Crop Protection from Animals Using Deep Learning

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Abstract: - Crop damage caused by animal's attacks is one of the major threats in reducing the crop yield. Due to the expansion of cultivated land into previous wildlife habitat, crop raiding is becoming one of the most conflicts antagonizing human-wildlife relationships. Farmers in India face serious threats from pests, natural calamities and damage by animals resulting in lower yields. Traditional methods followed by farmers are not that effective and it is not feasible to keep an eye on crops and prevent wild animals. Since safety of both human and animal is equally important. It is important to protect the crops from damage caused by animal as well as divert the animal without any harm. In order to overcome above problems and to reach our aim, we use machine to detect animals, entering into our farm by using neural network concept, a division in computer vision. In this project, we will monitor entire farm at regular intervals through a camera which will be recording. With the help of deep learning model, we detect the entry of animals and we play appropriate sounds to drive the animal away. In our project, we use various libraries and concepts of convolutional neural networks used to create the model.

Key Words: — ***Crop protection, CNN, Wild animal attacks, Deep learning.***

I. INTRODUCTION

In agriculture one of the major social Problems that is existing in the present is the damaging of the crops by the wild animals. Some of the animals in South India that act as a threat to crops are deer, monkey, elephant and others. This problem must be attended immediately and an effective solution must be created and accomplished. Thus, this project aims to address this problem.

We approached this problem using deep learning it focuses on the important point about scale, that as we construct larger neural networks and train them with more and more data, their performance continuous to increase. Deep learning excels on problem domains where the inputs (and even output) are analog. Meaning, they are not a few quantities in a tabular format but instead are images of pixel data, documents of text data or files of audio data.

The dataset used as input for this project is image dataset. We have three classes namely elephant, cow and monkey as we take this animal as threat to farms in South India. The input to the model is received from the camera which records 24/7 and received video is converted to image for further processing with the training dataset.

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To build a model, we use Convolutional Neural Network technique. CNN are powerful image processing as we takes an image as an input. A filter is applied to the image in ConvNet.

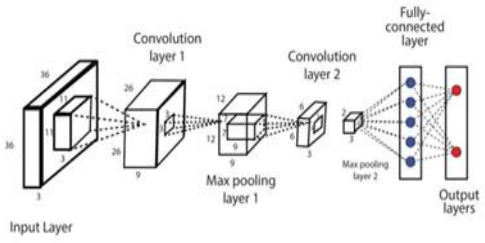

Fig.1. Convolutional Neural Network

II. ARCHITECTURE

CNN have the neurons arranged more like those of frontal lobe, the area responsible for processing visual stimuli in humans and other animals. The layer of neurons are arranged in such a way as to cover the entire visual field avoiding the piecemeal image processing problem of Traditional Neural Network [1,2,3].

A CNN uses a system much like a multilayer perceptron that has been designed for reduced processing requirements. The layers of a CNN consist of an input layer, an output layer and

a hidden layer that includes multiple convolutional layers, pooling layers, full connected layers and normalization layers. The removal of limitation and increase in efficiency for image processing results in a system that is far more effective, simpler to trains limited for image processing and natural language processing.

III. RELATED WORK

Manual way such as constructing different kinds of fences and using natural repellents are effective but they are not cost efficient. It is also not possible to increase the man power. So, initially projects were taken upto drive away the animals automatically by using hardware components like controllers and sensors.

One such approaches camera interfaced to the *Raspberry pi module*. Camera is used to capture an image of wild animal and send captured image to the Raspberry pi module. When image can take by the Raspberry pi and compared with database image. After comparing, if the wild animal is detected then it gives commands to GSM module. GSM used to send message to the owner of the farm.

Disadvantage: The problem here is there is more of hardware components which is not cost efficient and its maintenance is also hard.

Fig.2. Raspberry pi

Another approach is based on *Arduino Uno* based system using microcontroller [4]. This system uses a motion sensor to detect wild animals approaching near the field. In such a case the sensor signals the microcontroller to take action. The microcontroller now sounds an alarm to drive away animals from the field as well as sms send to the farmer so that the farmer may know about the issue.

Fig.3. Arduino

In recent times, researches are taken to solve this problem using *Artificial Intelligence.* One of the already proposed idea was WCoHOG. WCoHOG is a Histogram oriented gradients-based feature vector. LIBLINEAR[5] classifier is used in order to get better accuracy for high dimensional data. The feature vector supplied to the classifier to detect the animal in a particular window. In the CoHOG method gradient directions are used to calculate feature vector. But this is a complex process.

Fig.4. Pic microcontroller

It is another way of approaching microcontroller based on pic family of microcontroller. This approach uses a motion sensor to detect wild animals which is near to the field. In that cases the sensor signals the microcontroller will take actions. The microcontroller will produce a sound to drive away the animals from the fields. It also sends sms to the field owner regarding the issue of the animal so that if the animal does not turn away for sound which is produced in microcontroller the farmer can handle it. This makes sure that crop are protected from animals and prevents farmer's loss.

IV. PROPOSED SYSTEM

Our idea is to implement crop protection from animals using Convolutional Neural Network[6,7].We are using packages like Keras and Playsound in order to access libraries like Sequential, Dense, ConV2D, MaxPooling2D,Flatten, Image Data Generator. After importing the above mentioned

libraries, convolutional process will take place, followed by this process max pooling and flattening process occur. Then the output of these layers will act as an input for our Artificial Neural Network model, after compiling these process Image Data Generator is used to train and test the model. Then the model is saved. On the other side, we will get a continuously running video from our monitoring system and then the video is converted into separate frames. These frames are compared with our testing data if they both has some resemble features then it will produce the sound.

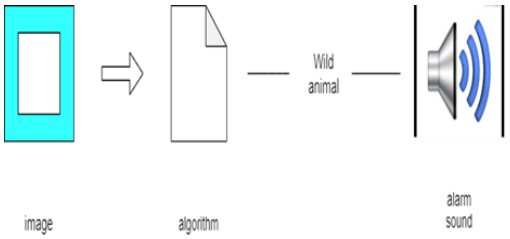

Fig.5. Flowchart of proposed system

Once the frame matches with our data then it will identify what animal it is and will produces an appropriate sound to drive that animal away from the field. If the frame does not match with the data then it will continues to run without any alarm sound until the animal is detected. This ensures complete safety of crops from animals thus protecting the farmer's loss.

V. BLOCK DIAGRAM

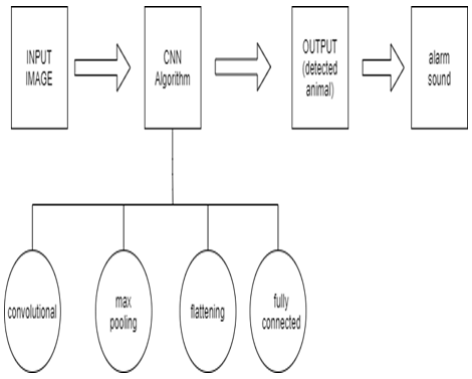

Fig. 6. Block Diagram

Conv2D: It is a convolution layer. Which defines input shape and activation function.

Max pooling: Extracts the max value in pooling defining size of the pool.

Dense: This layer consists of maximum neurons compared to other layers.

Compile: It is used to define loss function and optimizer.

Image Generator: It is used to pre-process the images.

Classes: The labels are deduced for each set of images.

A. *Convolutional Layer*

Convolution conserves the association between pixels by learning image features by means of small squares of input image data. In this mathematical operation, two inputs search as image matrix and a filter is used. Convolutional [8,9,10] of an image data with various filters can do operations like an edge detection, blur and sharpening of images.

B. *Pooling*

Pooling layer would lessen the number of parameters when a large image is given as input. Max pooling [11,12] is done by taking the largest element from the revised feature map. The objective of max pooling to down sample an input image, reducing its dimensions etc.

C. *Flattening*

Flattening[13,14] is the procedure for converting the two dimensional array set into a single, long continuous linear vector, It receives the output from the convolutional layers, flattens its structure to create a single long feature vector to be use the next layer for the final classification.

D. *Fully Connected*

The hidden layers inside a Convolutional Neural Network that are called as Fully Connected Layer [15]. These are a specific type of hidden layer which must be used within the CNN. This is used to combine the feature into more attributes that predict the outputs more accurately.

VI. MERITS AND FEATURES

This Project is very effective and it has following merits and features:

A. *Effective, Accurate and Adaptive*

It is very effective in driving off the animals from the fields and keeping them away from the crops. It accurately determines the presence of the animals in the fields and plays an appropriate sounds. It only plays a sound when animals enter the fields. It does not sound due to some random motion. This is very effective against animals and cause no noise pollution.

B. *Requires no human supervision*

This project require no human supervision except for the task of switching the computer on and off. It plays a sound

automatically whenever it detects the animals and driving of the animals thus protecting the crops from any damage.

C. Economical

It is much cost efficient compared to many of the existing system is like electric sense and manual supervision of the fields. It saves lot of money of the farmer.

D. Causes No Harm to Animal and Human

It is totally harmless and doesn't injure animals and humans in any way. Also the system has a very low power requirement does reducing hazards of electric shocks.

VII. Application

This project will help farmers in protecting their or –chards and fields and save them from significant financial losses and will save them from the unproductive efforts that they endure for the production of the fields. This will also help them in achieving better crop yields thus leading to their economic wellbeing.

VIII. Future Scope

We our using an integrative approach in the field of deep learning to overcome this. The goal of this work is to provide a repelling and monitoring system for crop protection against animal attacks. In our future work, we will extend the current functionalities of a model like increasing the dataset so as to achieve high accuracy and investigate the chance of incorporating the future of the model to other sectors.

IX. Conclusion

It can be concluded that we can recognize and reverse the animals before they enter the field by playing various repelling sounds. By doing so, we reduce the crop loss and man power. This project is very useful and affordable to the farmer. The module will not be dangerous to animal and human being, and it protects farm. Thus this project carries a great social relevance as it will help farmers in protecting their fields and save them from significant financial losses and will save them from the unproductive efforts that they endure for the protection of their fields.

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