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ADVANCED WILD ANIMAL ACTIVITY DETECTION AND ALERT SYSTEM

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ABSTRACT:

All the sight-having animals, including man, vision in a manner that seems natural and instinctive. Animals employ their vision system in early life frequently even since birth to navigate their environment, identify and communicate with other animals, and get to know their environment. Due to this, an animal's vision system is constantly being taught and adjusted to allow it to perform a range of things. In the human, for example, it operates through the optic nerve, which carries light information from the eye to the brain to be interpreted and processed. This complex vision system allows us to zoom in on objects and perceive the world in three dimensions, and still be capable of automatically adjusting to varying light levels. One can regard computer vision, digital image processing, and digital image analysis as a compound phrase consisting of words that are often used interchangeably to denote connected operations. The primary cause of this confusion is that they are connected disciplines that emerged with the development of digital picture capture. So it is critical to understand how the different disciplines interact, how an image is formed digitally, and how the different sensors that are used each uniquely best suited for a specific application are different. Since the advent of charge-coupled devices, which marked the start of digital imaging, the discipline has evolved very rapidly. In this research, we will utilize a camera that captures the environment around the clock to monitor the farm periodically. We can detect when an animal is approaching with the help of a deep learning model, and we play the appropriate sounds to push the animal away.

INDEX TERMS: Camera, Computer vision, Deep learning, Digital image processing, Farm monitoring, Optic nerve.

I. INTRODUCTION

The dietary requirements of the population are met by agriculture, which also provides a range of raw materials to other industries. Crop loss is highly exacerbated when animals encroach on farms. Crop damage caused by animal raids these days has become a serious concern. Certain animals capable of doing a lot of harm and have, from time to time, caused some human casualties include wild boars, macaques, porcupines, deer, monkeys, and bears. The stringent wildlife laws bar small farmers from meting out punishment, even when animals can pilfer half of their crop. Elephants are a highly conflict-generating wildlife species, especially in India, and hence human-elephant conflict is growing. Many industries, such as robotics, medical, remote sensing, machine vision, and content-based image retrieval, can be helped by computer vision. In many fields, computer vision offers solutions to many problems. In the security field, computer vision is also applied for automated surveillance, access control, and attendance monitoring. There are many uses of computer vision in the agricultural sector, including quality inspection of agricultural produce and the detection of tree diseases based on the scanning of leaves, flowers, and fruits.

A computer vision animal monitoring system is a technology designed to monitor and track animal activity by utilizing computer vision algorithms. The main aim of the system is to be able to recognize individual animals through their distinct physical features, for example, patterns of fur or other distinct traits, and monitor their movement in real-time. This technology is crucial to researchers, conservationists, and animal caretakers who must track the behavior of animals in order to collect important data and information about their welfare, ecology, and behavior. The computer vision-based animal monitoring system has some benefits over the conventional methods of animal monitoring. The system is capable of handling large amounts of data efficiently and accurately, cutting down the time and effort it takes to monitor animals manually. In addition, the technology is non-invasive, meaning that it does not disrupt the natural behavior of the animals. The goal of the behavior monitoring of the system is the observation and documentation of the movement and behavior of the animals, such as their feeding patterns, social behavior, and other habits. These data can be utilized in the investigation of animal behavior and ecology, detecting changes in behavior caused by environmental pressures or human disturbances, and evaluating the welfare of the animals. In general, the computer vision-based animal monitoring system can revolutionize animal monitoring and research by offering useful data and information that can assist us in better understanding and conserving our planet's wildlife. Fig 1 defines the animal detection with deep learning models.

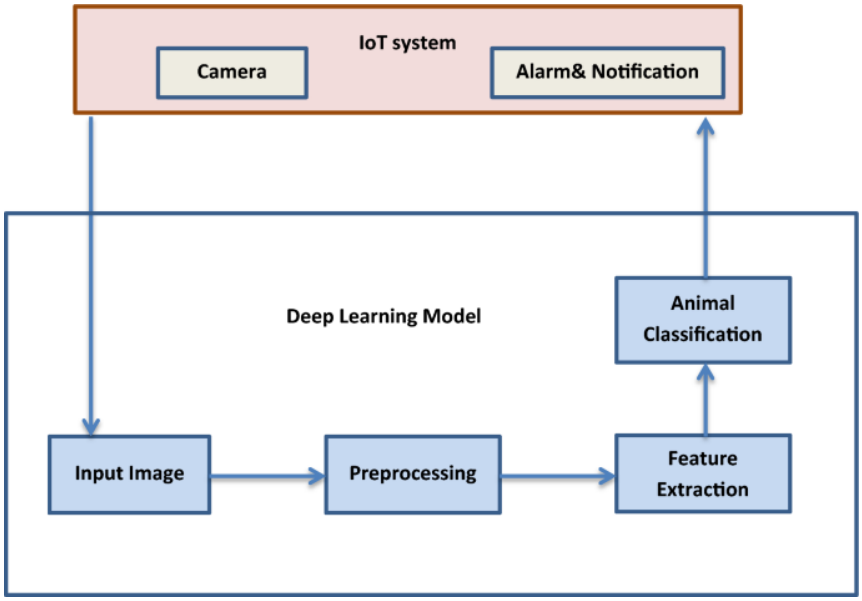


Fig 1: Animal datasets training procedure

II. RELATED WORK

N. Banupriya, et.al,…[1] can retrieve information and use it to learn by themselves. The learning begins with interpretation or information, such as examples, past model, or recommendations, to make better decisions in the future. The main purpose is to allow the computers learn by themselves without any human intervention or support and corrects its errors by itself through this learning. Deep neural networks are the family of algorithms which set new benchmark levels of accuracy on many of the critical issues; Convolutional neural network (CNN) is a variety of deep neural networks, applied most broadly to examine visual images. CNNs utilize relatively restrained pre-processing when compared with other image classification techniques. This freedom from prior information and human engagement in feature learning is a notable advantage of Convolutional neural network (CNN). They have a number of applications in image and video recognition, recommendation systems, image classification and medical image processing. Watching wild animals in their natural habitat is a critical activity in ecosystem. Owing to the vast expansion in human population and augmentation in hunt of economic growth causes excessive utilization of natural resources, rapid, revolutionary and tremendous modifications in the Earth's ecosystems. A growing area of the Earth's surface has been altered through human intervention, altering natural life population, habitat and behavior. More lethally, numerous wild creatures on our planet have gone extinct, and numerous species are transported to other locations where they can disrupt all natural and human resources.

Vidhya s, et.al,..[2] crops damage by wildlife has become an important social phenomenon in recent events. Up to now, no good solution is available for the issue and hence needs serious thinking. The ways available are making wire fences and electric fences that are not much effective. Electric fences also have batteries to deliver shock on animals that touch it and a risk of causing fire if crops or bushes intrude too closely on the fence. If care is not exercised in maintaining fence, it interferes with electromagnetic signals which affect telephone and radio communications. Electric fencing is dangerous to animal and human life even though it is the most utilized farm defense method. Thorn fencing which is also a widespread strategy employed has a comparable effect as above. This research presents an intelligent solution to tackle this issue. In this setup, image is taken when an animal intrudes and then image is categorized as domestic or wild animal through Convolution Neural Network (CNN) and deep learning method. This categorization assists in alerting the farmer by sending SMS in event of wild animal intrusion. The smart farm protection system provides trustworthy security and safety to the crops. This system ensures the well-being of creatures while scaring them off. It also reduces the effort exerted by man in occupying the field

Priyanka r, et.al,…[3] discusses the enhancement of a Wireless Sensor Network application (Zigbee) for Crop Protection to redirect animal intrusions in the crop field. Crop field nodes are provided with object sensors, sound generating devices, and arduino module. Intrusion detection system at the farm perimeter is installed for early detection of the animal. Animal intrusion in the farm perimeter is sensed by the nodes which are mounted on the boundary and is reported to the central base station. Node renewal sequence is location based, time based and proximity based. Upon receiving such information, nodes near the animal trigger the deterring devices and steer the animal away from the field. A Graphical User Interface is also provided for showing the measure of the field conditions. The system includes zigbee application that is able to talk to a plethora of co-located sensors, each one of the sensors for sensing a different one of a multitude of various alarm predicaments. Upon detection of a respective one of the alarm conditions by one of the sensors, an alert is sent to the destination. Thus this method is beneficial to the farmers in shielding fields and rescuing them from economic losses. Case study was done on provided Animal dataset, wherein various local and textural topographies were derived from the images. These features comprised descriptors like the height and area of the bounding box, the surface area of the animals, including number of colors. Three different classification methods were experimented using varying numbers of classes. What can be gathered from the results of classification is that at times, simple local features for such datasets as under investigation here might be the ideal solution, and even a trivial classifier such as the KNN may yield extremely high accuracies

Meenatchi k, et.al,…[4] used to conduct automatic wildlife surveying and animal monitoring. Detection of animals in aerial videos is difficult due to the complexity of wild environments. The approach for moving animal detection is suggested by leveraging global patterns of pixel motion. In the video dataset, where animals move clearly against the background, motion vectors of every pixel are estimated by using optical flow techniques. A coarse segmentation then eliminates most parts of the background by applying a pixel velocity threshold. Depending on the segmented areas, another threshold

was used to eliminate negative candidates which may belong to the background. The advantages and disadvantages of this approach are explained. Efficient and accurate monitoring of wild animals in natural habitats is required to inform management and conservation decisions. Auto convert cameras or "camera traps" are becoming a very popular device for wild life monitoring because they record unobtrusively, continuously and in high volume. But processing such a high volume of images and videos taken from camera traps manually is very costly, time consuming and also boring. This is a big hindrance to scientists and ecologists to monitor wild life in an open environment. Capitalizing on recent developments in deep learning methods in computer vision, to develop autonomous animal recognition in the wild with a view to an autonomous wild life monitoring system. Today, world has made computers [6] an indispensable part of their life since computers are used to perform the whole work of humans with greater accuracy and efficiency. Visual scene analysis is an abstract activity that gain knowledge from videos or computer images that falls in the field of computer vision.

P.navaneetha, et.al,…[5] involves the procurement of data on the behavior of animals under natural conditions. The data is utilized for both scientific and conservation efforts. The main type of data that must be procured is the position of the animal at specific moments in time and this is usually termed as tracking or radio–tracking. Despite the similarities involved in procuring the data, the terms are often used interchangeably. There exist distant techniques by which animals may be tracked and seen visually as well as identified via acoustic signals. It makes sense to construct a plan for coarsely locating mobile phones with no GPS utilizing available circumstances and devices particularly in areas lacking the availability of GPS. The fact that there are Bluetooth devices for most phones and there are several GPS equipped phones among a crowd of phones allows us to propose a Bluetooth assisted mobile phone localization approach. With the location of GPS equipped phones as landmarks, and with the Bluetooth link between neighbor phones as proximity constraints, we cast the problem into an inequality problem on the Bluetooth network. The neural network and solution feasibility convergence to the problem formulated are theoretically established. The architecture of the proposed hardware implementation of the neural network is; also presented in this article. As an example, rough localizations of drivers within a tunnel and customers' localization within a supermarket are investigated and simulated. Simulations confirm the performance of the proposed approach.

III. BACKGROUND OF THE WORK

Wild animals pose a unique challenge to farmers all over the globe. Deer, wild boars, rabbits, moles, elephants, monkeys, and numerous other animals can inflict major damage on crops. They can destroy the crops by eating parts of the plants or merely by running over the farm and treading over the crops. Most farmers like to schedule possible yields before the start of each farm season. On the contrary, others opted not to plan. While wishing for the best, farmers are usually given numerous issues and challenges that force them to continuously doubt their productivity and consequent end achievement. Wild Animal detection methods are suggested by other people prior with other methods. Histogram based feature vectors are favored because of high detection rate and strength. Histogram Oriented Gradients (HOG) applied in computer vision tasks such as object detection, Content-based Image retrieval and detection of people in videos. In HOG, Gradients of the image are computed and then transformed to orientations. Histograms are later computed for the oriented gradients. There are various variants of HOG suggested by various individuals with enhanced accuracy CoHOG is a better method than HOG which employs a pair of oriented gradients to compute co-occurrence matrix in an attempt to enhance the accuracy. W-CoHOG is an extension of CoHOG, in this approach magnitude component added to a co- occurrence histogram matrix in an attempt to enhance the accuracy. Fig 2 illustrates HOG Based approach for animal detection

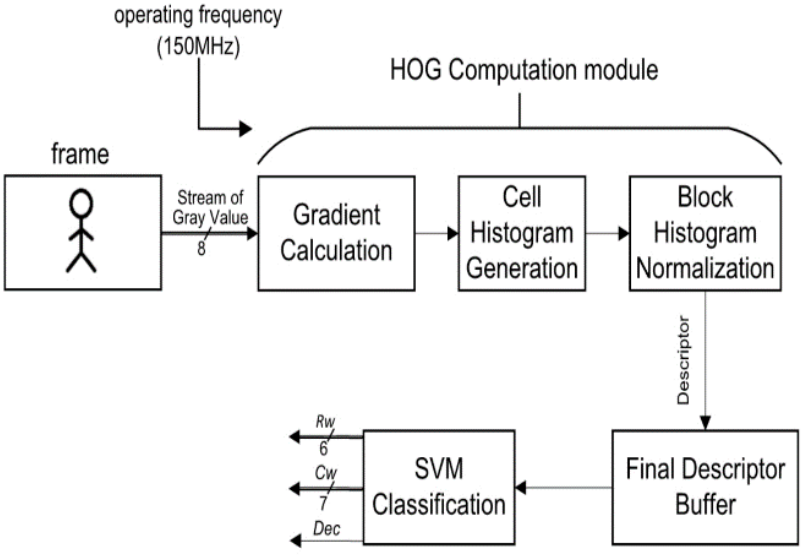


Fig 2: HOG based animal classification

IV. PROPOSED WORK

At present, the animal detection and recognition remain a challenging problem and there is no special approach that offers a good and efficient solution to every situation. Typically, the animal detection algorithms realize the animal detection as a binary pattern classification problem. That is, for an input image, it is partitioned into blocks and each block is converted into a feature. Characteristics from the animal belonging to a specific class are employed to train a specific classifier. Then, upon being presented with a new input image, the classifier can determine whether the sample is the animal or not.

Deep learning is a category of machine learning. Measure of performance in most real-world applications like image recognition, sound recognition etc is significantly enhanced when deep learning is used. Convolutional Neural Network (CNN) utilized in deep learning known as deep neural networks is commonly applied to image processing analysis. Pre-processing requirement in CNN is relatively minimal compared to the other image processing algorithms. Thus, the concept of CNN together with deep learning is more desired for image classification tasks. Animals are classified by utilizing CNN and symbolic classifiers. First, features are extracted from images/frames by blink app pre-trained convolution neural network. Then the extracted features are passed to multi-class CNN classifier for classification. CNN is built by sequence of layers such as Convolutional, sub-sampling and fully connected Layer. Thus, the proposed algorithm is more appropriate for classification and detection of animals from the camera images with varying pose and partial image of animals.

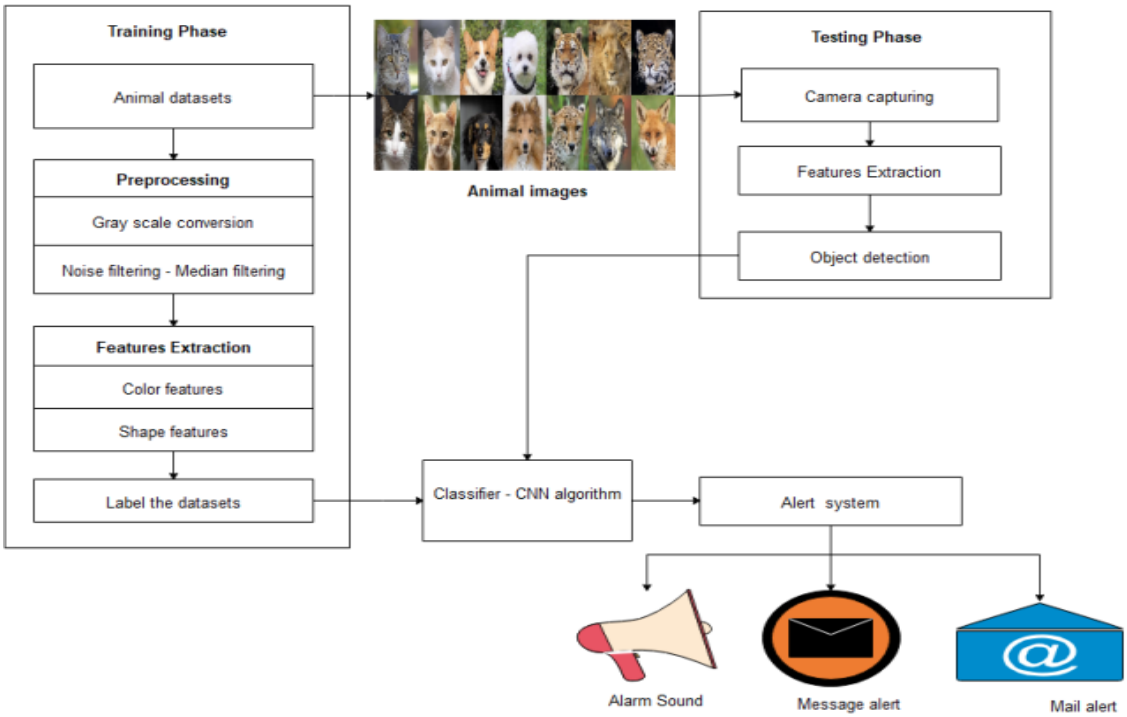


Fig 3: Proposed framework

In above figure specifies the architecture proposed work and modules can be described below.

FRAMEWORK CONSTRUCTION

Animals can be identified by their footprints. Certain features in an animal footprint can be used to assist with the identification of an animal. Of these features, the most vague and most used by humans to identify the animal manually is the number and size of blobs in the footprint. Applying image processing, an algorithm was designed to segment and obtain the best possible representation of the footprint, which was varied in colour. Connected Components was then applied to determine the number of blobs included in the footprint and to find the size of each blob. The system proposed is applied to predict the age of the animal from the footprints. In this module, admin can train the animal datasets that are fetched from Kaggle websites. Training folder has various image datasets in jpeg form. And also on testing side, capture the input from real time surveillance cameras

FOREGROUND DETECTION

In this module, employing preprocessing processes to remove noises in images. And also find the noises and remove using Median filtering algorithm. The median filter is a form of non-linear digital filtering technique, commonly used to eliminate noise from an image or signal. Such noise elimination is a standard pre-processing stage to enhance subsequent processing results (for instance, edge detection within an image). Detect the foreground objects with Binarization methods. Foreground detection is among the key tasks of computer vision and image processing whose objective is the detection of changes in image sequences. Background subtraction is any method which enables an image's foreground to be separated for processing (object recognition etc.). Most of the applications don't require all information regarding the evolution of movement in a sequence of videos but need to know the information of changes in the scene, because an image's region of interest are objects (humans, cars, text etc.) of its foreground. Following the image pre-processing stage (which could be image denoising, post processing like morphology etc.) object localisation is needed which could utilize this technique. Foreground detection isolates foreground from background according to these changes occurring in the foreground. It is a collection of methods that normally examine sequences captured in real time with an image.

OBJECT DETECTION

Feature extraction is a dimension reduction process by which a preliminary group of raw data is minimized into more tractable groups for handling. A property of such extensive data sets is an enormous set of variables, which takes massive computing resources in order to be processed. Feature extraction is the terminology for techniques which choose and/or aggregate variables into features, thus diminishing the level of data that needs to be processed, while still correctly and fully defining the initial data set. Within this module, adopt features extraction processes to get the features like color, shape, texture. And also create the feature vectors on the basis of objects. These features vectors matched for future purposes

OBJECT RECOGNITION

Lastly, equate the feature vectors with trained databases through the use of YOLO algorithm. It involves a Convolutional Neural Network which is a Deep Learning algorithm which can be able to receive an input image, give significance (learnable weights and biases) to different aspects/objects within the image and be in a position to distinguish one from the other. Pre-processing that is needed in a ConvNet is significantly low compared to other classification algorithms. Convolutional Layer: It is the first and fundamental layer for CNN with the objective to extract features from the input image. Thus, the convolution is a mathematical process performed on input data (input image pixels) with the use of the convolution filter (kernel) to yield a features map.

Kernels: Also referred to as filters (such as the traditional filters in image processing). Kernels are typically small in spatial size (3×3) and used on all pixels input with some strides. These Kernels are used for edge detection, sharpen, box blur, or Gaussian blur. To optimize the output of the convolution layer, Three hyper parameters are typically tuned

Depth: can be reduced by reducing the number of filters used in the convolution operation.

- Stride: is the step taken to multiply with a filter. In order to reduce the amount of overlapping, the stride should be incremented.
- Padding: it is a useful process to give more control over the output dimensions, by zero-padding (padding the zeros in the border of the input) or valid padding (drop part from the input and keep only the valid part).

ALERT SYSTEM

In each task, we train YOLO models on two settings: imbalanced and balanced datasets. We calculate the classification accuracy in both scenarios. For dataset imbalance, F-measure is utilized alongside accuracy to verify the insensitivity of the proposed system. In machine learning, a convolutional neural network (CNN, or ConvNet) is a class of deep, feed-forward artificial neural networks, most traditionally used for visual imagery analysis. CNNs utilize a variation of multilayer perceptrons that is made to necessitate little preprocessing. Lastly present the alert system

5. EXPERIMENTAL RESULTS

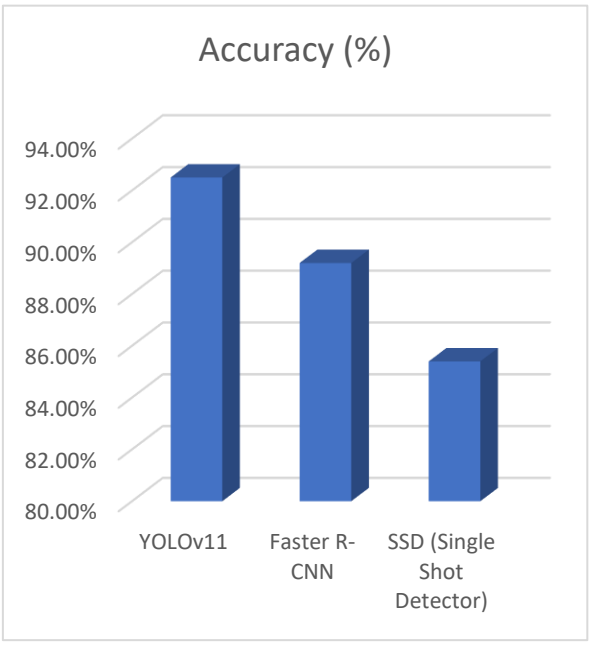
In this research, we can feed the KAGGLE web sources' datasets and performance can be measured based on accuracy. Accuracy as primary measure is taken into account for comparing and measuring the various classification techniques. The animal classification performance is measured using repeated random sub-sampling validation. For measuring the classification accuracy, the overall accuracy measure is computed as follows

$$\text{ACCURACY} = \frac{\text{Number of true detections}}{\text{Total number of epochs}}$$

Model	Accuracy (%)
YOLOv11	92.50%
Faster R-CNN	89.20%
SSD (Single Shot Detector)	85.40%

Table 1: Accuracy chart

Fig 4: Accuracy



From the diagram, YOLO algorithm provides the improved accuracy than the existing frameworks

Model	Processing Speed (FPS)	Strengths	Weaknesses
YOLOv11	30-60 FPS	Fast, efficient, works well in real-time	May require retraining for rare animals
Faster R-CNN	5-10 FPS	High accuracy	Slower inference time
SSD (Single Shot Detector)	20-30 FPS	Good balance of speed and accuracy	Struggles with small objects

Table 2: Performance table

The application of YOLO for animal detection was effective, with high accuracy and real-time processing. Low-light environments and dataset size are still challenges. Future enhancements, including custom model training and multi-sensor fusion, can improve the system's reliability for wildlife conservation, farm monitoring, and security use cases.

VI. CONCLUSION

Deep Learning is a subcategory of machine learning that involves different algorithms and was motivated by the human brain neural networks. The model used in the given work was developed based on convolution neural networks to recognize the animal in real-time. The model can extract the features from the images using its different layers of YOLO algorithm network model. We took the photograph by employing the camera and what is then turned into features vector in order to make it possible for comparison to the available data set the YOLO could successfully extract the features from images and a classification model was created. The designed system illustrated from the block diagram conducts the detection. Computer vision systems based on YOLO have been largely implemented in livestock farming to facilitate the management of animals, while present knowledge, practice, confines, and options of the uses need to be elaborated on and investigated further. The main purpose of the research is a systematic review of the use of computer vision systems based on YOLO within livestock farming against the five tasks of deep learning-based computer vision: image classification, object detection, semantic/instance segmentation, pose estimation, and tracking. In this paper, we had introduced a novel algorithm for the recognition of animals. This technique was more accurate on real time datasets than any other existing techniques. The experiments were performed in real time settings.

REFERENCES

[1] Banupriya, N., et al. "Animal detection using deep learning algorithm." J Crit Rev 7.1 (2020): 434-439.
[2] Vidhya, S., et al. "Smart crop protection using deep learning approach." Int J Innov Technol Exploring Eng 8 (2019): 301-305.
[3] Priyanka, R. R., et al. "Crop Protection by an alert Based System using Deep Learning Concept." (2018): 47-49.
[4] Navaneetha, P., et al. "IOT Based Crop Protection System against Birds and Wild Animal Attacks." International Journal of Innovative Research In Technology 6.11 (2020).
[5] Verma, Gyanendra K., and Pragya Gupta. "Wild animal detection using deep convolutional neural network." Proceedings of 2nd international conference on computer vision & image processing. Springer, Singapore, 2018.
[6]Okafor, Emmanuel, et al. "Comparative study between deep learning and bag of visual words for wild-animal recognition." 2016 IEEE Symposium Series on Computational Intelligence (SSCI). IEEE, 2016.
[7] Zhuang, Peiqin, et al. "Marine Animal Detection and Recognition with Advanced Deep Learning Models." CLEF (Working Notes). 2017.
[8] Nasirahmadi, Abozar, et al. "Deep learning and machine vision approaches for posture detection of individual pigs." Sensors 19.17 (2019): 3738.
[9] Mathis, Mackenzie Weygandt, and Alexander Mathis. "Deep learning tools for the measurement of animal behavior in neuroscience." Current opinion in neurobiology 60 (2020): 1-11.
[10] Xu, Wenwei, and Shari Matzner. "Underwater fish detection using deep learning for water power applications." 2018 International conference on computational science and computational intelligence (CSCI). IEEE, 2018.
[11] 45] D. Li, L. Deng, and Z. Cai, ‘‘Design of traffic object recognition system based on machine learning,’’ Neural Comput. Appl., vol. 33, pp. 8143–8156, Jan. 2020.
[12] G. Ciaparrone, F. L. Sánchez, S. Tabik, L. Troiano, R. Tagliaferri, and F. Herrera, ‘‘Deep learning in video multi-object tracking: A survey,’’ Neurocomputing, vol. 381, pp. 61–88, Mar. 2020.
[13] A. Saxena, D. K. Gupta, and S. Singh, ‘‘An animal detection and collision avoidance system using deep learning,’’ in Advances in Communication and Computational Technology (Lecture Notes in Electrical Engineering), Singapore: Springer, 2021
[14] D. Sato, A. J. Zanella, and E. X. Costa, ‘‘Computational classification of animals for a highway detection system,’’ Brazilian J. Veterinary Res. Animal Sci., vol. 58, May 2021, Art. no. e174951
[15] K. Boudjit and N. Ramzan, ‘‘Human detection based on deep learning YOLO-V2 for real-time UAV applications,’’ J. Exp. Theor. Artif. Intell., vol. 34, no. 3, pp. 527–544, May 2022.
[16] X. Huang, X. Wang, W. Lv, X. Bai, X. Long, K. Deng, Q. Dang, S. Han, Q. Liu, X. Hu, D. Yu, Y. Ma, and O. Yoshie, ‘‘PP-YOLOv2: A practical object detector,’’ 2021, arXiv:2104.10419.
[17] M. Loey, G. Manogaran, M. H. N. Taha, and N. E. M. Khalifa, ‘‘Fighting against COVID-19: A novel deep learning model based on YOLO-V2 with ResNet-50 for medical face mask detection,’’ Sustain. Cities Soc., vol. 65, Feb. 2021, Art. no. 102600
[18] M.-T. Pham, L. Courtrai, C. Friguet, S. Lefèvre, and A. Baussard, ‘‘YOLO-Fine: One-stage detector of small objects under various backgrounds in remote sensing images,’’ Remote Sens., vol. 12, no. 15, p. 2501, Aug. 2020.

[19] L. Xiao, P. Zhou, K. Xu, and X. Zhao, ‘‘Multi-directional scene text detection based on improved YOLOv3,’’ Sensors, vol. 21, no. 14, p. 4870, Jul. 2021

[20] H. Zhao, C. Wang, R. Guo, X. Rong, J. Guo, Q. Yang, L. Yang, Y. Zhao, and Y. Li, ‘‘Autonomous live working robot navigation with real-time detection and motion planning system on distribution line,’’ High Voltage, vol. 7, no. 6, pp. 1–13, 2022