Animal Identification Using Deep Learning on Raspberry Pi

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***Abstract*: The purpose of this project is to build a system that detects animals which trespasses into a farm or any household Here we will build a system that detects and classifies animals in real-time by implementing a Convolution Neural Network(CNN). A video fed to the raspberry pi, wherein we run a Python based program with some dependencies to identify the animal and classify it into categories. Here we will try to show how Deep learning concepts like CNN can be implemented in a low powered and relatively inexpensive device.**

***Keywords*: Deep learning, Raspberry pi.**

1. Introduction

Classifying animals plays a very distinguishing role in multiple professions and activities such as farmers, railway track monitoring, highway monitoring, etc. It is a very redundant task for a person to constantly monitor and classify an animal by spending hours. An image classifier/identifier comes in handy in such situations as it automates the process of identifying and classifying the animal. Here, we have trained the classifier with the concept of Convolution Neural Network (CNN) and have implemented on a raspberry pi 3. A raspberry pi is a series of sized single-board microprocessor which are very cheap. The raspberry pi is completely based on Linux, which supports Python and makes it relatively easier to implement deep learning concepts. It has very low computational power .so to compensate that we have used MobileNet and Single Shot Detector as the base network and the detection network. It makes up for the Low computational power by performing classification/identification with high speed but lacks in accuracy. For the purposes of the alerting the type of animal remotely we have also implemented an application program interface (API) that lets us alert the user of the identifier with the name of the animal identified. This feature is highly applicable in the field of farming, railway track, streets, houses, monitoring, different objects.

A. Problem formulation

Detection of animals plays a crucial role in some of the specific areas of profession like farming, highway monitoring, railway track monitoring etc. Some of the problems/issues in manual detection would be requiring a human to constantly monitor the area 24/7 which is not possible and would also be prone to constant human error.

An automated system is needed for this type of monitoring as it would ease the process and reduce the human effort. It would also improve the accuracy of detection and also making the system in real time would prove to be much useful and also a method of alerting the users remotely if anything is detected.

B. Problem identification

Raspberry pi plays an important role in the area of modern IOT systems. In order to be cost effective Raspberry pi 3 will be used. The system is designed so as to tackle the ongoing issues that the farmers face due to destruction of crops by animals, also issues created by animals in highway, railways tracks etc.

Most of the current systems have designed their identifier to take up a lot of cpu/gpu power. To avoid that scenario a base network and a detection network using MobileNet SSD is used. It uses low cpu/gpu power and has high speed.

C. Problem statement and objectives

Areas like farmers, railway monitoring, highway monitoring, National parks and reserved forests require a lot of surveillance on animals causing issues like crop destruction, road blockage the etc. Owing to above issues, this project work includes the following objectives are given: Detection and identification of animals. In order to implement single shot detector(SSD) framework for fast, efficient detection. To use CNN for classifying animals, and send alert messages.

2. Literature survey

yiting Li [1] proposed this paper aims to achieve real-time and accurate detection of surface defects by using a deep learning method. For this reason, the Single Shot MultiBox Detector (SSD) organize was received as the meta-structure and joined with the base convolution neural system (CNN) MobileNet into the MobileNet-SSD It basically utilizes a parallel camera, advanced camera, and charge-coupled gadget (CCD) camera to gather target pictures, extricate includes and

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set up relating scientific models, and to finish the MobileNet-SSD It, for the most part, utilizes a paired camera, computerized camera, a profundity camera, and charge-coupled gadget (CCD) camera to gather target pictures, remove includes and set up relating numerical models, and to finish the preparing of target acknowledgment, following, and estimation.

Debojit Biswasa [2] in his paper he explains Implementation of SSD used in this paper, the most monotonous job for any object detection algorithm is to create training data sets. We labeled approximate 500 objects over 450 images. All the label image creates a.xml file which contains the detail information (location, height, and width) about the label objects. Before presenting the labeled dataset to SSD, the mapping is created about the location of the datasets. SSD generated TensorFlow is the base model for MobileNet-SSD. The MobileNet architecture (stored as MobileNet.) used to cross-train the SSD's TensorFlow by the MobileNet architecture. The broadly educating process is additional tedious than a crisp preparation of SSD arrange. The newly generated TensorFlow is now used for object detection.

Shraddha More [4] proposed in her paper object detection system using cnn application that takes a picture of leafy foods organic products in an alternate class and gives nourishment esteem once you snap a picture of your plate, the application uses the pictures to form the comparison. It at that point gives you a stock of things that territory unit the premier without a doubt nourishment. You will not see one choice with everything on your plate. Instead, you will see every known item listed separately. – for example, all Oranges are round. Object class detection uses these features and attributes of every object. For example, when looking at orange, it states its features like shape, colour, texture, etc.

Bojan Mrazovac implemented [16] in his paper explains Initially, Protocol Buffers (Protobuf) have been developed by Google to solve the issue on a large number of requests and responses to the index server. Preceding convention cushions, there was a configuration for solicitations and reactions that pre-owned hand marshaling/unmarshalling of solicitations and reactions, and that bolstered various convention adaptations. This resulted in a rather inconvenient code. Since it is exploited by the Google, it is assumed that it is stable and well tested. Likewise, it is language and platform independent. It supports Java, C++, Python, as well as other programming language (through third party implementations).

3. Methodology

Step 1: Set up the environment for the Machine Learning model

Install OpenCV, Pandas, NumPy, Pillow, protobuf modules that will be used by the TensorFlow Object Detection API. TensorFlow is a free and open-source software library for dataflow in the machine learning module. OpenCV (Open source computer vision) is a library of programming functions mainly aimed at real-time computer vision. Mobilenet SSD is a

neural network architecture that we have used, it uses less memory and has high speed, but lacks in the accuracy. It is high speed because it only under goes forward pass.It provides high-level features for classification or detection

Step 2: Install protobuf, mobilenet SSD

The TensorFlow object detection API uses Protobuf, a package that implements Google's Protocol Buffer data format.The characteristics of the image are obtained and the protobuf module gets input and converts the data into XML file. So when the models are trained the hidden nodes search the characteristics from the saved XML file.

Step 3: Programming the model

We will be creating a python script that can be used to classify detected animal using OpenCv and a pre-trained model which includes MoblileNet using the single shot detector(ssd) framework.

Step 4: Sending the alert message

We will use sms4india API to send notification to mobile via the internet.

4. Working

Using the CNN module train, the hidden nodes. The protobuf module saves the characteristics from each image in the XML file. Once the hidden nodes are trained, the model is ready for the identification of animals. So when the Pi cam captures the image the TensorFlow module checks for the characteristics in the hidden nodes, and the animal is classified. Once the classification of animal is done the name of the animal is send through sms4india to the corresponding mobile number.
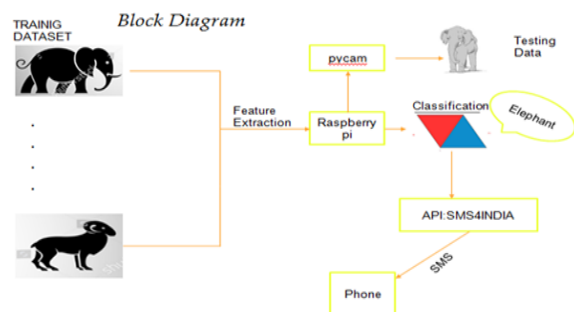

Fig. 1. The identification of animals based on the training dataset

5. Scope for future work

The project can also be useful in other cases like, for burglar alert and surveillance where the camera can be detect and identify any intruder. It can also be installed in highways to detect any animal crossing on the roads. One of the best use of object detection and identification is for autonomous driving car to decide what to do in the next step i.e to move forward or apply brakes or turn, it needs to know where all the objects are around the car. It can be extended for tracking cars or any vehicle at traffic signals. As the hardware requirement is cost-effective and the processing time is fast the model can be trained for number plate detection of vehicles.

6. Conclusion

The simulated output can predict and identify the object efficiently at any time and the algorithms can be used to implement Deep learning concepts like CNN in a low powered and relatively inexpensive device.

Acknowledgement

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