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CROP PROTECTION AGAINST BIRDS USING DEEP LEARNING AND IOT

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Abstract*: Air as an empty space is in many ways a commercial use. These make it free for all animals to use. But sometimes these terms are used by a handful of birds to hurt farmers, so work in this area to save crops. Visual and spatial perception is one of the most important applications of computer vision. This is a comparison of deep learning in the state. Bird detection is an important issue for many applications such as aviation safety, bird protection and the ecological science of migratory birds. In this study, a system has been developed to detect birds in high-definition video. Requirements to consider are Convolutional Neural Networks (CNN), background visualization, contour detection and classification confusion matrix. Findings include, but are not limited to, the following, using PCA in deep features not only reduces size and thus reduces training/testing time, but also improves recognition accuracy, especially when using neural network classifiers. Keywords: authentication, identification, image detection, biometrics, image recognition.*

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1. INTRODUCTION

1.1 Bird detection

Bird detection is an important issue in a variety of applications, such as aviation safety, the ecological science of birds and migratory birds. Due to the increasing number of flying vehicles, bird detection plays an important role in protection from all kinds of dangers and threats. Thousands of bird strikes are reported each year, many of which result in takeoffs, engine stalls, and other negative consequences. According to the International Civil Aviation Organization (ICAO),there were more than 25,000 bird strikes reported by civil aviation between 1988 and 1992. Bird shooting is also a big problem for soldiers. In 2006, the US Air Force reported more than 5,000 bird strikes.

2. THE LITERATURE SURVEY

One of the newest technologies is computerized automatic bird detection. According to Dominique Chatbot, bird studies are organized using aerial photographs and video rather than audiences. Even a short examination of the image takes a long time. Thanks to advances in digital cameras and image recognition systems, it is now possible to perform computer assisted bird detection in the highest quality images. The visuals of the research methods were given and the data collected on this subject were evaluated.

Birds focusing on a gray background are often affected by this perception, which requires a large visual field.

Some of the methods used to measure prey can be used for birds, but low resolution bird detection using thermal infrared imaging is generally somewhat used for large mammals. With continued advances in camera and drone technology, birdwatchers can reduce the time and resources spent watching birds by using automatic bird trackers.

In other methods, according to Jeongjin Jo, the problem of collision between airplane and bird has been studied in different ways. Deep learning techniques are currently used in image recognition research.

This article describes how to process images and capture birds in multiple dynamic environments using a convolutional neural network (CNN). Dynamic background is removed from body movement by prioritization and disease movement is isolated from it. The learning model was created based on the input data of the bird images in the background before processing. The authors hope to improve the accuracy of small objects using the Inception-v3 neural network model, history subtraction is a method for moving objects for viewing.

Picardie examines and categorizes various ways to perform extraction based on speed, need and accuracy. Among the methods, a combination of Gaussian (MOG) and Kernel Density Estimation (KDE) works better.

Model precision. Due to KDE's memory requirements, MOG is suitable for low memory devices. An improved background subtraction, which is a better model for both simple static and complex dynamic scenes.

To identify background birds, true bird detection based on background subtraction is recommended. They capture the motion of the Gaussian Mixture Model (GMM). As mentioned earlier, MOG-based background subtraction is often used for motion detection. However, it shows some shortcomings when applied to dynamic backgrounds. Therefore, it has been proposed to use deep learning for bird detection for classification.

Various object detection methods have been used to identify objects in video frames. This technique combats high computational costs, as CNNs typically have hundreds of thousands of potential candidates. Therefore, the Region-Based Convolutional Neural Network (R-CNN) has been proposed. To reduce computational cost, a selective search is used to extract recommendations that should include the product. However, the computational cost is still high because the CNN is executed approximately 2000 times for each region separately.

Therefore, Fast R-CNN and Faster R-CNN are recommended for better detection. Product search performance. One of them is Google's Inception V3, a feature extraction module. Inception V3 achieves high performance by using 1×1 convolutions to reduce mapping and processing. Another is the machine learning-built NASNet.

NASNet reduces the search space by searching the entire network location and interconnecting the units to complete the network. Along with these attempts to reduce the computational cost, lower cost object detection methods have since been proposed. YOLO and SSD can directly guess the class list using only one pipeline. In terms of accuracy, SSD shows up more clearly than YOLO because of its multi-layer configuration and similar strategy. The concept of ResNets and MobileNets has the same purpose, which is to reduce the computational cost.

ResNets provide the best performance in many applications through cross-linking, where the output of one layer is added directly to the output of some subsequent layers. MobileNets embed convolutional neural networks into mobile and visual applications at low cost. Based on distributed network architecture, MobileNets creates light and deep neural networks. Many studies use classification for bird studies. These two studies use background subtraction and deep learning to search for birds similar to ours.

On the other hand, they differ in the way they reduce the negative. To reduce false detection, analysis of beautiful images is used to filter out pre-candidates and different tools use convolutional neural networks (CNN), fully convolutional networks (FCNS) and super resolution depending on size. article. Both of these articles use background inference before deep learning. However, in the history of agriculture, the results of the extraction date are murkier, due to the strong attack on non-avian crops such as leaves and grass.

3. METHODOLOGY.

3.1 Basic Working

Working of Bird Detection System:

Take the video input from the embedded camera in the field. Convert the video footage in the frames. Apply Image Processing and enhance the picture quality. The image pre-processing involves background subtraction phases:

Background Subtraction

The background subtraction is done with the help of calculating the Foreground mask. The foreground mask is calculated according to the [56], and the background subtraction between the current moving frame and the input frame is performed.

Background subtraction involves 4 essential steps:

Pre-processing, background modelling, detection of foreground, and data validation process.

pre-processing is process where the video frame raw data from the input video arrangement can be willing for the next stage.

The background modelling consists of the regular frame where the touching object is eliminated by revising the new video frames and calculating the background model with statistical illustration. Data validation investigates the mask and eliminates the unneeded pixels from moving objects and supplies the foreground mask output.

We prefer the MOG2 method because of its soft memory consumption and soft complexity rate. For the MOG2 the background is considered as a parametric frame and each pixel is represented as the particular number for Gaussian function. The equation is given as :

$$P(X_t) = \sum_{i=1}^{k} \omega_{i,t} \,.\eta(X_t, \mu_{i,t}\,, \sigma i, t)$$

Where

$X_t = Observations$
$\eta = i^{th}\ Gaussian\ Component$
$\omega_{i,t} = Data(Weights)\ associated\ by\ i^{th}\ component\ with\ time\ t$
$\mu = Mean\ intensity$
$\sigma i, t = Standard\ deviation$
$t = \text{time}$

Classification with Confusion Matrix

The error Matrix is another name for the Confusion Matrix used to determine the performance of the classifiers for binary classification tasks. The confusion matrix is a square matrix that is situated with columns and rows which store a record of the actual values and predicted values. The prediction error, accuracy, precision, and recall are calculated which helps to improve the prediction power of our model.

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$

$$Error = \frac{TP + TN}{TP + TN + FP + FN}$$

$$Precision = \frac{TP + TN}{TP + TN + FP + FN}$$

$$Recall = \frac{TP + TN}{TP + TN + FP + FN}$$

Confusion Matrix

	Manual data(y-true)		
Predicted data (y- pred)	-	Detected	Not detected
	Detected	True Positive	False Positive
	Not Detected	False Negative	True Negative

Table 3.1.1: Confusion matrix

Fig 3.1.1: Bird farm

Fig 3.1.2: Open sky

Fig 3.1.3 Open sky with zoomed image

Evaluation Criteria	Description
Size	The main criteria for the evaluations of the birds are the size of the bird. As we have seen many of the times that the small birds are less harmful to the environment but these scenarios changes many times so we will be adding more criteria to.
Body Color	Body Color of the bird plays the vital role in the detection of the birds. This helps in the detection of harmful species because they share a similar color pattern in the body.
Flying skills	It will be able to detect the bird by the flying skills because few species differ from their flying skills.
Flock of birds	Many birds which are sometimes not harmful do cause destruction because of their flock.

Table 3.1.1 Evaluation criteria

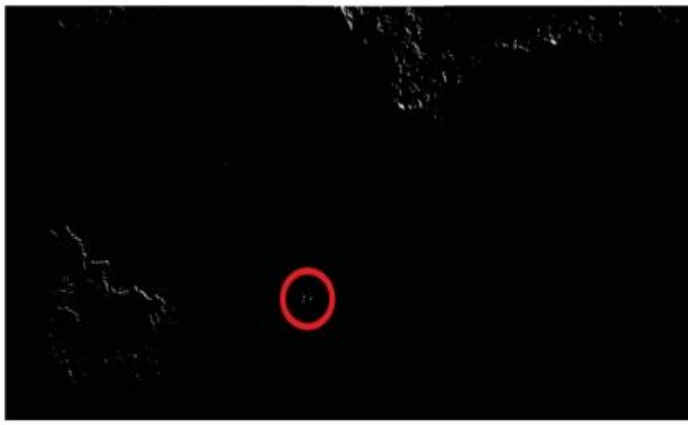

Fig 3.1.4: After performing image detection

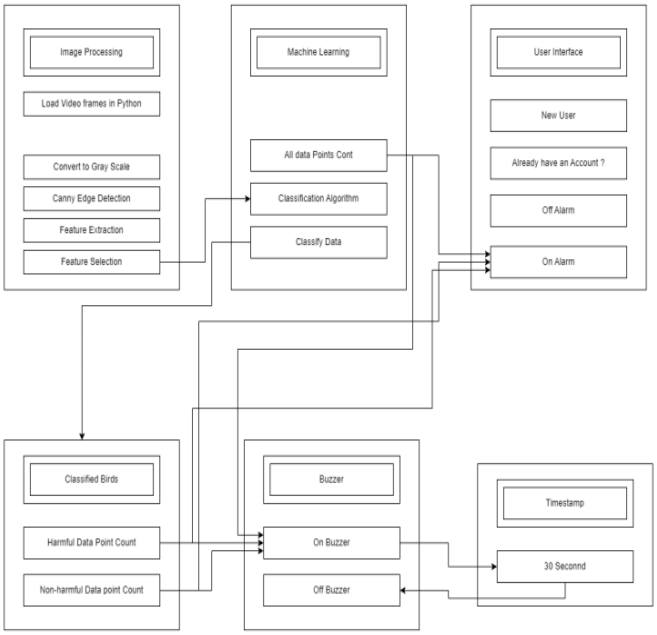

Fig 3.1.5: Flow Diagram Of System

When using the Box method, thinning pictures are split into equal numbers of boxes. The distance from the box's left corner may be used to compare any two input photos, and the orientation can be utilised as a feature in each box. The average distances between squares are then saved as a feature vector. It is possible to compare two feature vectors by calculating their Euclidean distance from each other.

There are two kinds of impersonators: those who are real and those who aren't. As can be seen in Figure 5, the system's histogram and associated graphics illustrate the findings.

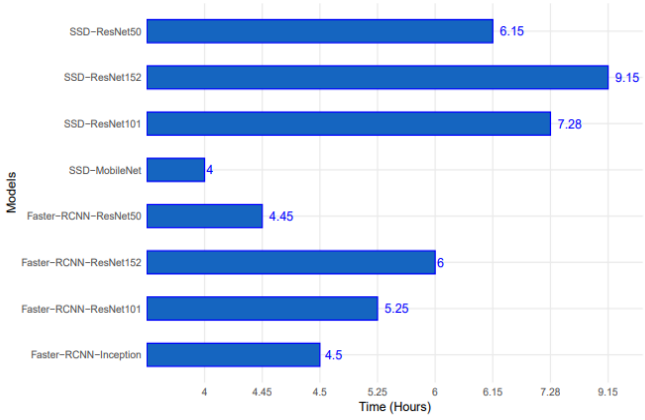

Figure 3.1.6 : Time Taken to train different model

4. Algorithm Development

4.1 SVM

A Support Vector Machine is a machine learning algorithm that can be used for the following purposes:

• Natural Language Processing

• Classification

As mentioned earlier, it attempts to use super-segmentation for label vector planes. . class. Finding the true hyperplane is finding the saddle point of the Lagrangian function. It is equivalent to a bivariate quadratic program.

DVM is supposed to solve the following optimization problem. This is a tracking algorithm, so a training dataset must be used to train a classifier that needs to be tested using a test dataset. The

SVM uses a custom kernel function to create a hyperplane for classification. These kernels are the basis for finding the true hyperplane among many possible hyperplanes split into a vector. The 4 basic kernels are as follows:

• Linear Kernel

• Polynomial Kernel

• Radial Basis Function Kernel

• Sigmoid Kernel

One of these kernel functions is used to create a separate object as the subject requires.

These kernels have the following advantages:

• Kernel function type

• Kernel function parameter values

• Edit parameter values

These values must be calculated carefully regardless of the kernel selected, because the effects are kernel. classifier and accuracy. Any errors or miscalculations in these results may affect the results and the final result.

4.2 LIBSVM

LIBSVM is a library for support vector machines. This pack has been produced since 2000.

This package is designed to easily use SVMs in their applications. This library is used in machine learning as well as in many fields. Used for the following purposes

• Support Vector Classification

• Support Vector Regression

• Single Class Support Vector Machines

LIBSVM implementation has two steps: first, training data is used to obtain the model, and second. , the model is used to predict data. For SVC and SVR, LIBSVM can also give the estimated result. The structure of the LIBSVM package is as follows.

• Home directory: core C/C++ programs and sample files. In particular, the svm.cpp file uses the training and testing algorithms detailed in this document.

• Tools subdirectory: This subdirectory contains tools for checking input data and selecting SVM parameters.

• Other subdirectories contain prebuilt binaries and interfaces for other languages/software.

CNN

A Convolutional Neural Network or CNN is a deep learning neural network designed to process data sequences such as portraits. CNNs are very interesting at extracting patterns like lines, gradients, circles, and even eyes and faces from their input images. This technology makes neural networks very powerful for computer vision. CNNs can be run directly on unprocessed images without preprocessing. Convolutional Neural Network is a type of less than 20 feedforward neural network.

The power of convolutional neural networks comes from a special type of layer called the convolutional layer. A CNN has many layers stacked on top of each other, each capable of recognizing more images. Alphabets can be recognized using three or four layers and faces can be recognized using 25 layers. The reaction process is to make machines see the world like humans, see the world the same way, and even use the information for various tasks such as image and video recognition, image analysis and classification, media entertainment, recognition, natural language processing. And more.

Convolutional Neural Network Design:

The construction of a convolutional neural network is a multi-layered feed-forward neural network, made by assembling many unseen layers on top of each other in a particular order. It is the sequential design that give permission to CNN to learn hierarchical attributes. In CNN, some of them followed by grouping layers and hidden layers are typically convolutional layers followed by activation layers.

The pre-processing needed in a ConvNet is kindred to that of the related pattern of neurons in the human brain and was motivated by the organization of the Visual Cortex.

Quality assessment of images of the palm vein:

If the palm vein picture supplied by the user does not satisfy the identification criteria, the quality evaluation of the image may be utilized to determine if hardware acquisition performance is adequate. It's still difficult to make an accurate assessment of the quality of a palm vein picture.

5. IMPLEMENTATION

5.1 Input

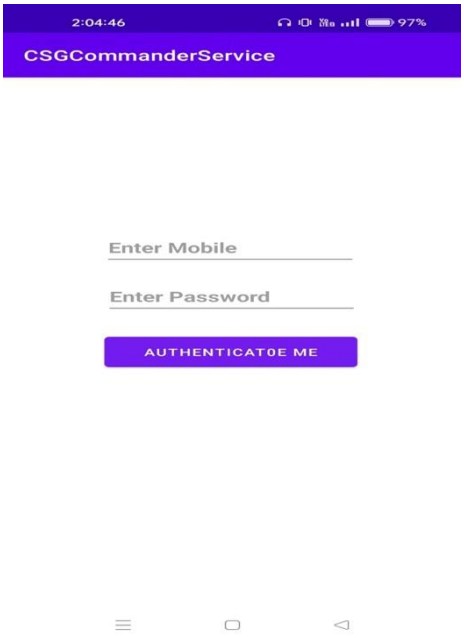

Fig : 5.1.1 GUI

Launch the program using the app, navigate to the start button, and launch the program file for video bird identification. The program began to function, and using the video input, it recognized the birds and produced the proper output for the farmer and system keeps on working until turned off.

5.2 Video Detection

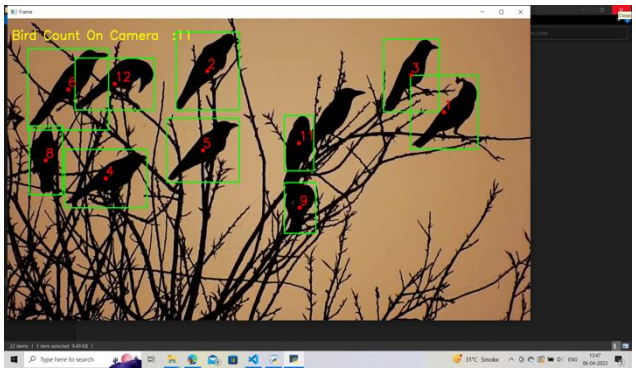

Fig : 5.2 Bird detection

Choose the video for analysis and detection of birds. Play the video, and then you can see how many birds and varieties of bird are in your field or video. Two different category of birds are recognised simultaneously. The UI created for detections of birds and species works in the background and gives output on screen. It provides the count and start the buzzer when we have reached the count.

5.3 Video Report

As a video is played, birds are picked up, and we created a visual interface to show the birds and species. There are many categories of birds seen in the representation.

Fig : 5.3 GUI with numbers

6. RESULTS:

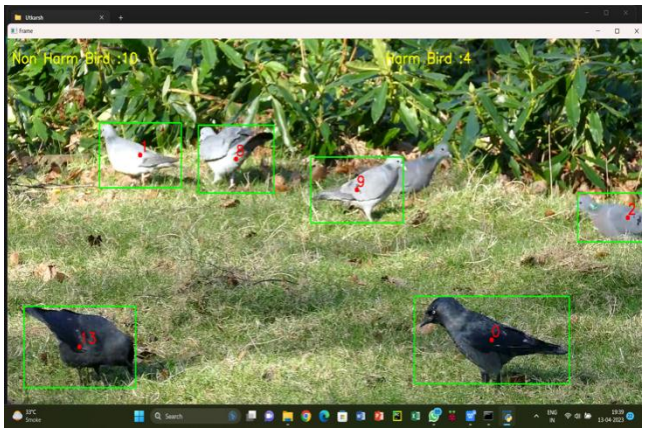

Fig : 6.1 Output of detection

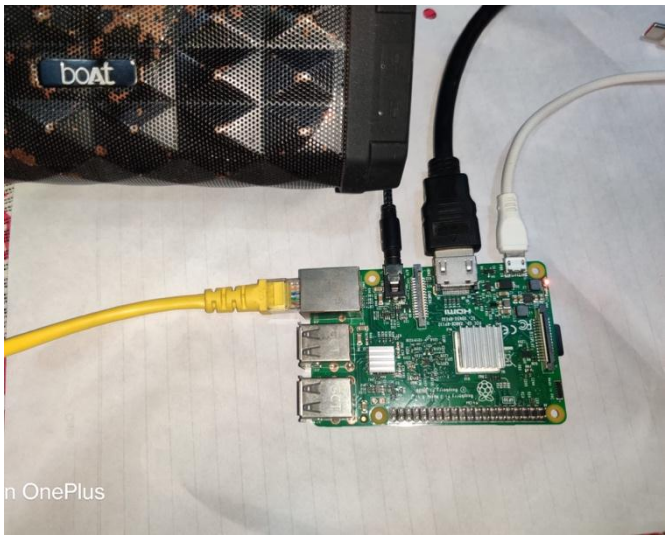

Fig: 6.2: Base Model of detection

Here, we present the result of our project where we can have a look at the classification of the birds is in 2 types harmful as well as non-harmful. In the above image one can see that crow (the bird which is black colour and having a long beak) is categorized in to the harmful bird category and pigeon (the bird having a grey colour and small beak) is categorized in non-harmful bird category.

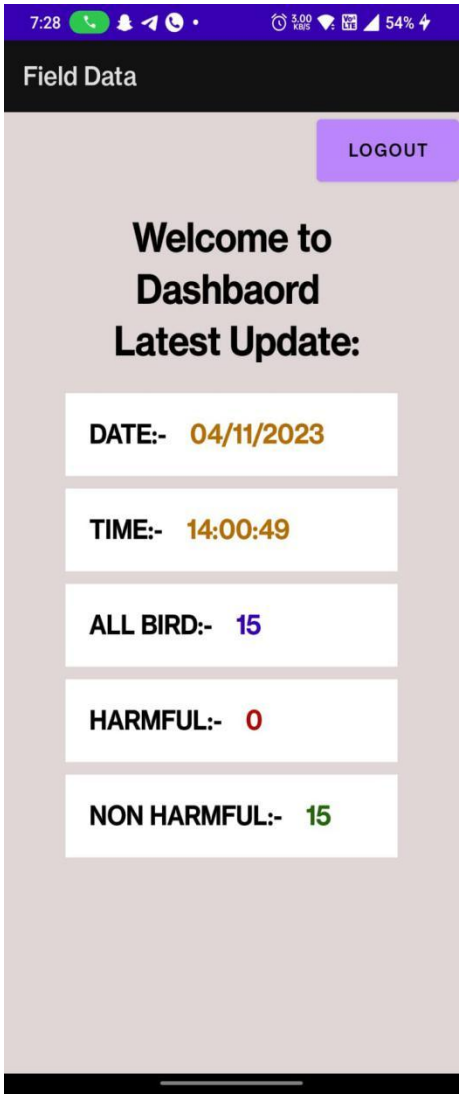

Fig: 6.3: Output of UI

In this image we can have a look at our dash board where the count as well as bifurcation is given between harmful and non harmful birds.

7. Conclusion:

Pollination, known to play an important part in guarding against pests and rodents, can damage crops and lead to crop decline, according to the report" A common problem in Indian husbandry." Development of Farmer Income (DFI), Inter-ministerial Report- Risk Management in Agriculture Volume 10, published by the Ministry of Agriculture, shows that catcalls beget agrarian damage by damaging seeds, seeds and growth crops, causing profitable losses to the husbandry community. In numerous agro-ecological zones of the nation, catcalls are known to seriously harm a range of crops during times of weakness. raspberry damage to the crop restroom depends on numerous factors, similar as original raspberry visibility, overall crop area, planting patterns in the area, season and physical strength of catcalls.

" Software that can identify and classify catcalls and other objects is needed in the advanced world." Saving crops and fields from colourful raspberry attacks will help us achieve lesser growth in husbandry. We strive to produce a further cost-effective and effective way for growers to cover their fields. The software helps to identify objects moving in the air near cropland, land and can descry objects veritably directly. In this design, we use background deduction and figure discovery to descry objects in videotape frames. This fashion is used to identify moving objects.

8. Future scope

Our project can be improvised by integrating it with more high resolution cameras and the data of more species of birds as well as extinct species. On further scale one can add a robots linked to our system as a future project. This Future projects can be done using artificial intelligence and machine learning.

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