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Animal detection in farms using machine learning

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Abstract. Agriculture is extremely important to a country's development. Agricultural issues have consistently stymied the country's progress. Farmers face a slew of problems, including a lack of water for irrigation, crops withering due to climatic changes, nutrient-depleted soils, and crop damage from pests and wildlife. In recent decades, innovation has developed to provide effective solutions to a large number of these difficulties. In any event, agricultural protection from wild animals has not been fully addressed until now. The fields have been destroyed by elephants, monkeys, and wild boars. The production of crops is diminished when wild animals trample them or eat them. The presence of wild animals on farmland has always been a contentious issue for farmers. Deer, wild boar, moles, elephants, and monkeys are just some of the animals that might ruin a harvest. When the farmer isn't there, these animals may eat the crops and wander the field, which is bad for the harvest. Because of this, yields might drop significantly, and supplementary financial protection could be necessary to cope with the fallout. This problem has to be solved as soon as possible, and a workable solution needs to be found and put into action. Accordingly, the goal of our programme is to address this problem. Wireless sensors might be used to set off an alarm in the event of an animal intrusion, communicating the situation to the proprietor and forest authorities with an attached photo. This provides an early warning so that measures may be taken according to the intruder type.

Keywords: Machine Learning, Deep Learning, Image Processing, OpenCV.

1. Introduction

Agriculture is the primary sector of the Indian economy, yet crop loss caused by wild animals has recently become a significant social issue. There is currently no viable solution to this issue., which necessitates careful thought. Building wire fences and electric fences are two existing options that are ineffective. Electric fences have batteries that are charged by solar panels and shock animals that come into touch with them. If plants or shrubs grow too close to the barrier, they can catch fire. Electromagnetic interference occurs when the fence is not properly maintained, interfering with telephone and radio signals. Electric fencing, although being the most extensively used farm protection

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device, is dangerous to both animals and humans [1]. A thorn fence, which is also extensively utilized, has a similar effect to the previous strategy. This paper proposes a clever solution to this issue. When an animal intrudes, a picture is collected, and the image is then categorized as domestic or wild using a Convolution Neural Network and deep learning technique. This classification assists in informing the farmer through SMS in the event of a wild animal encroachment. Crops are secure and protected thanks to the smart farm protection system. There has been a rise in reports of dangerous wild animals venturing into human settlements, especially in areas close to forests. The expenditures associated with animal incursions, whether they be due to agricultural damage or attacks on livestock, may be quite high. One of the key causes leading to the growth in human animal disputes is the growing human population, which leads to decreasing forest cover. Erection of electric fences or posting of sentries to watch for animals overnight are two methods now available for settling such problems [2]. Technology advancements like computer vision are needed to solve the interconnected problems. The major goal of this study is to explore the development of a computer vision system that can recognize and track wild animals. The project's main purpose is to keep an eye on the farmingfield for wild animals and to protect them by pushing them away rather than killing them. The project also intends toprotect human lives from animal attacks. We're using an integrative Deep Learning methodology to create a checking and repelling architecture for crop insurance against monster attacks. First, automated systems were developed to eliminate the brutes by exploiting their weaknesses (such as controls and sensors). Camera's scheming with the boo pi module is a similar method. Images of wild animals are taken using a camera and transmitted to the Jeer pi module. When the boo pi captures a picture, it is compared to the images already in the database. If the wild animal is also spotted after comparing photos, the GSM module is commanded. The estate's owner was contacted using a GSM gunshot [3]. Connect boo pi to the speaker to hear the event unfold in audio form. Disadvantage There's also the fact that other forms of assault element aren't very effective, and their conservation is difficult. Recently, efforts have been made to find a solution to this issue by using AI. The World Congress of Hog Owners and Growers was one such notion that had been offered already (Weighted- circumstance of Histogram-Acquainted Slants). LI- BLINEAR (Library for large direct type) classifier is used in order to get better delicacy for high dimensional data. The trials were conducted on two standard datasets called Wild- Beast and Camara-Trap dataset. But it's a com- Megaplex process. This point vector is supplied to the classifier to descry the beast in a particular window. In sliding window fashion different sliding windows are used in order to identify brutes of different sizes predicated upon drone position of the camera. In the CoHOG (Co-occurrence of Histogram-Acquainted Slants) system, grade directions are used to calculate point vector and the magnitude is ignored (2). One another approach was by relating the sound of brutes and recovering it by concepts of signal processing and deep knowledge which involved more attack and as well as complex process depending on the database.

2. Related Work

Working together, we developed an Internet of Things (IoT) software to deter animals from damaging crops in the field. The authors coupled modern IoT gateways with wireless devices such as 6LoWPAN, WiFi to harvest or monitor data from the agricultural field [4]. The small solar and LiPo batteries were used to power an ultrasonic repellent that could function in low-light conditions. This gadget performs frequency transmission and networking by broadcasting a small frame across a distance of 50 metres; a PIR (Passive Infrared) sensor was employed to increase its efficiency. When an animal is identified, the device uses the RIOT-OS software to communicate by making a 120dB noise. Its effectiveness drops to below 90% after that. Produce from buffaloes, cows, goats, and birds, among others, were preserved in the field with the help of a PIC microcontroller [5]. The device employs a motion sensor to identify the presence of animals in a farming area, and then notifies the microcontroller so that the farmers may take the necessary precautions. The microcontroller sends signals to the PIR-based motion detector to identify the presence of animals, as well as the bell sounds to notify the farmers. Authors claim this method saves farmers from blocking off an entire field for an entire day. Deep deep learning and the Convolutional neural networks method [6] are employed by the author to safeguard crops against animal damage. The goal of the author is to protect crops from animals without endangering either animals or humans. Researchers developed a prototype to direct the animals toward the croplands. To use the neural

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network concept and computer vision method, a model is developed using a machine learning algorithm to identify animals entering the agricultural field. In this approach, we periodically deploy a camera to the field to check in on the crops' progress. The method uses a combination of libraries and neural network concepts to deduce the animal's motion from the camera frames. The present study was focused on a model to safeguard the crop from pests and rodents, and utilized Internet of Things (IoT) technology to regulate irrigation [7]. The right irrigation and crop protection are managed by an Arduino UNO microcontroller in the suggested design [8[. The level of moisture in a farm's soil is used to control when water syphons are activated. Intentional sensors installed in the agricultural field protect the crops from insects, animals, and other pests; the sensors measure the motion of insects and animals closer to the crop and give the signal to the Arduino Uno microcontroller for distance calculations and other activities [9]. The microcontroller permits high-frequency sound based on the estimated distance values [10]. The collaborated to create a prototype that uses two new technologies, IoT and machine learning, to monitor crops and alert wild animals [9]. PTZ (Pan- Tilt-Zoom) camera, GSM module, Sensors, and Arduino UNO microcontroller are among the IoT components used[11]. Machine learning algorithms for animal categorization include KNN (K-Nearest Neighbour) Algorithm, Logistic Regression, andSVM (Support Vector Machine) Algorithm [7]. Elephants, horses,Zebras, and other animals are represented in 605 photos [12][13]. For the iterated regularization parameter of C=100, SVM outperforms the KNN and Logistic Regression models withan accuracy of 89.6 [14][15]. Numerous of the above-mentioned state-of-the-art prototypeand classifier systems function on IoT and recognize animals using machine learning approaches [16]. This system, however, is still in its infancy for real-time use because it has yet to achieve the needed performance [17][18]. As a result, we offer a better model based on IoT and machine learning techniques for defending the farm field from intruders [19].

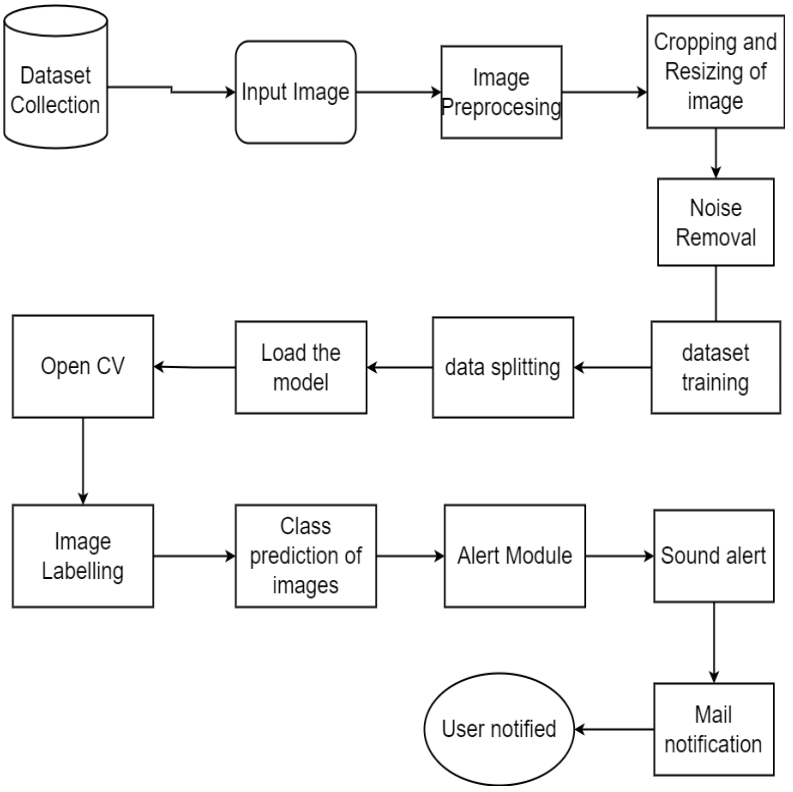

Figure 1. Proposed system Architecture

3. Proposed Framework

The object sensor will be fixed in the cropland that covers a specific area in our system architecture. The object sensor detects and transmits a signal to the Arduino microcontroller whenever any object enters

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the cropland. The user interface is then notified that an object has entered the farmland via this controller. We employed a MatLab software interface with a trained data set as the user interface. When we upload an input image, it goes through deep learning classification and is compared to the training data set. If it matches, the categorized result will be communicated to the microcontroller, which will issue a buzzer alarm, scaring the animals away from the farmland and reducing crop loss. If the classified image does not match the trained data set, it will deliver an unclassified result message and sound a buzzer to inform the user. Figure 1 depicts the proposed system architecture and Figure 2 depicts the working model flowchart.

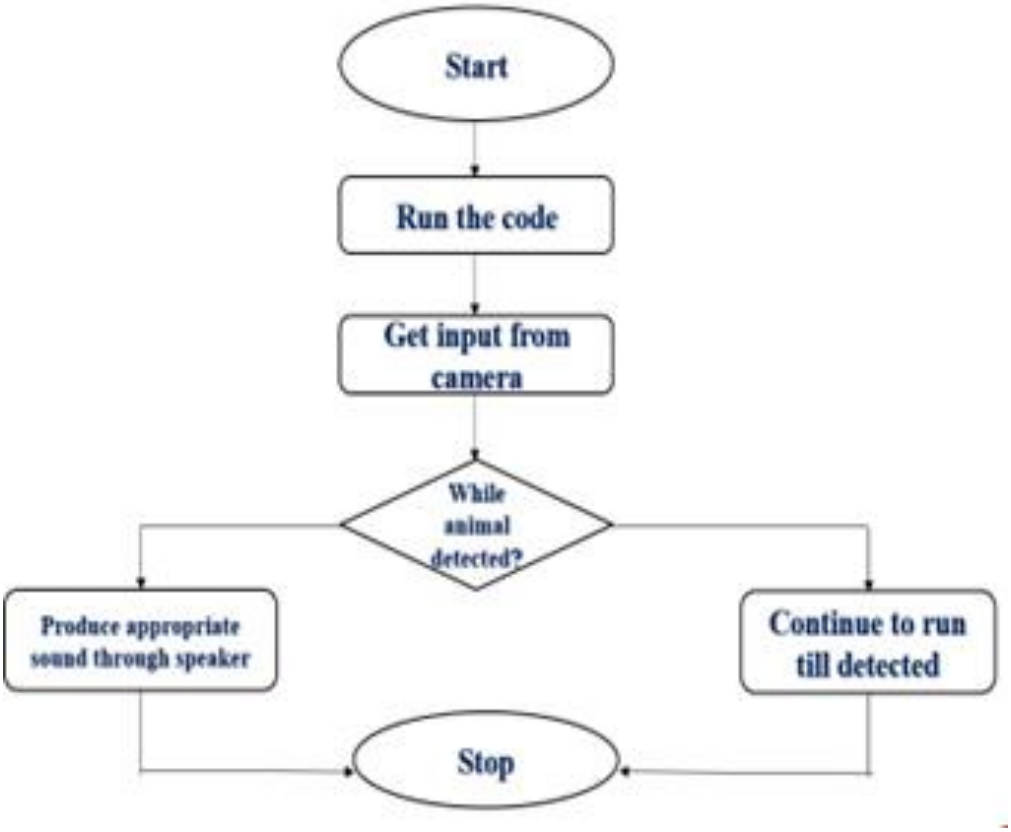

Figure 2. Flow chart of the working model

We'll need to collect some data in order to construct this system. Images of wild animals from eight distinct classes are included in our datasets. After gathering the data, it will be subjected to picture pre-processing, commonly known as annotation, before being transformed into a training dataset. The class file, photos, and txt files for those images are all included in this dataset, which is generated automatically following successful annotation. We can now begin to train our system, and we will do so using Google Colab. While the dataset is being trained, weights are generated that can be used for testing later. Although the training method can take 12-15 hours, testing can be done quickly with the help of those weights that have been trained.

4. Experimental Results

Python language is used for wild animal detection. this initiative has a huge social impact since it will assist farmers in safeguarding their farms, Protect them from significant financial losses and the wasteful operations that are required to sustain their fields. This could also help with preventing frequent human-animal confrontations and the loss of human life, as well as avoiding any substantial injury to people. Figure 3 represents the image classification like; cat or dog.

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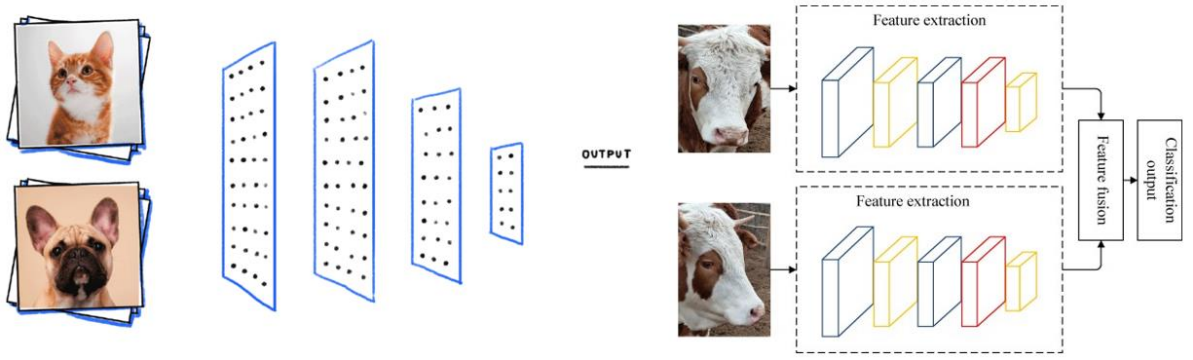

(a) (b)

Figure 3. Image Classified (a) as dog; (b) as cow

5. Conclusion

Farmers are facing a growing problem due to the destruction of their crops by wild animals. An timely response and a viable solution are essential to resolving this urgent problem. To address the issue facing the farmer, we employed IoT to develop a protective and proactive system capable of early detection. The primary objective is to lessen the number of human deaths and to protect agriculturally productive land from destructive wild animals. When animals are seen on the forest's edge, it's best to take precautions as soon as possible. Therefore, our scientific method will aid farmers in protecting their farms, saving them money and relieving them of the effort and time needed to defend their lands. Future improvements in sensor efficiency will allow us to spread our wings to a broad variety of locations. The proposed system would only provide service to a small area around a few villages that are located close to a forest. It is possible that the range of uses will grow as more efficient sensors are included in the future. In light of the persistence of the aforementioned problems regardless of intervention, we resolved the issue by using computer vision to mechanically scare away the animals. CCTV footage is used as an input in the model we propose (Closed Circuit Television). The system analyses and anticipates the images from the camera, then plays a repellent sound to frighten away the detected animal. This programme has far-reaching societal effects since it helps farmers prevent agricultural failures, saves them money, and frees them from time-consuming and inefficient maintenance tasks. The frequent encounters between humans and animals, the resulting human loss of life, and the severe harm that often follows may all be reduced with this measure.

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