CROP PROTECTION FROM ANIMALS USING CONVOLUTION NEURAL NETWORK

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Abstract

Crop damage due to animal intrusion is a critical problem faced by farmers in many parts of India, especially in areas near national parks and wildlife sanctuaries. It is not possible to manually monitor agriculture lands 24x7. They can damage the plants by feeding on plant parts or simply by running over the field and trampling over the crops. Therefore, wild animals may easily cause significant yield losses and provoke additional financial problems. Our aim for the project is to make use of TensorFlow and Keras libraries from python and use deep learning applications on the image classification to identify which bird is destroying your crops. Currently, most farmers use fire fences or electric fences to prevent animals from entering the farmland. Electric fences hurt animals by inflicting shock and are possible fire hazard so it is helpful to agriculture fields. We use CNN for this purpose.

Key-Words: CNN, Deep Learning, Machine Learning, image classification and crop protection.

INTRODUCTION

Machine learning is the application of artificial intelligence that provides systems the ability to automatically learn and improve from its own experience without being explicitly programmed.

In India the main source of income is mostly from crops. Good income can be earned from the crops if they are healthy. As the global population is growing continuously a large increase of food production must be required. Along with this the natural ecosystem must be protected by sustainable farming procedures. Food needs to contain a high nutritional value and its security must be guaranteed around the world. Crop damage by animal intrusion is one of the major threats in reducing crop yield. The farm areas near the forest boundaries are apparently affected by the wild animal attacks. Agriculture plays a major role in the development of the country. Issues concerning framework have been continually baffling the advancement of the nation. Farmers face a huge number of issues, insufficiency of water for irrigation, crops withering because of climatic changes, soils lacking in nutrients and harm to crops because of pests and wildlife. The productivity is decreased by the wild creatures trampling over harvests and eating them. In such scenarios we require smart vision which could efficiently predict and notify the farmer at earliest. Further a visual system is used to solve this problem by predicting the animal before it enters the field. This whole new part of the visual system comes under the concept of Deep learning in artificial intelligence.

Deep learning is used to make a computer think or process the data using the images. In general, we can also say that deep learning consists of “neurons” and are interconnected with each other as in the human brain and process the information. It is mostly used for classifying the objects that means it can predict if a thing belongs to a particular class.

Classification of the intruded animals as local or wild animals is done using the photos taken utilizing Convolutional Neural Network. CNN a special architecture of artificial neural networks model is mainly used for classification of images. Convolutional neural Network takes image as an input. Accordingly, a filter is applied to the image in ConvNet. This filter

consists of weights when multiplied with pixel values in image to reduce the features, the clarity of original image is reduced. The output of ConvNet is a feature map which is input to max pooling. In max pooling the shape of the object in the image is preserved. After classification is done accordingly sounds are used to ward off the creature and an SMS is sent to account of the wild creature to the land owner. Data regarding these intrusions of wild and domestic creatures are sent to the cloud by means of the web. This way it is easy to arrive at useful information regarding the intrusions and take measures against it.

This project provides a solution without hurting creatures or setting human life at stake. Hence, this approach is helpful to the farmers in protecting fields, saving them from financial losses.

LITERATURESURVEY

[1] Yang et.al , proposed Convolutional Super-Resolution Layers grouped together various Super Resolution algorithms into four groups: edge-based methods, example-based methods, prediction model and image statistical methods. The state-of-the-art performance is achieved in Convolutional Neural Network as CNN has been adopted for super-resolution recently, and attempted to use convolutional neural networks for image super-resolution.

[2] Cheng et al, proposed the system uses discriminative features for classifying the bird species based on parts of birds that uses a support vector machine along with Normal Bayes classifier. Fine-Grained Image Categorization – Technique for discriminating fine-grained classes which can be divided into two very important maingroups useful for future work as well.

[3]Peng et al. proposed the method of transforming the detailed texture of information in High-resolution images to Low-resolution images with the help of fine-tuning for boosting the accuracy of recognizing fine-grained objects in Low-resolution images. This technique has certain limitations such as it requires the High-resolution images for the training of a model which limits their generalized implementation. [4] Marini et al proposed an approach to eliminate background elements using a colors segmentation and compute normalized color histograms to extract feature vectors for classification. Fine-Grained Image Categorization – Technique for discriminating fine-grained classes which can be divided into two main groups. [5] In 2018 yamanaka et al , made a tensor flow implementation of last and accurate image super resolution by CNN with skip connection and network in network a deep learning based single image super resolution model. [6] In June 2018, A Kamilaris conducted a survey of research efforts that employ CNN Convolution Neural Network, which constitutes a specific class of Deep learning, which is applied to various agricultural and food production challenges. CNN are compared with other existing techniques considering its advantages and disadvantages and the overall findings indicates that CNN constitutes a promising technique with high performance in terms of precision and classification accuracy, outperforming existing commonly used image processing techniques. Given that the success of each CNN model is also highly dependent on the quality of data used. [7] In July 2019, Mohamed Elsayed Abd Elaziz presented a new multi-objective metaheuristic based on a multi-verse optimization algorithm on segment grayscale images via multi-level thresholding.The result showed that the presented method provides better approximation to the optimal than the other algorithms in terms of hypervolume and spacing plus the quality of the segmented image is better than those of the other methods in terms of uniformity measures. [8] Yu Han Lieu, 2018 , Presented a thorough recognition process of CNN with its local connection and weight sharing characteristics, CNN Manages to scan the images and extract objects' features with much lower compute cost. He also states the forth coming challenges is to provide stable calculating environment and increase the computing speed with help of hardware and software. CNN gives and Excellent performance on image Recognition [9] In July 2017, Neha Sharma, vibhor Jain, presented an empirical analysis of the performance of popular CNN for identifying images. Upon taking various types of Datasets for image classification to test the performance of CNN as a single type of dataset does not reveal the true capability and limitations.Upon only testing the images and not training they found that CNN's vary substantially across different categories of images provided and also outperforming in the analysis.[10] Victoria Y

Yoon evaluated some of the most used activation function and how they impact the time to train a CNN model and the performance of the model.The result showed that the Rectified Linear unit activation function trains the CNN model quicker than any other activation function.Based on the Evaluation performed if every decimal digit of the achieved accuracy is important and there is sufficient time, Leaky Relu is Recommende.

DATASET COLLECTION

In this project, the dataset used is downloaded from some datasets available on kaggle and some parts of it was collected manually as well. The dataset consists of total 1595 images of five different species, i.e. owl, hens, dove, parrot, humming bird. This dataset contains two folders test set and trainset. Out of which 80% of images for training and 20% of images for testing were used. The training set is the material through which the computer learns how to process information. Training data set is used for learning and to fit the parameters of the classifier. Test set is a set of unseen data used only to assess the performance of a fully specified classifier. We used 1265 images for training and 330 images for testing.

PROCESS FLOW

Pre-processing:

Real-world data is often incomplete, inconsistent, and/or lacking in certain behaviours or trends, and is likely to contain many errors. Data pre-processing is a proven method of resolving such issues. There are certain steps executed to convert the data into a small clean data set and make it feasible for analysis, this part of the process is called data pre-processing. When it comes to Machine Learning, Artificial Neural Networks perform really well. Artificial Neural Networks are used in various classification tasks like image, audio, words. Different types of Neural Networks are used for different purposes, for example for predicting the sequence of words we use Recurrent Neural Networks more precisely an LSTM, similarly for image classification we use Convolution Neural Network. To achieve our goal, we have used one of the famous machine learning algorithms out there which is used for Image Classification i.e.,**Convolutional Neural Network (or CNN).** As we know it is a machine learning algorithm for machines to understand the features of the image with foresight and remember the features to guess whether the name of the new image fed to the machine. At first, we created our very own dataset which includes the images of 5 different bird species i.e. hens, hummingbirds, owls, doves and parrots. Now after getting the data set, we pre-process the data a bit and provide labels to each of the images provided.

Libraries used:

Data Generator- The ImageDataGenerator is an easy way to load and augment images in batches for image classification tasks.

TensorFlow – To add layers as well as compare the loss and adam curve our result data or obtained log.

Layers used to build

ConvNets: A covnets is a sequence of layers, and every layer transforms one volume to another through differentiable functions.

Types of layers:

1. Input Layer: This layer was used to hold the raw input of the image. 2. Convolution Layer: This layer computes the output volume by computing dot products between layers are max pooling and average pooling. 3.Dense layer - It is the regular deeply connected neural network layer.

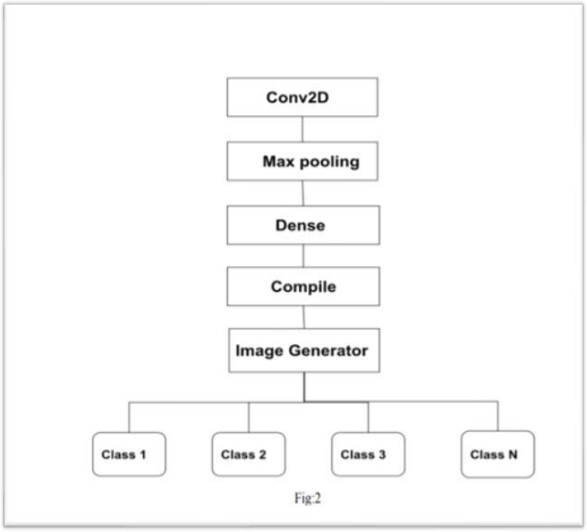

Fig1: Layers used in the model

We developed this crop protection from animals by using the Python language which is an interpreted and high-level programming language and using the Machine Learning algorithms. For coding we used the Jupyter

Notebook environment of the Anaconda distributions and the Spyder, it is an integrated scientific programming in the python language. For animal prediction we used the Flask. It is a micro web framework written in Python. It is classified as a micro framework because it does not require particular tools or libraries. It has no database abstraction layer, form validation, or any other components where pre-existing third-party libraries provide common functions, and a scripting language to create a web page is HTML by creating the templates to use in the functions of the Flask and HTML.

Our main goal was to develop an Image classifier using convolutional neural networks. The proposed system will monitor the entire crop at regular intervals through a camera which will be recording the surroundings throughout the day. Once the frame matches our data then it will send information to the farmer and will produce an appropriate sound or alarm to the person who hands over that. This ensures complete safety of crops from wildlife animals thus protecting the crops loss. Hence CNN is used to train the animal images. To achieve our goal, we have used one of the famous machine learning algorithms out there which is used for Image Classification i.e., Convolutional Neural Network (or CNN). As we know it's a machinelearning algorithm for machines to understand the features of the image with foresight and remember the features to guess whether the name of the new image fed to the machine. At first, we created our very own dataset which includes the images of 5 different bird species i.e. hens, hummingbirds, owls, doves and parrots. Now after getting the data set, we pre-process the data a bit and provide labels to each of the images provided.

We trained and tested our algorithms on the complete data set to start with. Later we randomly separated the data set into training data and test data so that we had samples from each class.80% of data is used for training data and 20% is used for test data. The dataset consists of 1595 pictures of these birds, and was used as a development set for CNN. The model was able to classify more than 90% of the images. The testing accuracy of the system is about 97%. Depending on the classification, the message and details will be sent over to produce sound or alarm to the person who hands over that department. Thus, safeguarding the crops.

The following figures and tables show the results we observed:

Fig2: Prediction of the bird responsible

Fig3: Mail acknowledgement

CONCLUSION

This project is exceptionally viable in driving off the animals from the fields and keeps them away. Once the intrusion had been detected using camera, the camera was triggered to capture an image. The harvests are harmed through 5 bird species. Hence, the dataset which consisted of 1595 pictures of these birds, was used as a development set for CNN. The CNN was tested with various test images including images taken by mobile cameras. CNN was able to classify more than 90% of the birds perfectly well. An alert gets sent to the farmers as soon as there's a bird in the picture. The farmer can then raise alarms and prevent his crops from any damage.

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