

Wildlife Detection Systems: A Literature Review of Emerging Approaches

Rajesh B ¹

Abstract

Currently human lives are in danger due to the attack from wildlife. The attacks are in forests, agricultural fields, and inroads. As a result, humans have to suffer losing their crops, pets, and their lives too. The animals that cross roads may collide with vehicles and this causes the loss of the life of not only the drivers but also the animals. To identify the road-crossing animals manually is a tedious task. This paper suggests a classification technique using deep learning which designs an automated Animal Detection System, which helps to detect and identify wild animals accurately. After identifying the animal, a message notification is sent to the inhabitants and the authorities as a warning signal. It also tries to prevent animal-vehicle collisions

Keywords: Deep Learning, Detection, Classification, Collisions

1. Introduction

The expansion of urban areas in modern times has resulted in widespread displacement of humans in forested areas. As a result, wild animals are forced to venture into the human settlements that often invade their routine activities. Food is the main issue for this problem. At this point, there is a tangible danger to any humans that carelessly cross the path of these animals. Hence, a need arises for the detection of wild animals at the border of human settlements close to wild habitats.

A reliable and effective warning mechanism would eliminate the risk of fatal human-animal conflict, both in the interest of protecting human lives and avoiding the loss of endangered

¹ Assistant Professor, School of Computer Science, DIST, Angamaly, Kerala, India
E-Mail: rajeshb@depaul.edu.in ORCID ID: 0009-0006-1918-8447

animals. Moreover, such a system would also be useful in wildlife sanctuaries and biosphere reserves to monitor the movement of animals at the border areas of such establishments which have often proved difficult to control. Although there has been a considerable amount of progress, software-based tools have not been explored to a satisfactory extent in these use cases.

2. Literature Review

Prof. D. D. Pukale, Komal Dudhane, Shreya Dawghat, Anushka Deshmukh, Sharwari Deshmukh[1]. “Wild Animal Detection and Identification, using Deep Learning”. They used YOLOv3 Machine Learning models and associated techniques to detect and identify animals. They used these techniques are used to predict and count animals. Using video processing applications, the identification of animals is impactful.

N. Banupriya, S. Saranya, Rashmi Jayakumar, Rashmi Swaminathan, Sanchithaa Harikumar, Sukitha Palanisamy [2], “Animal Detection Using Deep Learning Algorithm”. Used CNN for detecting the animal. The algorithm efficiently identifies animals with a high degree of accuracy, and the image of the discovered animal is displayed for a better result that can be used in various applications.

Sahil Faizal, and Sanjay Sundaresan[3] in their work titled “Wild Animal Classifier Using CNN” Used CNN for classification. The obtained accuracy is satisfactory for real-world use cases, detection of wild animals at night is the most challenging problem.

Molly K. Grace, Daniel J. Smith, Reed F. Noss[4], “Reducing the threat of wildlife-vehicle collisions during peak tourism periods using a Roadside Animal Detection System”, Used different sensors to inform drivers that they are entered RADS area.

Mansi Parikh, Miral Patel, Dulari Bhatt[5], “Animal Detection Using Template Matching Algorithm”. Used Template Matching Algorithm. They have used video-level processing techniques for the identification of specific objects, in recorded videos of the farm. Background sub-traction methods like frame differencing, a mixture of Gaussian, and the sum of absolute differences were implemented and tested on the video and the Gaussian method worked better

Gyanendra Kumar Verma, Pragya Gupta[6] “Wild Animal Detection Using Deep Convolutional Neural Network”. used DCNN. DCNN was proposed as a reliable and robust method for detecting animals in highly crowded photos. The crowded photos are obtained using camera-trap networks

Zhi Zhang, Zhihai He, and Wenming Cao[7], “Animal Detection from Highly Cluttered Natural Scenes Using Spatiotemporal Object Region Proposals and Patch Verification”. Faster-RCNN method for animal detection. Successfully developed an accurate method for animal object detection from highly cluttered natural scenes captured by motion-triggered cameras (camera traps). Also found that the DCNN and FV-HOG features can enhance the performance of each other during animal object verification.

Nedeljkovic[8], “Image Classification Based on Fuzzy Logic” Fuzzy Logic used for the classification of images. Fuzzy logic takes advantage of already created simple rules and equal or less time-consuming image classification. Considering the level of classification accuracy, fuzzy logic can be satisfactorily used for image classification.

S. Sharma, D. Shah[9] in their article “A Practical Animal Detection and Collision Avoidance System Using Computer Vision Technique” discussed the necessity of an automatic animal detection system and our algorithm for animal detection based on HOG and cascade classifier. The algorithm can detect an animal in different conditions on highways. The proposed system achieves an accuracy of almost 82.5 % regarding animal (cow) detection

3. COMPARISON OF VARIOUS ANIMAL DETECTION TECHNIQUES

This section provides an overview of different methods and findings in different areas

Table 3.1 Comparison Chart

Sl.No.	Author Name	Methods	Findings
[1]	Prof. D. D. Pukale, Sharwari	YOLOv3 Machine Learning models and associated techniques	These techniques are used to predict and count animals.

	Deshmukh. Komal Dudhane, et. al		Using video processing applications, the identification of animals impactful
[2]	N. Banupriya1, S. Saranya, Rashmi Jayakumar, Rashmi Swaminathan, Sanchitha Harikumar, Sukitha Palanisamy	Used CNN for detecting the animal.	The algorithm classifies animals efficiently with good accuracy and also the image of the detected animal is displayed for a better result so that it can be used for other purposes

[3]	Sahil Faizal, Sanjay Sundaresan	Used CNN for classification.	The obtained accuracy is satisfactory for real-world use cases, detection of wild animals at night is the most challenging problem.
[4]	Molly K. Grace, Daniel J. Smith, Reed F. Noss	Used different sensors to inform drivers that they have entered the RADS area	Roadside Animal Detection System did cause some drivers to reduce their speed, we they entered the RADS sensor array

[5]	Mansi Parikh, Miral Patel, Dulari Bhatt	Used Template Matching Algorithm	They have used video-level processing techniques for the identification of specific objects, in recorded videos of the farm. Background subtraction methods like frame differencing, a mixture of Gaussian, and the sum of absolute differences were implemented and tested on the video. The best one found is the Gaussian method.
-----	---	-------------------------------------	--

[6]	Gyanendra K. Verma and Pragya Gupta	DCNN	Proposed a reliable and robust method for animal detection in highly cluttered images using DCNN. The cluttered images are obtained using camera-trap networks.
[7]	Zhi Zhang, Zhihai He, and Wenming Cao	Faster-RCNN method for animal detection	Successfully developed an accurate method for animal object detection from highly cluttered natural scenes captured by motion-triggered cameras (camera traps). Also found

			that the DCNN and FV-HOG features can enhance the performance of each other during animal object verification.
[8]	Nedeljkovic,	Fuzzy Logic used for the classification of images	Fuzzy logic takes advantage of already created simple rules and image classification is equal or even less time-consuming. Considering the level of classification accuracy, fuzzy logic can be satisfactorily used

			for image classification
[9]	S. Sharma, D. Shah	HOG is used to detect an object in a video or image content.	The algorithm can recognize animals in various conditions on highways. The proposed approach detects animals with an accuracy of about 82.5%.
[10]	Abhineet Singh, Nehla Ghouaiel, Marcin Pietrasik, Gabriell Natha, Ken	RETINA, YOLO	Synthetic data generation employing segmentation masks to extract animals from photos of real

	Brizel, Nilanjan Ray		environments and insert them into target scenes was demonstrated to be an effective method. Coarse unsupervised masks outperformed accurate manual masks in training detectors on simulated pictures, demonstrating an automated approach.
--	-------------------------	--	--

4. Conclusion

In this research, various animal identification methods are investigated and contrasted in various locations to assess performance. The above table clearly shows that Machine Learning Models are employed in the majority of domains, with CNN providing the highest accuracy. The comparative table

demonstrates how the object identification techniques are performed in various contexts and datasets.

5. References

- [1] Prof. D. D. Pukale, Komal Dudhane, Shreya Dawghat, Anushka Deshmukh, Sharwari Deshmukh. “Wild Animal Detection and Identification, using Deep Learning”. IJCRT | Volume 11, Issue 7 July 2023 | ISSN: 2320-2882
- [2] Mansi Parikh, Miral Patel, Dulari Bhatt, “Animal Detection Using Template Matching Algorithm”, Vol. 1, Issue: 3, April 2013 (IJRMEET) ISSN: 2320-6586.
- [3] N. Banupriya¹, S. Saranya, Rashmi Jayakumar, Rashmi Swaminathan, Sanchithaa Harikumar, Sukitha Palanisamy, “Animal Detection Using Deep Learning Algorithm”, Journal of Critical Reviews ISSN- 2394-5125 Vol 7, Issue 1, 2020
- [4] Jinbang Peng, Dongliang Wang, Xiaohan Liao, Quanqin Shao, Zhigang Sun, Huanyin Yue, Huping Ye, “Wild animal survey using UAS imagery and deep learning: modified Faster R-CNN for kiang detection in Tibetan Plateau” , ISPRS Journal of Photogrammetry and Remote Sensing, Volume 169, November 2020, Pages 364-376
- [5] Molly K. Grace, Daniel J. Smith, Reed F. Noss, “Reducing the threat of wildlife-vehicle collisions during peak tourism periods using a Roadside Animal Detection System”, Accident Analysis & Prevention Volume 109, December 2017, Pages 55-62
- [6] Gyanendra Kumar Verma, Pragya Gupta “Wild Animal Detection Using Deep Convolutional Neural Network”, January 2018, DOI:10.1007/978-981-10-7898-9_27, In book:

Proceedings of 2nd International Conference on Computer Vision & Image Processing (pp.327-338)

[7] Nedeljko, “Image Classification Based On Fuzzy Logic” MapSoft Ltd, Zahumska 26 11000 Belgrade, Serbia and Montenegro

[8] Zhi Zhang, Zhihai He, and Wenming Cao, “Animal Detection from Highly Cluttered Natural Scenes Using Spatiotemporal Object Region Proposals and Patch Verification”

[9] S. Sharma, D. Shah, “A Practical Animal Detection and Collision Avoidance System Using Computer Vision Technique” DOI 10.1109/ACCESS.2016.2642981, 2169-3536 (c) 2016, IEEE Access

[10]. Abhineet Singh, Marcin Pietrasik, Gabriell Natha, Nehla Ghouaiel, Ken Brizel, Nilanjan Ray “Animal Detection in Man-made Environments”. arXiv:1910.11443 [cs.CV], <https://doi.org/10.48550/arXiv.1910.11443>

[11] Sahil Faizal, Sanjay Sundaresan, “Wild Animal Classifier Using CNN”, IJAR SCT, Volume 2, Issue 1, September 2022, <https://doi.org/10.48550/arXiv.2210.07973>

[12] S. Keerthana, Dr. E. Mary Shyla, “A Literature Survey On Wild Animal Detection Using Various Datamining Techniques”, IJRAR August 2018, Volume 5, Issue 3