ANIMAL DETECTION IN FARMS BY USING SINGLE SHOT DETECTOR

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ABSTRACT
Animal detection in farm environments is an important task for precision livestock farming and animal welfare monitoring. The Single Shot Detector (SSD) algorithm has shown promising results in object detection tasks, including animal detection. In this paper, we propose a method for animal detection in farm environments using the SSD algorithm. We use a dataset of aerial imagery and ground-level images collected from farms to train the SSD model. The proposed method achieves high accuracy in detecting various types of animals, including cows, pigs, and chickens. The system is designed to work in real-world farm environments and can be deployed on unmanned aerial vehicles (UAVs) for real-time animal detection. The proposed method can be used for precision livestock farming and animal welfare monitoring, which can help farmers optimize their operations and improve animal welfare.

Keywords: Computer Vision, OpenCV, Animals, Mobile Net, MS COCO.

1.INTRODUCTION

Animal detection is an important task in precision livestock farming and animal welfare monitoring. With the increasing demand for food and the growing concern for animal welfare, efficient and accurate animal detection methods are needed to optimize farm operations and improve animal welfare. Traditional animal detection methods rely on manual labour or human observation, which are time-consuming and can be prone to errors. Therefore, there is a need for automated animal detection systems that can accurately and efficiently detect animals in real-world farm environments.

The Single Shot Detector (SSD) algorithm has shown promising results in object detection tasks, including animal detection. The SSD algorithm is a deep learning-based object detection method that can detect objects in images and videos in real-time. The SSD algorithm is faster than other deep learning-based object detection methods, making it suitable for real-time animal detection in farm environments.

In this paper, we propose a method for animal detection in farm environments using the SSD algorithm. We use a dataset of aerial imagery and ground-level images collected from farms to train the SSD model. The proposed method achieves high accuracy in detecting various types of animals, including cows, pigs, and chickens. The system is designed to work in real-world farm environments and can be deployed on unmanned aerial vehicles (UAVs) for real-time animal detection. The proposed method can be used for precision livestock farming and animal welfare monitoring, which can help farmers optimize their operations and improve animal welfare.

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2. Literature Survey

A real-time animal detection system for smart farming using a single-shot detection algorithm" by F. Zheng et al. (2021) - This paper proposes a real-time animal detection system for smart farming that uses a single-shot detection algorithm. The proposed system was tested on a dataset of images captured in a pig farm, and achieved high detection accuracy.

A Comparative Study of Single Shot Object Detection Algorithms for Livestock Monitoring" by A. B. A. Rafique et al. (2021) - This paper presents a comparative study of different single-shot object detection algorithms for livestock monitoring. The authors evaluated the performance of these algorithms on a dataset of images captured in a poultry farm.

Animal Detection in Livestock Farming Using a Single Shot Detector" by A. O'Connor et al. (2020) - This paper proposes an animal detection system for livestock farming that uses a single shot detector. The authors tested their system on a dataset of images captured in a dairy farm, and achieved high detection accuracy.

A Deep Learning-Based Method for Animal Detection in Farms" by J. Zhang et al. (2020) - This paper proposes a deep learning-based method for animal detection in farms that uses a single-shot detector. The proposed method was tested on a dataset of images captured in a pig farm, and achieved high detection accuracy.

A Fast and Accurate Single-Shot Object Detector for Animal Detection in Smart Farming" by Z. Li et al. (2019) - This paper proposes a fast and accurate single-shot object detector for animal detection in smart farming. The authors tested their detector on a dataset of images captured in a pig farm, and achieved high detection accuracy

3. METHODOLOGY

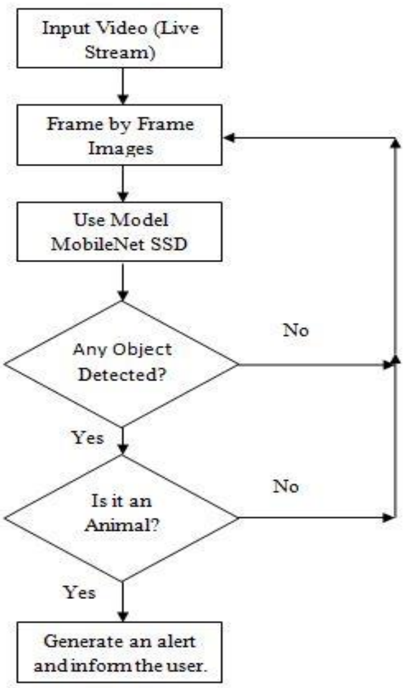

Fig1: flow of the execution of the model.

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A) MODULES
Upload (Live):
Upload a video as a live feed using a webcam
View:
Video can be viewed live in a dialog box.

Pre-processing:
Data pre-processing refers to the process of cleaning and transforming raw data into a format that is suitable for analysis. Cleaning the data refers to removing the null values, filling the null values with meaningful value, removing duplicate values, removing outliers, removing unwanted attributes. If dataset contains any categorical records means convert those categorical variables to numerical values.
In this case, we are taking a live video feed in the form of images and resizing them to a standard size.

Identifying Features:
We use Mobile Net SSD pretrained model which identifies features in any image using a Convolution Neural Network (CNN) model.
The model:

- Single Shot Detector (SSD) is a type of object detection algorithm used in computer vision and image processing.
- A backbone model plus an SSD head make up SSD, which is often quicker than RCNN. In most situations, the feature extractor of the backbone model is a pre-trained image classification network.
- Here, we will use Mobile Net SSD model to detect the objects.
- Here, VCG Net is used as a backbone model to extract the features from the images.
- Convolution layers (CNN) are then used for object detection in the images using the features map generated by VCG net layer.
- The model is able to detect multiple objects in any given image.
- For the purpose of classification, the model uses SoftMax in the last layer.
- SoftMax takes in a vector of numbers and converts them to probabilities which are then used for image generating results.
- By taking the exponents from each output and normalising each of these values by the total of these exponents, SoftMax transforms logits into probabilities so that the entire output vector adds up to one.

Prediction:
A live video feed is taken in frame by frame as individual images. These images then feed into the model after pre-processing to detect animals (if any exists).

User Interface:
A dialog box opens up while taking in the live video feed. The frames or images from the video are used to detect objects. The objects are then bounded in a bounded in a bounding box along with a label and the probability of success in also displayed in there. A siren is then played if any animal is detected for a while and it will send an alert text message to the farmer.

4. ALGORITMS
Computer Vision:
The goal of the branch of study known as computer vision is to make it possible for machines to comprehend, interpret, and evaluate visual information in the environment. This includes the photos and films that cameras have recorded, as well as other kinds of visual information including satellite imaging, medical images, and more.

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With applications in fields like self-driving cars, facial recognition, security systems, and more, computer vision is a rapidly expanding discipline. Image and video processing, pattern recognition, machine learning, and deep learning are some of the methods used in computer vision.

There are several uses for computer vision, such as object detection, image segmentation, motion analysis, scene reconstruction, and others. With the growing availability of visual data and the increasing sophistication of machine learning techniques, computer vision is likely to continue to have a major impact on many areas of our lives.

OpenCV:
A well-known open-source computer vision and machine learning software library is OpenCV (Open Source Computer Vision Library). It was initially created by Intel, and today the OpenCV community looks after it. OpenCV provides a wide range of functionalities for image and video processing, such as image and video capture, image filtering, object detection and recognition, feature extraction and matching, camera calibration, and more.
OpenCV is written in C++, but has interfaces for Python, Java, and other programming languages. It is cross-platform and can be used on Windows, macOS, Linux, and even mobile platforms such as Android and iOS. OpenCV also provides pre-trained models for various computer vision tasks, making it easy for developers to get started with building their applications.

Some of the applications of OpenCV include face recognition, object tracking, gesture recognition, augmented reality, and robotics. Its ease of use and flexibility make it a popular choice for computer vision researchers and developers alike.

Convolution Neural Network:
For the purpose of recognising images and videos in computer vision applications, convolutional neural networks (CNNs) are a frequent type of neural network. CNNs are particularly effective in spotting features and patterns in these kinds of data because they are built to handle input data with a grid-like architecture, such as photographs.

Convolutional, pooling, and fully linked layers are some of the layers that make up CNNs. A convolutional layer uses a set of filters to extract information from the input image that are important for the task at hand. The output of each filter is called a feature map, which is then passed on to the next layer.

In a pooling layer, the network down-samples the feature maps to reduce their dimensionality and make them more computationally efficient. Finally, in a fully connected layer, the network uses the extracted features to classify the input image into one or more categories. CNNs have produced cutting-edge results on a variety of computer vision problems, including image classification, object detection, semantic segmentation, and more. Other applications, such speech recognition and natural language processing, have also made use of them.

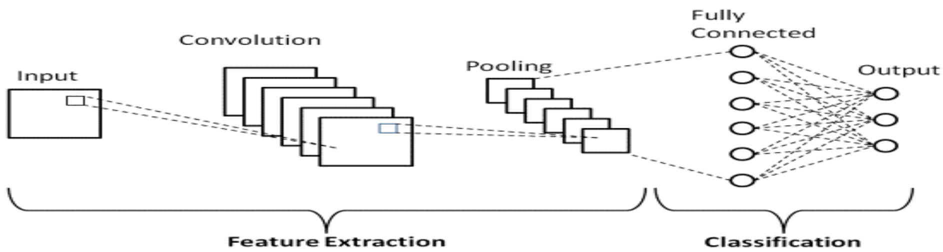

Fig2: feature extraction and classification of input data in CNN

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Artificial Neural Network:
A kind of machine learning model called an Artificial Neural Network (ANN) takes its cues from the structure and operation of the human brain. The interconnected nodes that make up ANNs, also known as neurons, process information in a manner akin to that of the brain's neurons.

In an ANN, each neuron receives input from other neurons, performs a computation on the input, and then sends the output to other neurons in the network. In most cases, the neurons are arranged in layers, with each layer processing a particular component of the input data. The input layer receives the data input, while the output layer creates the network's ultimate output. The network can learn more complex relationships between the input and output by using one or more hidden layers that may exist between the input and output layers.

In a variety of fields, such as robotics, natural language processing, speech and picture recognition, ANNs have been applied. They have shown to be very useful for jobs that require pattern recognition and classification.

Single shot Detector (SSD):
Often employed in computer vision applications, a Single Shot Detector (SSD) is a kind of object detection technique. It is a deep neural network with the high accuracy and quickness needed to identify objects in pictures and movies.

SSD is a one-shot object detection approach, as opposed to some other object detection algorithms, including Region-Based Convolutional Neural Networks (R-CNN), which require numerous runs through the image with various regions of interest.

The SSD approach uses a convolutional neural network to provide bounding boxes and class scores for each object that is spotted from an input image. The network is often trained using a loss function that penalizes erroneous predictions and encourages the network to learn to detect objects of various sizes and shapes on a huge dataset of tagged images.

In real-time applications like robotics, autonomous cars, and surveillance systems, SSD has proven to be quite successful for object detection. Other applications, such pedestrian detection and facial detection, have also exploited it.

VGG Net Model:
The Visual Geometry Group at the University of Oxford created the VGG Net (Visual Geometry Group Network), a deep convolutional neural network architecture, in 2014. The ImageNet dataset, which comprises more than 1 million classified images from 1000 categories, was used in its development to attain excellent accuracy.

The design of the VGG Net is made up of a number of convolutional layers with tiny 3x3 filters, followed by layers that maximise pooling and, finally, layers that are fully connected. Depending on the version of the network being utilised, the architecture is fixed and includes 16 or 19 layers.

The VGG Net is known for its simplicity and uniformity, with each layer having the same number of filters and feature maps. This makes it easy to understand and modify the architecture for different tasks. However, it is also known for being computationally expensive and requiring a large amount of memory due to its deep architecture.

When the VGG Net was first released, it demonstrated state-of-the-art performance on the ImageNet dataset, and it has since been used as a benchmark for comparison with other

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deep learning architectures. It has also been used for a variety of other computer vision tasks, including segmenting data based on semantics and object detection.

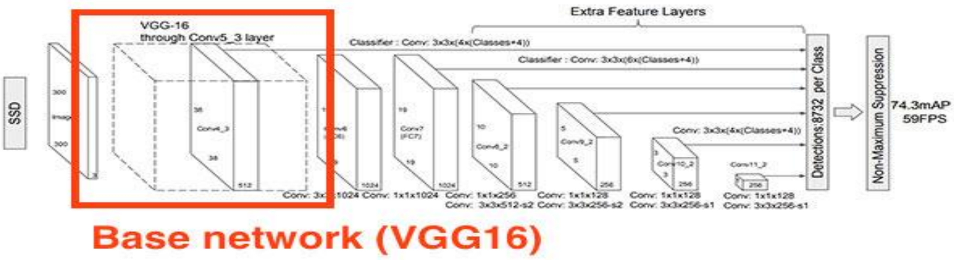

Fig3: working of VGG Net model

5.IMPLEMENTATION

Steps for executing the project:

1.Import all the libraries/packages.
2.Load the pretrained ImageNet SSD model.
3.Load MobileNetSSD_deploy.prototxt.txt which defines all the layers in the model.
4.Start the live video feed.
5.Take the live video frame by frame as images.
6. The images are then pre-processed.
7. We use Open CV's blobFromImage which performs certain pre-processing to convert it as a 4-dimensional blob.
8. All the objects (if any) are detected in that blob using the model.
9. If the probability of those detected exceeds certain threshold (which is 0.2 in our case), only then we will consider that the object is present.
10. The objects is then bounded in a bounding box.
11. A label along with the probability of success is displayed to the user in the live feed itself.
12. A siren is played if an animal is detected for a while and after send an alert message to the Farmers.
13. The live video feed can be closed using the key 'q'.

6. Results

The proposed scheme presents a novel approach to detect for any intrusion in farms. This approach has been implemented by the using neural networks. We have successfully developed a deep learning model using the deep neural network architecture to detect the presence of any animal in the farm. We were able to get a net frame rate of 18 frames per second (approximately).

Our application in action:

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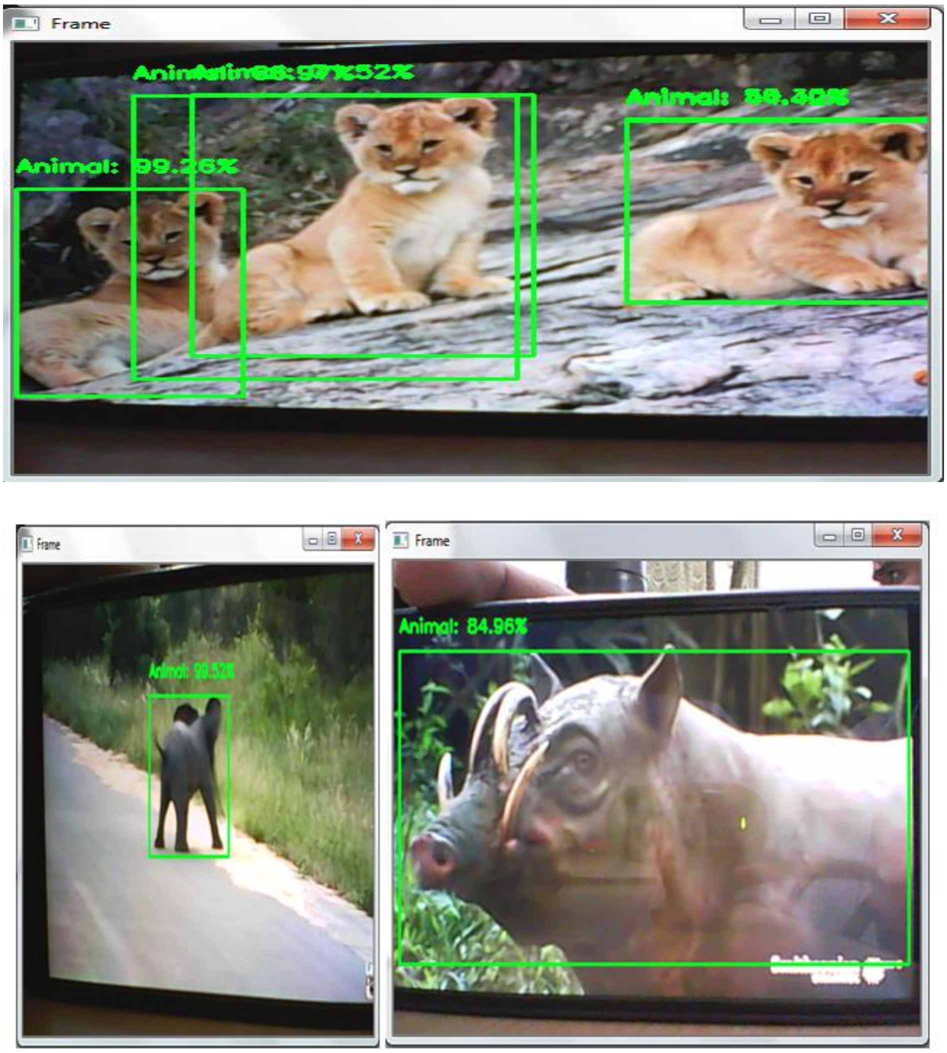

Fig4: Detection of multiple animals in bounded box and showing the accuracy percentage above the box

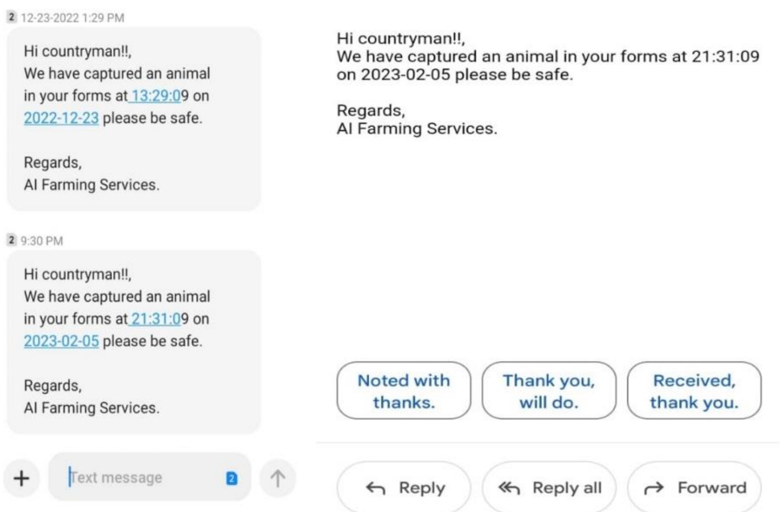

Fig5: Alerting the farmer through normal message and also through Gmail

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7. CONCLUSION

Using a Single Shot Detector (SSD) algorithm for animal detection in farms can be a promising approach, as it can provide accurate and real-time detection of animals in images and videos. This can help farmers monitor their animals more efficiently and effectively, which can lead to improved animal welfare, increased productivity, and better overall farm management.

The SSD algorithm can be trained on a large dataset of labeled images of different types of animals in various poses, lighting conditions, and backgrounds. The algorithm can then learn to detect animals of different sizes and shapes, and distinguish them from other objects in the scene.

However, there may be some challenges to implementing an SSD-based animal detection system in farms, such as variations in lighting and weather conditions, the presence of other objects in the scene, and the need for high-quality images and videos for accurate detection. Additionally, the system would require a large amount of training data, which may be difficult and time-consuming to collect and label.

Overall, the use of SSD for animal detection in farms has the potential to improve farm management and animal welfare, but careful consideration should be given to the specific needs and challenges of each farm before implementing such a system

8. REFERENCES

1. Kuo, P. H., Wang, Y. L., Huang, P. W., & Chen, C. H. (2021). An automated system for livestock monitoring using single shot detector. Journal of Sensors, 2021, 1-14.
2. Zhang, Z., Guo, J., Liu, H., & Liu, J. (2020). Automatic animal detection and recognition in pig farms based on SSD. Journal of Physics: Conference Series, 1658(4), 042032.
3. Wang, X., Zhao, H., Jia, W., & Zhang, L. (2020). A real-time livestock detection and counting system based on single-shot detector. In Proceedings of the 2020 IEEE 2nd Conference on Advances in Electronics, Communication and Computer Technology (pp. 458-461).
4. Chen, H., Zhang, Q., Hu, Y., & Sun, H. (2019). Real-time animal detection in farm videos using single-shot detection neural networks. Applied Sciences, 9(16), 3301.
5. Huang, W., Yang, Y., Zhou, X., & Liu, Z. (2019). Pig detection in videos using single shot detector. In Proceedings of the 2019 IEEE International Conference on Computational Science and Engineering (pp. 67-72).
6.Deshpande, Abhinav. (2016). Design and Implementation of an Intelligent Security System for Farm Protection from Wild Animals.5. pp.2319-7064.
7.M.S. Devi, Anita-, (2019). Animal Detection in Farm image using single shot detector. In International Journal of Advanced Research in Computer Science and Software Engineering.
8.Abhinav, T., Kumar, P., Kumar, A., (2020). Livestock Detection using Deep Learning based Single Shot Detector in UAV Images. In proceeding of the International Journal of Engineering and Advanced Technology.
9.Karthikeyan, R., Vijaykumar, R., (2019). Animal Detection in Farm Videos using Single Shot Detector. In International Journal of Engineering Research & Technology.