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Animal Classification implemented in Farm fields using CNN

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Abstract

The day-to-day lives of people depend on the food consumed. Even though food is required regularly, people don't often think of the struggle the farmers face in delivering the food to the market. There are much more criteria to be considered when it comes to the problems affecting the farmers and the fields. One of the most important criteria is the protection of farm fields. Animal intruding the field leads to crop damage, and of course some severe problems that affect the regular profit. Farm fields near mountain slopes are often intruded by wild elephants and wild pigs, that destroy most of the crops and pull down the profit as well as the investment. There are several old methods to protect the field like thorn fences, but those aren't quite beneficial.

The other problem is the classification of animal entering the field. The security features can be adapted only based on the animal that is entering. If the animal intruder is anonymous, preventive measures cannot be immediately taken. The proposed model uses a setup like fence, where cameras are mounted to capture animal movements using OpenCV python. Once any movement is detected, an alert sound goes on, so that people could be aware that some intrusion has occurred. Using image processing by CNN, classification of animal is done by training and testing the dataset. Precautions along with messages to people who could provide help can be implemented as an additional feature to this proposed work. This structure is considered beneficial to be implemented in military bases to capture movements and alert the soldiers.

Keywords: OpenCV, Grayscale reading, image processing, CNN, ANN, Alert signals, datasets, movement capturing

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1. Introduction

Every sort of land deals with lot of external problems as of now. One among them is animal entering the farm field, garden, restricted zones etc. This intrusion cannot be prevented by warning signs or threatening the animals. Hence many traditional ways have been implemented till date are of different impressions. Fence made of thorns and sticks surround most of the fields. There is a barrier to pass through. Even after preventing the animal intruders, it is still not possible to identify the animal during night. The aftermath is quite awful. The crops that are destroyed take-up most of the investment. Profit would be damaged leading to increased loss. There are several existing solutions that are of high maintenance, and with complex structure. A structure that is simple and can yield a better accuracy to prevent animal intrusion with classifying the animal type will boost the customization and profit. The proposed system handles animal intrusion by capturing the animal intrusion using motion detection algorithm with background subtraction implemented in python. Computer vision accesses the cameras to switch on and off whenever necessary. Two different frames are opted to capture still and moving screens. Grayscale reading is fetched to patch up with nighttime, that acts as an eye to the fence. The animal classification is implemented using Convolutional Neural Networks. The images of the animals are processed and tested with datasets to identify the similarities for easier classification. PyCharm IDE and Jupyter Notebook are the workstations for the outcome. Once a movement of animal is captured, the alert buzzer breaks out, so that the people in the surroundings could know that there is an intrusion. Immediate precautions could be taken depending upon the animal that is approaching. Messages can be passed to people who could actually help by means of simple python program as a future additional precautionary consideration. The modules involved in the proposed solution are as follows:

- Animal movement capturing and monitoring using cameras with AI and ML processing.
- If animal motion is detected, the data given by cameras trigger an alert sound to warn people about the intrusion. The rectangular range of the movement can assist the contours and threshold.
- The screenshots of animals are picturized for later analysis. The images are processed to identify the type of animal encroaching. Once the animal that periodically crashes the fence is determined, the precautions can be taken accordingly.

- The nighttime reading of animal movement is identified using gray scale reading and frame differentiation.
- The image classification of animals is scrutinized by Convolutional Neural Networks with CIFAR-10 dataset.

2. Related Works

Movement detection and image classification were implemented as separate modules under distinctive ideologies in the related works. The complexity increases with the increase in feature specifications and complex algorithms.

Shubham M, et al., [1] opted movement processing of objects using OpenCV python along with background subtraction. The system was implemented to act as surveillance cameras monitoring objects during particular crucial occurrences. The paper's major objective was to enable the detection of objects passing via a simple camera attached to a general-purpose computer, as well as to monitor the duration of which the object was present on the camera screening.

- The considerable factor that distinguishes the existing system with the proposed system is the fact that the object motion was captured in the existing system whereas animal movements are considered in the proposed system. The surveillance criteria are the same. But the region of implementation varies along with additional features for precautions since theft requires precautions that lead to capturing the thief. In terms of agricultural field, animal intruder need not be trapped instead had to be threatened.
- False alarms will cause discomfort towards the product when the precautions are quite specific like jurisdiction involvement.

Abhijit R, et al., [2] integrated the app with Django for classifying wild animals using machine learning techniques. Convolutional Neural Networks were considered for training and testing the dataset to provide better accuracy. Light Weight machine convolutional neural networks was preferred while working with CNN. TensorFlow package helped with animal classification in an effective way with Keras. Long short-term memory was implemented to cover multiple layer filtering to get perfect accuracy. The solution was proposed to classify

the species that are not seen quite often or to identify the species with their correct species names.

The variation the system projects when compared to the proposed system is that,

- This system covered large area of structure that leads to additional different features which tend to make the system a little complex to work with.
- The system classified the wild animals with exact names and not closely related to the proposed system that classify the farm trespassing wild animals.
- The algorithm included CNN with LSTM integrated in Django. The proposed system covers CNN with image processing and not the additional features, since approximate classification is enough to fetch precautions to threaten the intruder.

Akshaya B, et al., [3] used CIFAR -10 dataset to train and test with sample images to classify the animals randomly. The model was proposed to deliver the process of image classification using CNN and CIFAR -10 dataset. The method demonstrated a novel class detection model for photos and a better, more accurate classification method. Additionally, if a new class was required, it can be added to the model to ensure that the future classifications are accurate. By examining the trend of the class labels' SoftMax prediction score, new class was found. The system performs only the training and testing of samples to check with test results. The region of coverage is technical working of machine learning with deep learning. The region of exposure of the proposed system is the fence subjected to protect the field, with classification to picturize the animal with names.

- The CIFAR – 10 dataset training is quite similar to the proposed system, but the proposed system is integrated with the movement detection module to variate the animal whose movement is captured.

Abhineeth S, et al., [4] used deep learning methods from the disciplines of object detection, tracking, segmentation, and edge detection to address the issue of animal encroachment into human inhabited surroundings. To get the animal’s images, ImageNet dataset was imprinted. Labelling, segmentation and object detection were implemented using RCNN architecture. Evaluation of their generalizability in situations where the training and test settings differ was one of the study's main objectives. It has been demonstrated that none of the detectors can generalize effectively enough to produce deployable models, with missed detections on previously undiscovered backgrounds being the primary problem. It was

determined that synthetic data generation, which extracts animals from pictures of natural environments and places them in target settings, was an efficient technique.

- This system deals with accurate prediction of animals that enter the habitat and not the alert processing or precautions. The system was so complex but the prediction accuracy was about 97% which tends to be very effective.

- Multiple choices for choosing datasets and improving accuracy without missing out a picturization of intruder was provided by this system. This could be more adaptable on urban areas since not much of occurrences happen very often. However, the proposed system covers rural areas with simple yet cost efficient structure without complex features.

Ahmad PI, et al., [5] dealt with handling hand gestures and to detect the gestures using OpenCV and theories of Region of Interest. The hand gestures were obtained as threshold and gray scale readings so that if the gesture is handed, the system will fetch what the gesture is trying to expose. By putting the theories of hand segmentation and the hand detection system, which use the Haar-cascade classifier, into practice, this system worked with the hand gesture recognition using Python and OpenCV. The system had two modules: To capture the hand movement using OpenCV and python, and to create numbers and sign languages using the given hand gestures.

- The posture capturing of the system is done depending upon the hand input of a single person. But when replaced by other hands, the prediction may go wrong for trial and errors.

- The system deals with hand gesture and movement prediction. The proposed system handles animal movement prediction with python. The grayscale reading outlooks are the same. But works with different conventions.

Prabhat KP, et al., [6] presented a system that monitors the field to assist in the detection of wild animal invasions on agricultural farms using the Internet of Things (IoT). At the field's corners, ultrasonic sensors were used to detect intrusions. A camera mounted on an electric vehicle equipped with a Node MCU microcontroller subsequently photographs the intruder to help with field surveillance. The farmer receives a warning via an IoT application. With regard to the intruder's photographs that were captured and the notification alert, the

performance of the system was examined. The ultrasonic sensors captured the animal movement. When animals break the ultrasonic sensor waves, the alert buzzer goes on.

- The system works with IoT hardware, such that cost of construction could be an expense that would be huge to meet. The range of the sensors are within the limit. To cover up an acre of land, many sensor implementations might be required. The maintenance factor could increase the burden on expenses. However, the accuracy of the proposed system relies upon the camera. Hence. one time investment will reduce the investment on maintenance.

Prajna P et al., [7] designed the device to watch the field for issues with animal encroachment. Accordingly, it first used sensors to detect animal encroachment surrounding the field, after which a camera captured the intruder's image and identified them using image processing, before taking appropriate action based on the sort of invader. Finally, a GSM notification was sent to the owner of the farm and the forest officials. The system used PIR sensor to capture animal movement in the surroundings. Programs like IndexImage, ImageSet, RetrieveImage were implied to provide the image processing output of the intruded animal.

- The PIR sensor on field or fence covers of a minimum limit. The requirement of PIR sensor to capture the complete fence might cost as of a bigger amount of expenditure. The trial and errors might also increase.

Paramasivam K et al., [8] proposed a system that captured the animal movements and produced alert signs to take precautions rapidly rather than torturing the animals. A method based on deep Convolution Neural Networks (CNN) was developed to identify animals in both video and still photos. A classification model based on several features and classifiers was the suggested method. From the segmented animal photos, different features including color, Gabor, and LBP were retrieved. It has also been investigated whether it is possible to combine the traits to enhance classification performance. Animal classification is carried out using CNN and symbolic classifiers. In the study, successful attempts to construct an animal picture dataset and an animal video dataset were also made in order to validate the performance of the suggested algorithmic models and also since a big bench marking related dataset is not yet available. The suggested deep learning-based animal classification model was constructed and experimentally tested using the dataset in terms of accuracy, precision, and processing time.

- The system complexity increases as the algorithms complexity increases. The system used combinational methods to get improved accuracy. However, the proposed system doesn't focus on maximum accuracy. A closer prediction to animal intruder is far enough to take adequate precautions.

Shivam S et al., [9] presented a system about capturing the movement of people using motion detection algorithm implemented with frame differentiation using OpenCV framework. It worked based on two frames. One frame captured the pictures with still scene without moving objects also referred as background. In order to distinguish the areas of motion, often known as the foreground, each frame of the series was compared to this background. The distinction between relevant and irrelevant motion was greatly influenced by the threshold value. By keeping the threshold setting high, the system was able to ignore a variety of unimportant moving things, such as tree leaves. However, the algorithm was unable to detect an eyeblink if the threshold value was set too high.

- The above-mentioned system was implemented to variate the background and foreground images. The proposed system works with capturing the motion of animal using the above-mentioned algorithm with additional features.

3. Proposed Work

The proposed work commences with fence surrounding the farm field mounted with cameras. When animal movement is detected, the alert buzzer gets triggered. Alert triggered would pull off people's attention towards the targeted field. The images of the animal encroaching are captured and classification of the animal is preferred to avoid unnecessary preventive measures. The approached animal once classified can be made to run away with accurate disturbing noises or other valid sources that threatens the animal to enter the field. In addition to these features, sending messages to offices or to people who could help as a precautionary activity could protect most of the land with less damage. The countermeasures to avoid animal encroachment include kolhapuri chappal sound spoilage, and certain odors that the animal can't bear. These methods could be implemented along with alert buzzer sound so that preventing measures can also assist along with the proposed solution. The additional features are on choice to add up depending upon the user requirements.

The technical part of the proposed system involves movement capturing using OpenCV and frame differentiation implemented in python. OpenCV helps in controlling the

cameras. Using motion detection algorithm with background subtraction method, it is possible to variate the still and moving points. The threshold and grayscale readings are adjusted to capture the outlines of the moving object to trigger the alarm. The screenshots of the animal approaching are gathered. Those are fed as input into the dataset. The dataset is trained and tested to compare with sample results to get the type of animal that approached, so that precautionary modules could be held on ready when it approaches the very next time. The alert sound can be imported into the python program itself. Along with the alert sound if triggering noises like kolhapuri chappal sounds were added, that could satisfy the need for preventive measures. Using python programming, the system sends message acknowledgement referring to the direction of intrusion to people or officials who could give hands with protective strategies. The novelty of the proposed work is as follows. The animal movement prediction is combined with image classification to prevent the entry of animals and to notify the owners regarding the intrusion caused. The stages referring to the above prescriptions are as follows:

- Movement capturing using motion detection algorithm using OpenCV.
- Alert sound importing, and contour analysis with gray scale reading.
- Classification of animals using image processing CNN.
- Messages and alert acknowledgement for in need of help.

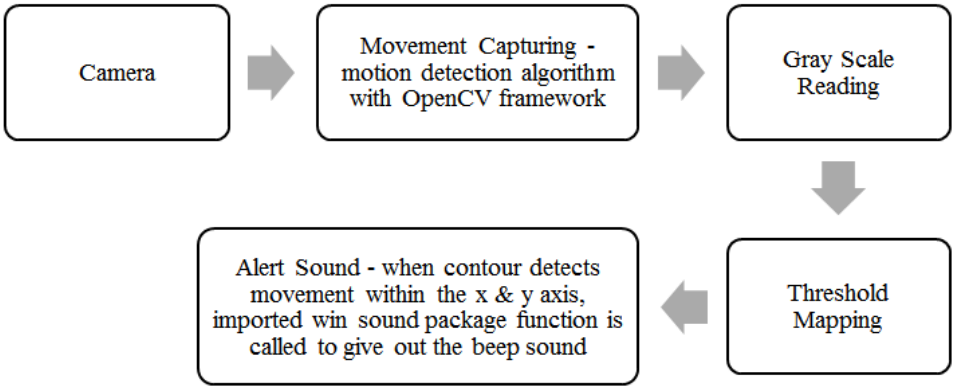


Figure 1. Movement prediction steps

Figure 1 represents the modules that are confronted in movement prediction phase to monitor animal motion. By using the motion detection algorithm with background subtraction implemented with OpenCV framework, the movement of animals can be captured [9]. As mentioned above, movement prediction module captures animal movement by specifying contour areas. If the movement satisfies the range that is fixed in the program, the alert sound

goes on. The alert sound is imported as a function call next to contour analysis. When contour captures motion, beep sound goes on. Fixation of range in manual, larger or smaller rectangular boxes can be represented.

3.1 Motion detection algorithm

The motion detection algorithm with background subtraction method using threshold and contour analysis is used to capture the movement of animals [9]. The still frames known as backgrounds are compared with other frames to capture the motion of animals. The steps include threshold reading, gray scale reading, and contour analysis [9]. The computer vision helps with accessing the cameras and still, moving frames of the scene.

3.2 Software – gray scale reading

The motion detection algorithm captures only the motion of an object or animal that is obtained on the contour range. The captured reading need not be a colored image to classify the motion of an animal. The reading is initially got in grayscale which is more efficient for night vision capturing, with low pixel cameras. The gray scale readings capture the outline of the moving object or animal. The accuracy for capturing movement of animal would be improved if the output is obtained as a gray scale reading. The image classification can also be done for blurred images with 70% accuracy when it comes to CNN rather than ANN.

```
Diff = cv2.absdiff(frame1, frame2)
Gray = cv2.cvtcolor(diff, cv2.COLOR_RGB2GRAY)
Blur = cv2.GaussianBlur(gray, (5, 5), 0)
```

3.3 OpenCV

Open Computer Vision helps in gaining control over the camera automatically to capture the surroundings. OpenCV occupies the vital position in machine learning and artificial intelligence. It is a free library that may be used to carry out operations like face recognition, object tracking, landmark recognition, and many other things. It supports a variety of languages, such as Python, Java, and C++ [1]. OpenCV helps with the first phase of the project to capture animal motion. Using contours and thresholds, the camera can get to the movement of animals that happen in two different frames.

```
Cam = cv2.VideoCapture(0)
```

3.4 Contour Analysis

A contour is a curve that connects all continuous points (rectangular box) that have the same hue or intensity. The contours are helpful tools for object detection and recognition as well as form analysis. Contour lines are used to depict the three-dimensional shape of the earth's surface on a two-dimensional map. The range or size of the contours can be controlled by the programmer. To capture smaller animal movements, the contour size could be minimized. To capture large animals, the contour size could be maximized depending upon the needs of the user. Much of false alarms could be controlled by handling the contours properly. The contour graph of the proposed system covers:

- Height
- Width
- Color of the contours

3.5 Alert Sound

Alert sound is attached to motion detection algorithm module. When the contour captures motion between frames, the next function i.e., win sound package imported play sound function is called to give out the alert sound. This module displays the sound that is audible during anticipated animal movement. The alert sound is necessary to keep the user updated on events in the farm fields.

The PyCharm package in sound has been imported for alarm sound effects. A better sound effect is provided for quick reaction by importing the external package. The default speaker in the prototype (laptop) was a beep sound which was quite lower. It won’t be efficient if implemented in the field. The sound has to reach many people, so that they could be aware of the intrusion on the field. Hence, win sound package is imported to obtain a louder noise.

3.6 PyCharm IDE

A Python-specific Integrated Development Environment (IDE), PyCharm offers a wide range of crucial tools for Python developers. The PyCharm IDE provides multiple packages and the accessibility gives better experience. The IDE for implementing movement detection of animals using OpenCV python is implemented in PyCharm IDE in the proposed system.

3.7 Hardware-camera & fence

The 360-degree rotating cameras are to be used in fences to capture the motion of animals. They are mounted on the four sides of the fence to capture the motion. Once motion is depicted alert buzzer goes on to alert the people or officials about the intrusion into the fields. The basic idea of the proposed system is to provide a fence with extra features. Hence, a fence structure is provided to mount the cameras. The furrows are made around the fence and are flattened without sticks or stones to prevent the entry of rodents.

3.8 Image classification using CNN

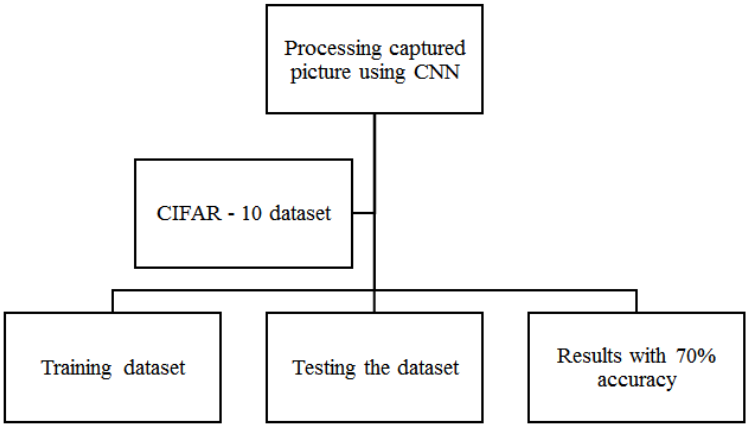


Figure 2. Steps in classification of images using CNN

Figure 2 represents the process of classifying the image of the intruded animal using convolutional neural network. CIFAR -10 dataset is being trained. The test results are compared to predict the type of animal that has entered the field. Both the ANN and CNN predictions are performed to find out whichever classification provides better accuracy in terms of epochs.

3.8.1 Convolutional Neural Network

For image categorization, convolutional neural networks are frequently utilized. CNN can recognize many items on photos by identifying useful properties. CNN is a supervised sort of deep learning that is most frequently used for computer vision and image recognition. With no loss of information, its integrated convolutional layer lowers the high dimensionality of images. The screenshots of the images got during the movement processing phase is taken for image classification. The screenshot is compared with the trained dataset to fetch the type of animal that has encroached. When implementing both artificial neural networks and

convolutional neural networks, the proposed system comes to a conclusion that CNN provide maximum accuracy when compared to ANN.

The technical stack of image processing involves:

- TensorFlow
- Keras
- Matplotlib

a) TensorFlow

The best practices for data automation, model tracking, performance monitoring, and model retraining can be adopted with the help of the TensorFlow platform. The outlet depends on the use of production-level technologies to automate and monitor model training throughout the lifespan of a good, service, or business procedure. Using TensorFlow, processing of the captured image is done efficiently by integrating with CNN.

b) Keras

Convolutional neural networks have a Python interface provided by the open-source software package known as Keras. The TensorFlow library interface is provided by Keras. As well as a variety of tools to make working with image and text data easier, Keras includes numerous implementations of widely used neural-network building blocks. This helps to simplify the coding required to create deep neural networks.

c) Matplotlib

For Python and its numerical extension NumPy, Matplotlib is a cross-platform data visualization and graphical charting package. As a result, it presents a strong open-source substitute for MATLAB. The APIs (Application Programming Interfaces) for Matplotlib allow programmers to incorporate charts into GUI applications. Matplotlib is used to give the classification accuracy graph and table for the movement capturing and image classification module.

3.9 Pywhatkit

Addition precautions can be taken by sending messages to people or officials who could lend help. Using pywhatkit package, simple program to send messages that has been scheduled already and called to a function can be initiated as a precautionary method that has

to be taken immediately once the animal enters the fence. Once the alert sound goes on, a function can be called to initiate the process to send message on the scheduled time using pywhatkit. This work is under scrutiny to work on with future work.

3.10 Flow Chart Representation

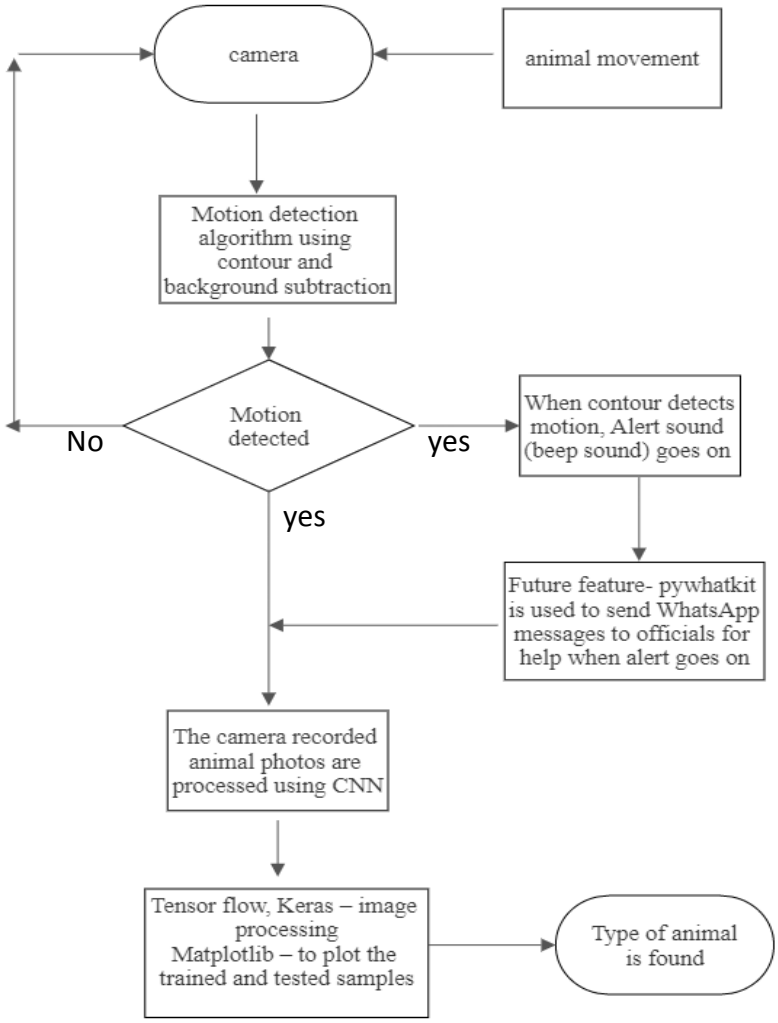


Figure 3. Flowchart representation of movement capturing and image processing phases

Figure 3 specifies the flowchart representation of the working phases. Motion detection algorithm with background subtraction is used to differentiate frames to capture the motion of animals. When the contour detects the changes, it calls the alert sound imported function and the alert buzzer goes on. Using TensorFlow and Keras, the images recorded by cameras are processed. Using Matplotlib, the x, y axis of frames is plotted. The type of animal is found out using this process. For future analysis, pywhatkit can be used to send messages to officials for immediate attention seeking and preventive measures.

4. Results and Discussion

When animal approaches the fence, the camera captures the motion using OpenCV and gives an alert signal to inform the surrounding people about the intrusion.

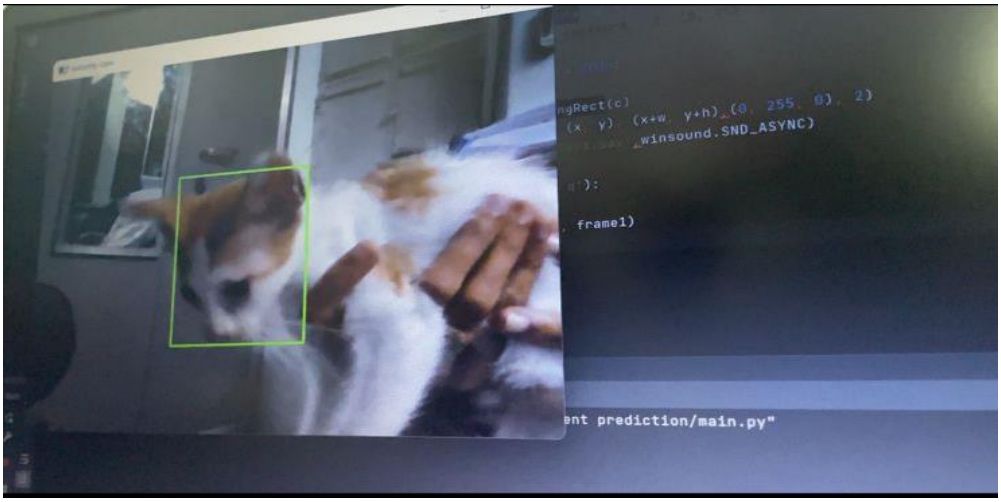


Figure 4. Animal movement (cat) captured using motion detection algorithm with background subtraction

Figure 4 represents the movement capturing of animal got on the contour rectangle using OpenCV implemented in PyCharm. The movable and non-movable frames are used to fetch the movement of animals while entering the fence. The contour analysis helps with capturing the movement when it falls into the given particular range, so that other small animal movements need not be captured. Animals like elephant, wild pig, cows, goats, dogs etc. are considered for alert processing.

Table 1. Accuracy of the working model

Phases	Accuracy
Animal movement capturing using motion detection algorithm with python OpenCV	90% of accuracy. The accuracy doesn't vary much since the contour helps with predicting every motion captured.
Image classification using CNN	70 % for 5 epochs

Table 1 specifies the accuracy of image classification obtained using CNN after processing the movement of animal trying to enter the fence at a distance of 10 meters to the mounted camera on the fence. The 90% accuracy depends upon the camera since the program will run efficiently on every IDE.

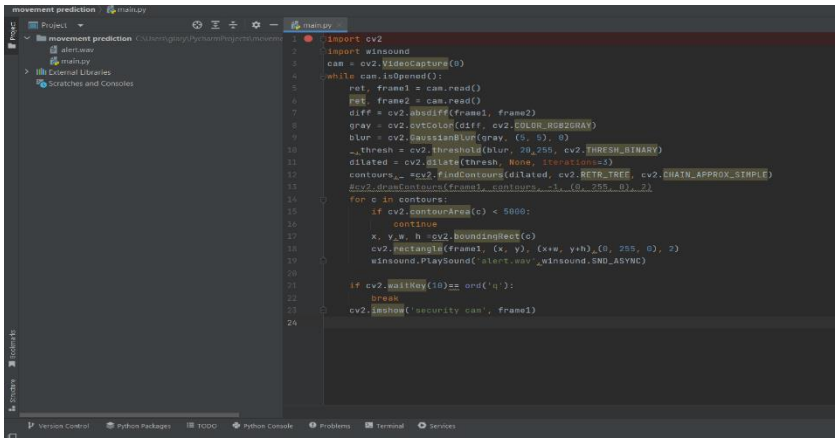


Figure 5. OpenCV implemented in python

Figure 5 specifies the python code implemented on PyCharm IDE to capture animal movement and to process alert sound using externally imported win sound package. Contours with height and width are mentioned to capture large wild animal movements.

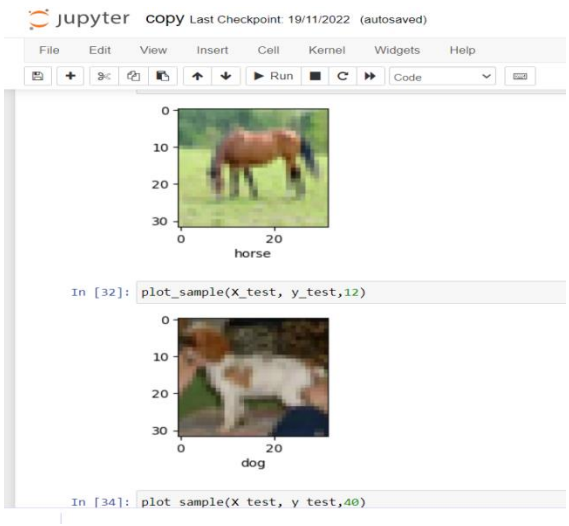


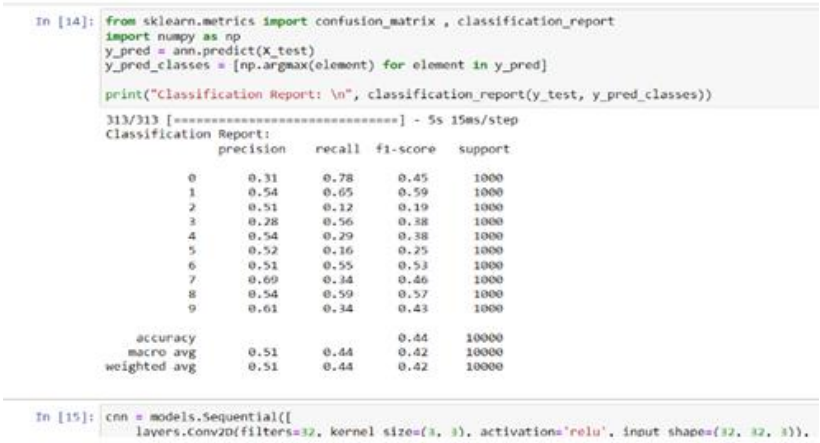
Figure 6. Classification of animals using CNN

Figure 7. Accuracy for 5 epochs using ANN

Figure 6 represents the classification of images using CNN by comparing with the CIFAR-10 dataset. The dataset is trained and tested to get the classified images. Figure 7 represents the accuracy obtained when training the datasets using ANN for 5 epochs. It is stopped at 5 epochs since 5 epochs attains only 49% accuracy, and proceeding to 10 epochs will not give a better accuracy.

Figure 8. Accuracy for 5 epochs using CNN

Figure 8 represents the accuracy of 0.70 that is obtained when training the datasets using CNN for 5 epochs.



```
In [14]: from sklearn.metrics import confusion_matrix , classification_report
         import numpy as np
         y_pred = ann.predict(X_test)
         y_pred_classes = [np.argmax(element) for element in y_pred]

         print("Classification Report: \n", classification_report(y_test, y_pred_classes))

         313/313 [==============================] - 5s 15ms/step
         Classification Report:
                       precision    recall  f1-score   support

                    0       0.31      0.78      0.45      1000
                    1       0.54      0.65      0.59      1000
                    2       0.51      0.12      0.19      1000
                    3       0.28      0.56      0.38      1000
                    4       0.54      0.29      0.38      1000
                    5       0.52      0.16      0.25      1000
                    6       0.51      0.55      0.53      1000
                    7       0.69      0.34      0.46      1000
                    8       0.54      0.59      0.57      1000
                    9       0.61      0.34      0.43      1000

             accuracy                           0.44     10000
            macro avg       0.51      0.44      0.42     10000
         weighted avg       0.51      0.44      0.42     10000

In [15]: cnn = models.Sequential([
             layers.Conv2D(filters=32, kernel_size=(3, 3), activation='relu', input_shape=(32, 32, 3)),
```

Figure 9. Classification report of ANN with f1-score

Figure 9 represents the classification report of ANN with f1 – score. The table includes precision, recall, f1 – score and support. ANN could provide the outcome as expected but still the accuracy is not adequate to classify animal images that are pictured during the night time. The ratio of the number of true positives (tp) to the total number of positives (tp/(tp + fp)), is used to measure precision. Wherein, 1 is the best value, while 0 is the worst.

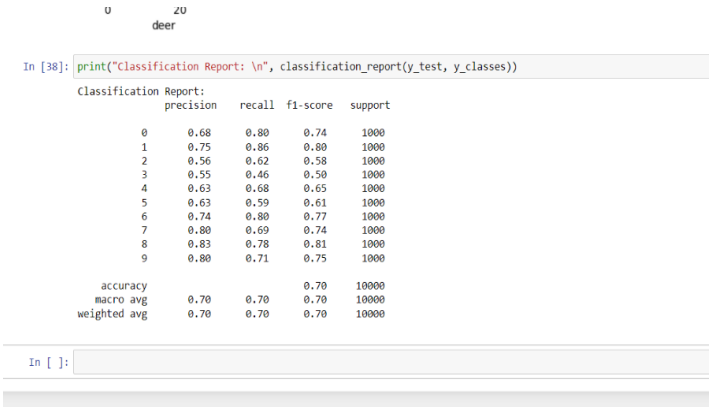


Figure 10. Classification report of CNN with f1-score

Figure 10 represents the classification report of CNN with precision, recall, f1-score and support.

Table 2. Accuracy comparison between CNN and ANN

ANN	CNN
Epochs 5, Accuracy = 0.49	Epochs 5, Accuracy = 0.70
Precision = 0.51	Precision = 0.70
Recall = 0.44	Recall = 0.70
F1-score = 0.42	F1-score = 0.70

Table 3. Speed variations of OpenCV and image classification by CNN

Classes	Speed
Motion detection algorithm – OpenCV framework	50ms per frame
CNN	100ms per image

Figure 11. A picturization of message alert

Table 2 represents the accuracy variation between Artificial Neural Networks and Convolutional Neural Networks when trained with CIFAR -10 dataset. Table 3 represents the speed variations between OpenCV processing motion and CNN processing the image classification module. As a future work using simple python program, a WhatsApp message can be sent to particular number with default help message to seek help when animal intrusion occurs. The pywhatkit package can be imported to work with sending WhatsApp messages that could be scheduled earlier.

Figure 11 specifies the message alert that may be passed to people who could provide help at the crucial situations. As of now every module is in separate working phase. The two phases can be integrated using Django to provide an app which would be handy. As a future work along with alert module, another sound module can be added to feed up with sounds that animals are afraid off. Some animals are sensitive to bees, some react to kolhapuri chappal sound, some are afraid of human foot sounds, whereas some are scared of snake hisses. By incorporating these sounds, the animals could be threatened. When animals try to enter the fence along with the alert buzzer, these incorporated sounds could be emitted. This could make the animal move away without causing any trouble to farms and fields. Most of the animals are sensitive to keen sounds like ultrasonic sounds. If ultrasonic sound is injected into the buzzer, animals trying to break the fence might get disturbed by the sound and can slip away. Clapping, firecrackers, and yelling sound could also provide distress to the trespassing animals.

5. Conclusion

Animal classification and alert system to protect the farm fields from animals is proposed in this work. The movement of animals trying to trespass is captured. Once the movement is detected, an alert sound goes on. Using the screenshots of the animal images, the type of animal is classified using image classification module. Using python, a message alert can be sent to people to provide precautionary help. The structure cost around 50000 Indian rupees for implementing in 1 acre field. Other regions like military base could also adapt to this methodology to capture enemy movements and produce alert signals. The movement processing module doesn’t give 100% accuracy and efficiency when compared to other modules [1]. But 90% accuracy is far enough for movement prediction module, since the contour responds for whatever actions happening in the given area. CNN provides 70% accuracy which is a better choice when compared to ANN whose accuracy falls under 49%.

The complexity of the system is simple when compared to other existing systems, since movement prediction and image processing are done with simple algorithms and packages. Both the modules can be integrated into single app using Django to reduce the separate module maintenance burden. Movement processing will not go under trial-and-error condition, since movement capturing doesn't depend on the animal instead it depends on the motion. Contour captures every motion around. Alert signals are passed without any delay. Precautionary features can be added depending upon the need of the users. Complex fences with enormous cost structure cannot be afforded by the farmers. Simple fence with technical support can be a better solution. Maintenance charges can also be omitted. By improving these features, the cost structure can be further reduced. Year to year maintenance can provide less investment with more profit accompanying advanced technological support and progress in economy.

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