ENGINEERING IN ADVANCED RESEARCH SCIENCE AND TECHNOLOGY

ISSN 2350-0174
Vol.03, Issue.02
April-2023
Pages: 662-668

LIVESTOCK & WILDLIFE ANIMAL DETECTIONWITH MACHINE LEARNING

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Abstract **- Nowadays, Wildlife monitoring in a particular area using raspberry pi is the application of science and technology to monitor the wildlife enclosures in area and to maintain the security of animals. Recently many incidents that occur in zoo parks like animals escaping form cages and causing damage to other animals and humans, and also sometimes humans also fall into the enclosures of animals. Hence, designed a system that can monitor such conditions. This system is used for surveillance and security of animal to detect the intruder that entered the area of animals and also to detect if the animal escaped or missing from the enclosure. This system could also label what intruder has entered the enclosure using Machine Learning. The system consists of raspberry pi camera and SD card circuitry interfaced to a raspberry pi B+ board The raspberry pi camera takes the video of the cage and gives to the raspberry pi, then the obtained video streaming data is analyzed using open cv platform. In open cv platform the data is classified using Machine Learning algorithms. The data is analyzed to check whether any intruder entered the cage or if the animal escaped from the cage. If any of the conditions mentioned above occurs then the alerts are sent to the caretaker using IoT.**

Keywords – Raspberry pi 3 model B+, Web Camera, Smart phone Edge impluse studio, Raspberry pi Raspbian, Twilio, Terminal App.

I. INTRODUCTION

Wildlife monitoring plays a key role in a extensive range of medical activities and societal pursuits. Understanding animal conduct and activity patterns is useful for comparing biodiversity and modifications in habitats and land use, heading off dangerous human flora and fauna encounters and damaging habitat overlap, monitoring species health and populace dynamics, and presenting human beings with excessive effect educational stories. Advancements in technology innovations primarily focus on monitoring and controlling of different activities. There is increasingly a demand to reach the human needs. Most of this technology is mainly focused on efficient monitoring and controllingdifferent activities. An efficient surveillance system is required to monitor and maintain the security of wild animals in zoological parks, and for monitoring of their enclosures. Recently many incidents that occur in zoo parks like animals escaping form cages and causing damage to other animals and humans in the zoo, and also sometimes humans also fall into the enclosures of animals and put their life to threat.

A. Literature Survey

- In various fields, there is a necessity to detect the target object and also track them effectively while handling occlusions and other included complexities. Many researchers (Almeida and Guting 2004, Hsiao-Ping Tsai 2011, Nicolas Papadakis and Aure lie Bugeau 2010) attempted for various approaches in object tracking. The nature of the techniques largely depends on the application domain. Some of the research works which made the evolution to proposed work in the field of object tracking are depicted as follows.
- Object detection is an important task, yet challenging vision task. It is a critical part of many applications such as image search, image auto-annotation and scene understanding, object tracking. Moving object tracking of video image sequences was one of the most important subjects in computer vision. It had already been applied in many computer vision fields, such as smart video surveillance (Arun Hampapur 2005), artificial intelligence, military guidance, safety detection and robot navigation, medical and biological application
- The background subtraction method by Horprasert et al (1999), was able to cope with local illumination changes, such as shadows and highlights, even globe illumination changes. In this method, the background model was statistically modelled on each pixel. Computational colour mode, include the

brightness distortion and the chromaticity distortion

which was used to distinguish shading background from the ordinary background or moving foreground objects.

Template Matching is the technique of finding small parts of an image which match a template image. It slides the template from the top left to the bottom right of the image and compares for the best match with the template. The template dimension should be equal to the reference image or smaller than the reference image. It recognizes the segment with the highest correlation as the target. Given an image S and an image T, where the dimension of S was both larger than T, output whether S contains a subset image I where I and T are suitably similar in pattern and if such I exists, output the location of I in S as in Hager and Bellhumear (1998). Schweitzer et al (2011), derived an algorithm which used both upper and lowers bound to detect 'k' best matches. Euclidean distance and Walsh transform kernels are used to calculate m

Our proposed system is comprised of three main modules: Animal detection and identification (to detect the animal's presence and identify them), Alarm (to switch on the buzzer to keep the animal away from the field) and GSM module (to send alert messages to the authorized person). When an animal enters the field its presence is detected using the sensor. It starts calculating the distance and sends the signal to the camera to start capturing pictures. This picture is then compared with the pre stored dataset and the animal is identified. When the distance crosses the threshold value the buzzer is turned on and the alert message is sent to the authorized persons.

SqueezeNet is name of a DNN for computer vision. SqueezNet is developed by researchers at DeepScale, University of California, Berkeley, and Stanford University together. In SqueezeNet design, the authors goal is to create a smaller neural network with few parameters that can more easily fit into memory of computer and can more easily be transmitted over a computer .

Inception v3 is widely used as image recognition model that has showed to obtain accuracy of greater than 78.1% on the ImageNet dataset. The model is the culmination of many ideas developed by researchers over years. It is based on "Rethinking the Inception Architecture Computer Vision" by Szegedy. DenseNet stands for Densely Connected Convolutional Networks it is one of the latest neural networks for visual object recognition. It is similar to ResNet but has some fundamental differences.

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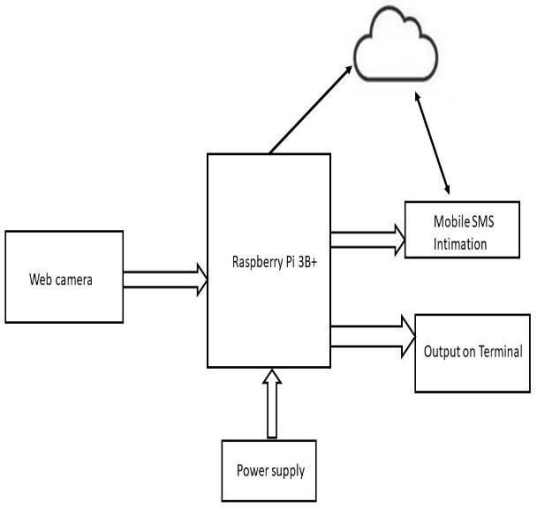

Fig: Block Diagram

C. System Design

- **Raspberry pi 3 model B+:** The Raspberry Pi 3 Model B+ is the latest product in the Raspberry Pi 3 range, boasting a 64-bit quad core processor running at 1.4GHz, dual-band 2.4GHz and 5GHz wireless LAN, Bluetooth 4.2/BLE, faster Ethernet, and PoE capability via a separate PoE HAT.
- **Webcam:** HD webcams, or webcams that are described in terms of 720p or 1080p resolution, have an aspect ratio of 16:9, which is a widescreen view. When it comes to a webcam that has a 'normal' (3:4, like the sensor in a DSLR camera) aspect ratio, you are more likely to see the resolution listed in terms of megapixels.
- **Edge impulse studio:** Edge Impulse provides the ultimate development experience for ML on embedded devices for sensors, audio, and computer vision, at scale. It enables the deployment of highly-optimized ML on hardware ranging from MCUs to CPUs and custom AI accelerators.
- **Raspberry pi Raspbian:** Raspberry Pi OS is highly optimized for the Raspberry Pi line of compact single-board computers with ARM CPUs. It runs on every Raspberry Pi except the Pico microcontroller.

- **Twilio:** Twilio is a cloud communications company which allows software developers to programmatically make and receive phone calls and send and receive text messages using its web service APIs. Twilio uses Amazon Web Services to host its communication infrastructure via APIs (Application Programming Interface) for SMS, MMS, and WhatsApp.
- **MobileNetv2 SSD:** we are using the MobileNetV2 SSD FPN-Lite 320x320 pre-trained model. The model has been trained on the COCO 2017 dataset with images scaled to 320x320 resolution.In the MobileNetV2 SSD FPN-Lite, we have a base network (MobileNetV2), a detection network (Single Shot Detector or SSD) and a feature extractor (FPN-Lite).
- **Terminal app:** Terminal App is a program that acts as a wrapper and allows us to enter commands that the computer processes. In plain English again, it's the "window" in which you enter the actual commands your computer will process.

2. IMPLEMENTATION

The proposed system for the "Livestock & wildlife animal detection with machine learning works as follows:

- Our project is used to detect animals with machine learning by using Twilio and MobileNetv2 SSD.
- A sample image we feed to the algorithm and expect our algorithm to detect and identify objects in the image and label them according to the class assigned to it.
- As expected our algorithm identifies the objects by its classes ans assigns each object by its tag and has dimensions on detected.
- ImageAI provides many more features useful for customization and production capable deployments for object detection tasks.

The main components used in this project

- Raspberry pi 3 model B+
- Webcam
- Smart Phone
- Edge Impulse studio
- Raspberry pi Raspbian
- Twilio
- MobileNetv2 SSD
- Terminal app

2.1 Raspberry Pi 3 model B+

The Raspberry Pi 3 Model B+ is the latest product in the Raspberry Pi 3 range, boasting a 64-bit quad core processor running at 1.4GHz, dual-band 2.4GHz and 5GHz wireless LAN, Bluetooth 4.2/BLE, faster Ethernet, and PoE capability via a separate PoE HAT.

2.2 Webcam

HD webcams, or webcams that are described in terms of 720p or 1080p resolution, have an aspect ratio of 16:9, which is a widescreen view. When it comes to a webcam that has a 'normal' (3:4, like the sensor in a DSLR camera) aspect ratio, you are more likely to see the resolution listed in terms of megapixels.

2.3 Smart Phone

The term smartphone refers to a handheld electronic device that provides a connection to a cellular network. Smartphones were introduced to the world in 1994 by IBM but have since expanded to include companies like Apple and Samsung.

2.4 Edge impulse studio

Edge Impulse provides the ultimate development experience for ML on embedded devices for sensors, audio, and computer vision, at scale. It enables the deployment of highly-optimized ML on hardware ranging from MCUs to CPUs and custom AI accelerators.

2.5 Raspberry pi Raspbian

Raspberry Pi OS is highly optimized for the Raspberry Pi line of compact single- board computers with ARM CPUs. It runs on every Raspberry Pi except the Pico microcontroller.

2.6 Twilio

Twilio is a cloud communications company which allows software developers to programmatically make and receive phone calls and send and receive text messages using its web service APIs. Twilio uses Amazon Web Services to host its communication infrastructure via APIs (Application Programming Interface) for SMS, MMS, and WhatsApp.

2.7 MobileNetv2 SSD

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2.8 Terminal app

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Fig : Implementation

3. Software Implementation

- Edge Impulse studio
- Raspberry pi Raspbian
- Twilio
- MobileNetv2 SSD
- Terminal App

3.1 Edge Impulse studio

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4. Advantages

- Deep leaning based Animal detection and alert system has been designed and demonstrated successfully. Thus, this project uses **MobileNet v2 SSD algorithm** to detect wild animals.
- These systems are specifi cally aimed at large animals (e.g., ungulates) that can cause human death, injury and property damage.
- Animal detection systems detect large animals before they enter the road and then warn drivers that a large animal is on or near the road at that time
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- Animal detection systems detect large animals before they enter the road and then warn drivers that a large animal is on or near the road at that time.

5. Conclusion

- By using this thesis and based on experimental results we are able to detect obeject more precisely and identify the objects individually with exact location of an obeject in the picture in x,y axis.This paper also provide experimental results on different methods for object detection and identification and compares each method for their efficiency.
- In this work, we tested the ability of state-of-the-art computer vision methods called DNNs to automatically extract information from images in the SS dataset, the largest existing labeled dataset of wild animals. We first showed that DNNs can perform well on the SS dataset, although performance is worse for rare classes.
- Perhaps most importantly, our results show that using deep-learning technology can save a tremendous amount of time for biology researchers and the human volunteers that help them by labeling images. In particular, for animal identification, our system can save 99.3% of the manual labor (>17,000 h) while performing at the same 96.6% accuracy level of human volunteers. This substantial amount of human labor can be redirected to other important scientific purposes and also makes knowledge extraction feasible for camera-trap projects that cannot recruit large armies of human volunteers. Automating data extraction can thus dramatically reduce the cost to gather valuable information from wild habitats and will thus likely enable, catalyze, and improve many future studies of animal behavior, ecosystem dynamics, and wildlife conservation.

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