. However, in resonance imaging, in-homogeneity within the magnetic flux produces an impact of intensity non- uniformity. This general artefact shows itself as a smooth, gradual change within the values of an image's pixels and may harm the implementation of methods. Therefore we could use of these advanced deep learning methods to develop a system that would recognize the threat and notify the concerned authorities. These will help us to scale back these incidents within the future and make smooth travel through the highways possible.

II. LITERATURE REVIEWS

A. Yiting Li, Haisong Huang, Qingsheng Xie and Liguo Yao, "Research on a Surface Defect Detection Algorithm supported MobileNet- SSD" IEEE Transactions on Pattern Analysis, vol. 34, pp. 743–761, Sep 2018 Yiting Li proposed this paper to realize real-time and accurate detection of surface defects by using deep learning methodology. For this reason, the only Shot MultiBox Detector (SSD) organize were received because the meta-structure and joined with the bottom convolution neural system (CNN) MobileNet into the MobileNet - SSD . It utilizes a parallel camera, advanced camera, and charge- coupled gadget (CCD) camera to collect target pictures, extricate includes and sets up a relating scientific models, and to end the MobileNetSSD It, for the foremost part, utilizes a paired camera, computerized camera, a profundity camera, and charge-coupled gadget.

B. Debojit Biswasa, Hongbo Sua, Chengyi Wangb, Aleksandar Stevanovica, Weimin Wangc, "An automatic traffic density estimation using Single Shot Detection (SSD) and MobileNet-SSD", pp. 3354–3361, Dec. 2018.

Debojit Biswasa in his paper he has proposed the implementation of SSD(Single Shot Detection) in his paper, the foremost monotonous job for any object detection algorithm is to make training data sets, where he labelled approximate 500 objects over 450 images. All the label image creates a.xml file which contains the detailed information (location, height, and width) about the label objects. Before we presenting the labelled dataset to SSD, where the mapping is generated about the situation of the datasets. SSD where generated a TensorFlow which is that the base model for MobileNet-SSD. The MobileNet architecture where it stored as MobileNet which is employed to cross-train the MobileNet architecture TensorFlow SSD's. The generated process are often utilized in TensorFlow for object detection.

C. Anita Chaudhari, Shraddha More, Sushil Khane, Hemali Mane, Pravin, "Object Detection using Convolutional Neural Network within the Application of Supplementary Nutrition Value of Fruits," International Journal of Innovative Technology and Explore Engineering, vol. 8, pp. 2278-3075, Sep. 2019

Anita Chaudhari proposed in her paper object detection system where she using CNN application which takes an image of leafy foods organic products in an alternate class and provides nourishment esteem once you snap an image of your plate, the appliance uses the photographs to make the comparison. At that time gives you a stock of things that territory unit the premier doubtless nourishment. you'll not see one choice with everything on your plate. Instead, you'll see every known item listed separately. – for instance , all Oranges are round. Object class detection uses these features and attributes of each object. for instance , when watching orange, it states its features like shape, color, texture, etc.

D. Bojan Mrazovac "Performance evaluation of using Protocol Buffers within the Internet of Things communication Protobuf vs. JSON/BSON comparison with attention on transportation's IoT," International Conference on Smart Systems and Technologies, At Osijek, Croatia, October 2016.

Bojan Mrazovac implemented in his paper explains Initially, Protocol Buffers (Protobuf) has been developed by Google to unravel the difficulty of an outsized number of requests and responses to the index server. Preceding

convention cushions and there was a configuration for the solicitations and reactions that pre-owned-hand arshaling/unmarshalling of solicitations and reactions, which bolstered various convention adaptations which resulted during a rather inconvenient code. Since it's exploited by Google, it's assumed that it's stable and well tested. Likewise, it's both language and platform-independent. It supports Java, C++, Python, also as another programing language .

E. Suganthi, N., Rajathi, N., M, F.I.: Elephant intrusion detection and repulsive system. International Journal of Recent Technology and Engineering 7(4S), 307–310

(2018).

Suganthi and Sailesh both have described a system wont to detect intrusion by elephants to scale back agricultural losses. Suganthi has used multiple vibration sensors and supported the number of triggered sensors, a camera trap acquires a photograph, and Google Vision API is employed to detect if an elephant is accessible. Sailesh has used a camera instead that's connected to a Raspberry Pi device that continuously captures images and checks if the pictures contain an elephant. Both methods contain deterrence mechanisms, such as playing sounds and switching on some powerful lights to drive away from the approaching elephants.

F. Jaskó, G., Giosan, I., & Nedevschi, S. (2017, September). Animal detection from traffic scenarios supported monocular chromatic vision .In Intelligent Computer Communication and Processing (ICCP), 2017

Jaskó, G., has proposed a system capable of detecting different huge-sized wild animals fromtraffic scenes. Visual data was obtained from a camera with monocular color vision. The objective was to analyze the traffic scene image, to locate the regions of interest, and to correctly classify them for discovering the animals that were on the road and might cause an accident. A saliency map was generated from the traffic scene image using intensity, color, and orientation features. The salient regions of this map were assumed to be regions of interest. A database was compiled from a large number of images containing various four- legged wild animals. Relevant features were extracted from these and were utilized for training Support Vector Machine (SVM) classifiers.

G. Nguyen, H., Maclagan, S. J., Nguyen, T. D., Nguyen, T., Flemons, P., Andrews, K., ... & Phung, D. (2017, October).

Nguyen proposed and implement a Animal recognition and identification with deep convolutional neural networks CNN for automating the wildlife monitoring. He explains and investigated the main obstacle that has been disturbing to both the scientists and the ecologists to monitor wildlife in an open environment. Leveraging on recent advancements in deep learning approaches on computer vision, a framework was introduced to build automated animal recognition in the wild, The objective was to develop an automated wildlife monitoring system.

III. PROPOSED SYSTEM

3.1 ANIMAL DETECTION :

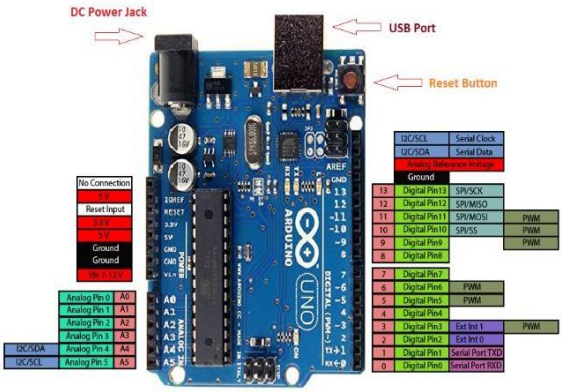
Object Detection may be a method commonly employed to automatically find objects of interest in respective images. It consists of two steps: the primary process involves finding portion(s) of the image that are of interest then classifying these locations into one among the known categories. a number of the foremost popular object detection models include Faster R-CNN (Region-Based Convolutional Neural Networks), YOLO (You Only Look Once), and SSD (Single Shot Detector). A key requirement of the intrusion detection system to figure accurately in real-time processing and image capturing; the thing detection network is required to be both fast and accurate. Faster RCNN isn't suitable for real-time processing , since it's relatively slow. A variation of YOLO – tiny-YOLO may be a lightweight object detection modelwhich will perform up to 155 fps on a GPU. Similarly, a mixture of the SSD detector with the MobileNetv2 backbone may be a lightweight network, optimized for embedded systems and mobile devices. during this paper, the performance of both thetiny-YOLO and therefore the MobileNetv2-SSD models are compared for real-time animal detection.

Since off-the-shelf pre-trained models don't perform well for specialised applications, both models are fine-tuned as per need for better performance. Fine-tuning refers to the method of altering the ultimate classifier layer of a trained neural network to predict a special number of classes and therefore the re-training of the model to update its weights to realize better performance for the new set of classes. Data used for fine-tuning the models. The MobileNetv2-SSD models is already trained on a datasets like MS COCO datasets and Open Images datasets respectively.

3.2 MICROCONTROLLER:

The microcontroller connects to the camera and receives raw image frames, which are processed using the trained object detection model loaded onto the device. This model is quantized for low inference time. Per the location , custom model deployment is additionally possible. As soon because it's activated,

the microprocessor registers with the central or edge server and sets up a channel for all future communication. When an animal is detected, an on-board Message is shipped through an SMTP Communication publisher (client) that dispatches a message to the server containing the sort of animal detected and time and image of animal corresponding portions of the image. the info sent also will contain the coordinates or the unique identifier which denotes the situation of the device thereby locating the location of animal intrusion on the highway.

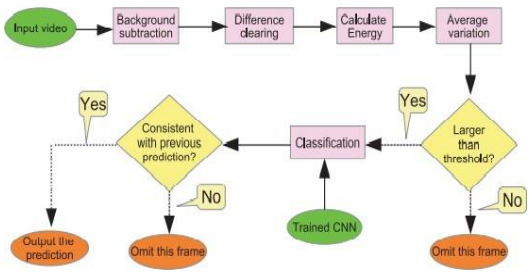


1. Fig : Arduino Uno (Micro-controller)

3.3 WORKING:

Using the CNN module, train the hidden nodes. The protobuf module saves the characteristics from each image within the XML file. Once the hidden nodes are trained, the model is ready for the identification of select wildlife animals. So when the Pi cam captures the image the TensorFlow module checks for the characteristics within the hidden nodes and therefore the animal is assessed . Once the classification of animal is done the name of the animal is send through SMTP protocol to the corresponding mail address given with an image of the detected animal.

The resulted image from the mobilenetSSD was classified as an animal then the process checks whether the detected animal is most dangerous or less dangerous. If most dangerous means the Arduino notify the user by display the light color as RED for danger and YELLOW for less danger.



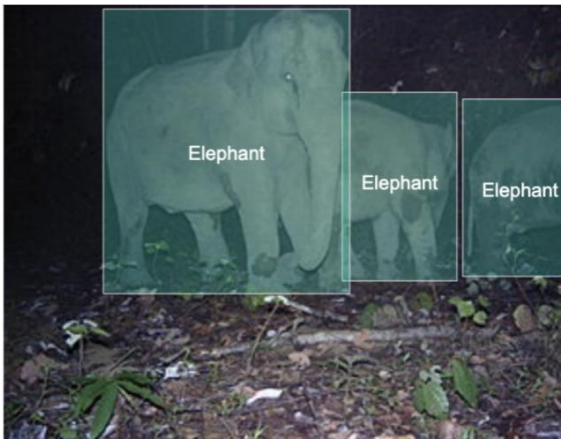


Fig : Resulted image From the Model.

IV. CONCLUSION

This application developed in this project proves that detection of animals done using the given training model gives us a decent measure of accuracy from the model MobilenetSSD proves that it can be able to obtain the best detection rate of 87.7% with a ratio of coaching to check data of 80:20 and 152,000 training iterations. A trained model can able to detect and identify the animal crosses in real-time. This application was able to help the farmers for identification of animal in their field and forest ranger for the animal intrusions in the highways & villages.

Future advancements may include SMS protocol and cloud-based applications which will make it accessible from any location and forest area. This model can be further trained thousands of animal images from most dangerous to least dangerous for better accuracy.

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