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HYBRID DEEP NEURAL NETWORKS FOR REAL-TIME WILD ANIMAL ACTIVITY DETECTION AND ALERT SYSTEM

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ABSTRACT

Forestry workers and rural residents are becoming more and more concerned about the problem of animal assaults. Both drones and surveillance cameras are frequently used to monitor the movements of wild animals. To identify the sort of animal, track its movement, and offer its position, an effective model is necessary. The safety of both people and foresters may then be guaranteed by sending alert signals. Although methods based on computer vision and machine learning are widely employed for animal detection, their cost and complexity make it challenging to get adequate results. In order to identify animals and produce warnings depending on their behaviour, this research proposes a Hybrid Visual Geometry Group (VGG)−19+ Bidirectional Long Short-Term Memory (Bi-LSTM) network. To enable prompt action, these notifications are transmitted by Short Message Service (SMS) to the nearby forest office. With an average classification accuracy of 98%, a mean Average Precision (mAP) of 77.2%, and a Frame Per Second (FPS) of 170, the suggested model demonstrates significant gains in model performance. Using 40,000 photos from three distinct benchmark datasets with 25 classes, the model was evaluated both subjectively and statistically. Its mean accuracy and precision were higher than 98%. This approach is a dependable way to preserve human life and provide precise information based on animals.

1. INTRODUCTION

In general, animal activity detection creates numerous challenges for researchers due to the continuous streaming of inputs and the cluttered backgrounds. There are huge varieties of wildlife categories with different facial, nose, body, and tail structures. The detection and classification of such animals in video sequences and the processing of huge feature maps demand the need to develop a robust framework. . Such developments in real-time cases need large-scale video data for training and testing purposes and high GGPU-based computing resources. Moreover, the incorporating techniques should handle the data in an intelligent way to produce plausible results. Hence, there is a high demand for developing such a model to detect animal activities in forest regions. Although numerous advancements have been made in this technological era, research in this area still seeks higher attention to produce a strong model. With this work, we can save humans from sudden animal attacks as well as send alert messages with location information to the forest officers for quick

action. These systems offer better monitoring services and help to find the activities of animals and detect if there is any hunting by humans or hindrance to wildlife. These clusters of activities, such as tracking the animal object and finding its activity and generating the alert messages, pose huge complexity in the Deep Learning area. Research on this work, investigates the advancements in video analysis techniques and complex neural network-based architectures. Recent developments in Deep Learning techniques have produced impressive results in image recognition, classification, and generation tasks [1]. Due to these developments, we focus our aim on developing a robust model for monitoring the activities of animals and generating alerts to the forest officers in case of any abnormal activity such as hunting, animals entering into human living areas or agricultural land. The development of the proposed model investigates this problem from multiple angles to provide a better solution.

Object detection techniques play a vital role in understanding the components of images and their associated relationships. In the case of videos, it provides the movement and activity-based details explicitly. The conventional methods use hand-crafted mechanisms [2], [3] for feature extractions and produce tangible results. The development of deep learning models handles this task in an efficient way to reduce the overheads present in earlier studies. Earlier works use traditional machine learning methods to detect objects, but they become stuck when confronted with complex datasets and multimodal inputs. The deep model handles the features of an image effectively to explore the finely tuned investigation on pixels and combines the relevant features to construct feature maps. Feature maps help to predict the patterns, shapes, edges, and contours of objects and learn the structure of objects easily without any manual interventions. Deep learning models are designed to handle such complex data structures and scale large volumes of data. The hyper parameter optimization techniques and regularization methods regulate the deep neural network performance to produce high accuracy results. Generally, the object detection mechanisms are applied in diverse fields, such as face detection [4], [5], scene understanding [6], and salient object detection [7], [8].

The research studies about animal activity detection are still in their infancy levels. The earlier approaches need to be upgraded and fine tuned to produce plausible results. We have used four different benchmark datasets, which total 40K images. The proposed model has been evaluated qualitatively and quantitatively using reasonable sizes of images and quality metrics. On the other hand, it is obvious that integrating different deep networks in a hybrid way adds additional complexity overhead to the model development. However, the successful implementation of such models produces unimaginable results over a combination of object detection and class prediction tasks [9]. With this motivation, we propose the novel approach termed ‘‘hybrid VGG−19+Bi-LSTM

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networks'' to detect the animal activities and create alert messages in case any problem occurs. A novel network is proposed to detect the activities of diverse categories of animals simultaneously, monitoring the locomotion of animals in forest regions and dark areas [10]. The proposed approach uses VGG−19 pre-trained networks to classify the type of animal, and the Bi-LSTM network creates text based alert messages with location information. The surveillance and night vision camera based videos consist of spatial and temporal dynamics. The VGG−19 networks deal with spatial information, and BI-LSTM recurrent networks effectively handle the temporal details [11].

Experimental results are also demonstrated to compare the proposed approach with earlier methods and explore the valid justification results. The details of various levels of development are explained clearly and exhibit the quality of our work [12]. In object detection and classification models, there are huge complexities in finding the expected results. In large scale scenarios, the model performance bottleneck results in low performance and degrades the entire development process. The earlier studies handled these scenarios using a wider range of mechanisms [13]. Although the models produce significant improvements in accuracy, they fail to perform well in testing phases.

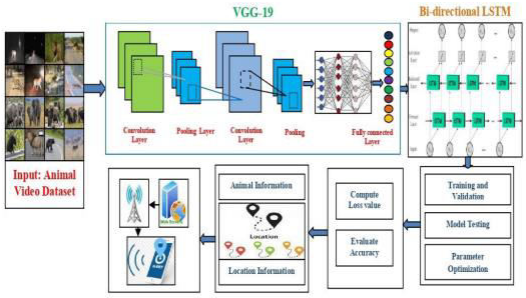
The contributions and objectives of the proposed techniques are listed as follows: 1) The proposed Hybrid VGG-19+Bi-LSTM model is built using deep neural networks with fine- tuned hyper parameters to yield greater recognition accuracy results.

2) The proposed model aims to achieve outstanding classification results by incorporating novel hybrid approaches.

3) 'The proposed system offers foresters more accurate prediction performance about animal detection and also supports them with faster alert services via SMS.

The further sections of the paper are arranged as follows: Section II discusses related works and identifies shortcomings in previous developments, while Section III describes the proposed VGG−19+Bi-LSTM system architecture and implementation details. Section IV presents the experimental results of the proposed model evaluation for four different benchmark datasets. Section V concludes the summary of the entire work and its future scope in a wider range of applications.

2. SYSTEM ARCHITECTURE



3. EXISTING SYSTEM

The author Zhang et al. proposed wild animal detection using a multi-level graph cut approach for investigating spatial details and a cross-frame temporal patch

verification technique for temporal details. The model analyzes the foreground and background details of the camera trap videos. This approach uses a Camera trap and Change Detection net dataset for segmenting the animal object from natural scenes based on cluttered background videos. Although the model produces a high detection rate, fails to perform well in detecting crucial details like location details, and human interruptions. The author [14] proposed animal detection using Convolutional Neural Network (CNN), and the author proposed animal detection using Iterative Embedded Graph Cut (IEGC) techniques to form regions over images and DeepCNN features and machine learning classification algorithms [15] for classification purposes. Although these models verify the extracted patches are background or animal, still need improvements in classification performance.

Object Detection using deep learning methods attained new heights in computer vision applications. The detection of objects present in images or videos by using object localization and classification techniques gives higher support in detecting various objects present in an image or video. From the extracted results, we can count the number of objects and their activity. This technique is highly used in video surveillance and security-based applications, tracking objects in hidden boxes, monitoring fraudulent activity in public and crowded areas, traffic monitoring and identification of vehicle theft, vehicle number plate recognition, and Object Character Recognition (OCR) [16].

This paper aims to identify the movements of animals around forest space, provides alert information to the forest officers in case of hunting, crossing the forest lines, any hindrance to villagers and tourists people, and detection of trespassing activity. The development of various methods for employing object detection in different environments and diverse applications shows the progress and importance of object detection in research fields and gained more attention. Moreover, further research works in this area provide useful insights into numerous applications and construct powerful frameworks for detecting objects in different scenarios. The Fast R-CNN techniques [17] are widely used for object detection due to their high accuracy and improved training performance. The introduction of the Faster R-CNN technique [18] rapidly improves the detection performance of the model by employing full image-based convolution features and region-based networks. The Histogram of Oriented Gradients (HOG) feature descriptors [19] uses the Region of Interest (ROI) techniques to identify the objects faster than earlier approaches. The conventional R-CNN technique [20] introduces efficient detection methods by incorporating region proposal networks and ConvNet. This method detects the thousands of object classes in an image or video using annotated information. The R-CNN techniques do not use any approximation techniques and hashing methods for predicting the object regions. R-FCN techniques [21] use weighted full convolution layers to detect object's region

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and finds ROI to detect the category of objects and its background details.Object detection techniques also sounds good with the help of deep learning techniques in the field of autonomous vehicles [22] and traffic scene object detection [23] also.

The Single Short Detector (SSD) methodology [24] uses bounding boxes based discretization techniques to effectively handle feature map information and large volume data. The Spatial Pyramid Pooling (SPP-net) [25] computes the feature maps in single computations and provides high robustness to the object detection tasks using sub-region-based fixed length representations. The You Only Look Once (YOLO) architecture achieves faster results by processing 155 frames per second in real-time cases. This technique uses an end to end approach to detect the objects using regression and probabilistic computations instead of considering classification approaches and produces remarkable results in object detection with a lower false-positive rate. The detailed investigation is done by the researchers with respect to background subtraction and elimination. The authors used different approaches to detect the background details such as estimating multiple hypotheses, non-parametric model [26], and global statistic-based methods [27], background cut [28].

Disadvantages

• The complexity of data: Most of the existing machine learning models must be able to accurately interpret large and complex datasets to detect Wild Animal Activity Detection.

• Data availability: Most machine learning models require large amounts of data to create accurate predictions. If data is unavailable in sufficient quantities, then model accuracy may suffer.

• Incorrect labeling: The existing machine learning models are only as accurate as the data trained using the input dataset. If the data has been incorrectly labeled, the model cannot make accurate predictions.

4. PROPOSED SYSTEM

The proposed architecture comprises five phases of development steps, which includes data pre-processing, animal detection, VGG−19 pre-trained model-based classification, extracting the prediction results, and sending alert messages. In the data pre-processing phase, 45k animal images were collected from different datasets such as camera trap, wild animal, and the hoofed animal dataset. The collected images were rescaled to the size of 224×224 pixels and denoised.

In the second phase, we pass the pre-processed images into YOLOR object detection model [39], which identifies the animal present in an image using bounding boxes as illustrated in Fig. 4. In the third phase, using hybrid VGG−19+Bi-LSTM model we perform image classification tasks and class label prediction was done and animal details are extracted using LSTM Networks. In the fourth phase, we collect the location information of the animal, and the web server creates a SMS alert and sends it to the forest officers. Finally, remedial action will be taken by the forest officers to save the animals and human lives.

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Advantages

1) The proposed Hybrid VGG-19+Bi-LSTM model is built using deep neural networks with fine- tuned hyper parameters to yield greater recognition accuracy results.
2) The proposed model aims to achieve outstanding classification results by incorporating novel hybrid approaches.
3) 'The proposed system offers foresters more accurate prediction performance about animal detection and also supports them with faster alert services via SMS.

5. IMPLEMENTATION

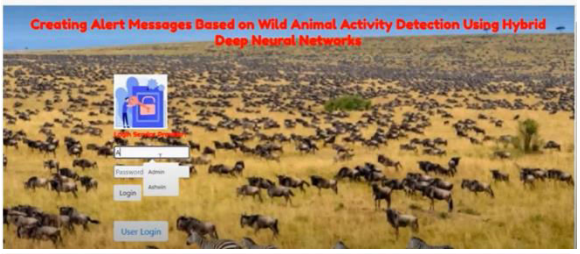
Modules description

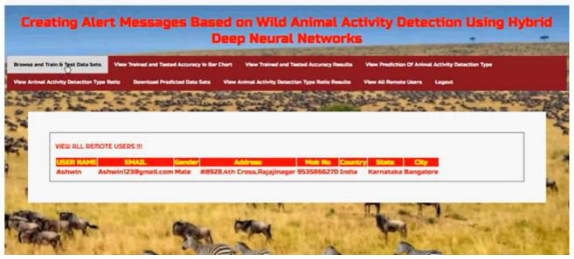
Service Provider
In this module, the Service Provider has to login by using valid user name and password. After login successful he can do some operations such as Browse and Train & Test Data Sets, View Trained and Tested Accuracy in Bar Chart, View Trained and Tested Accuracy Results, View Prediction Of Animal Activity Detection Type, View Animal Activity Detection Type Ratio, Download Predicted Data Sets, View Animal Activity Detection Type Ratio Results, View All Remote Users.

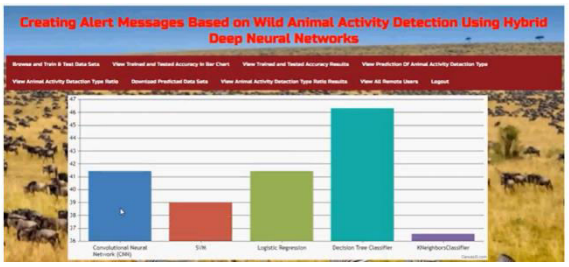
View and Authorize Users
In this module, the admin can view the list of users who all registered. In this, the admin can view the user's details such as, user name, email, address and admin authorizes the users.

Remote User
In this module, there are n numbers of users are present. User should register before doing any operations. Once user registers, their details will be stored to the database. After registration successful, he has to login by using authorized user name and password. Once Login is successful user will do some operations like REGISTER AND LOGIN, PREDICT ANIMAL ACTIVITY DETECTION TYPE, VIEW YOUR PROFILE.

6. RESULTS







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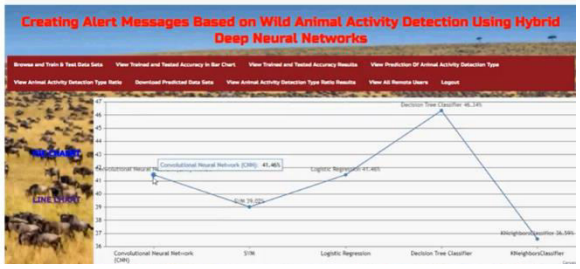

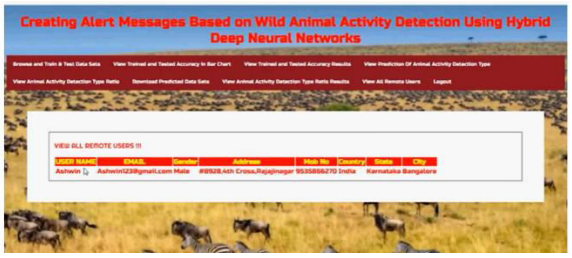

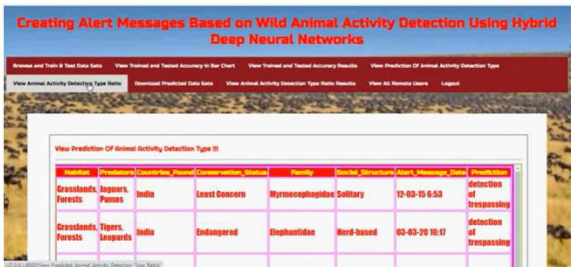

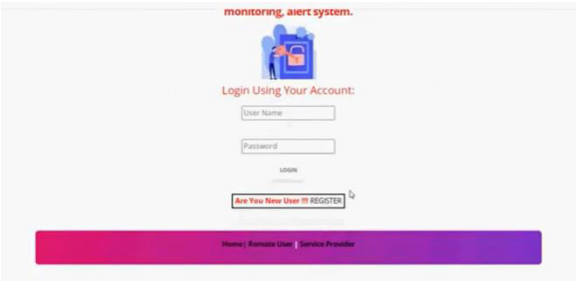

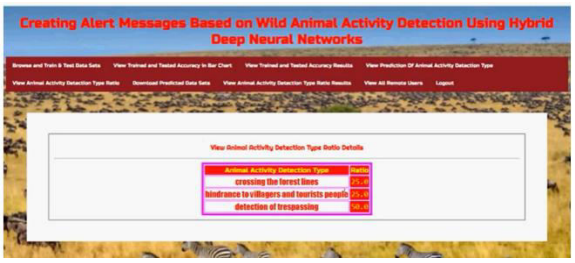

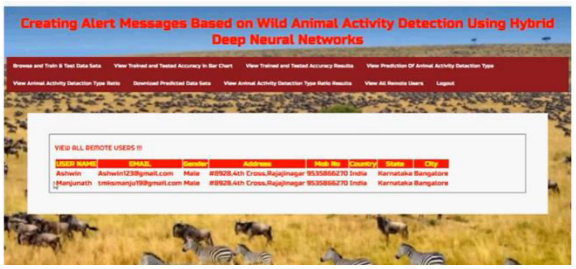

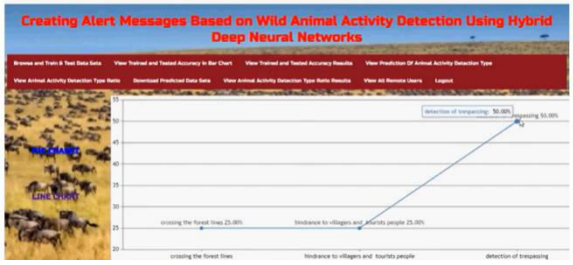

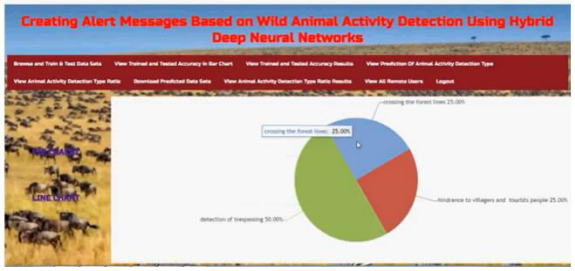

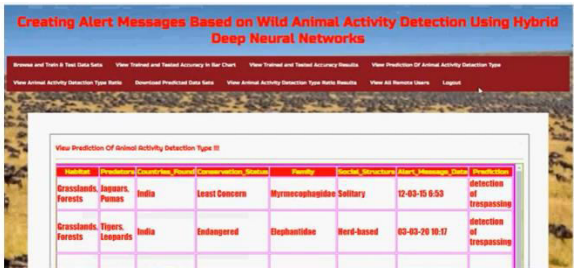

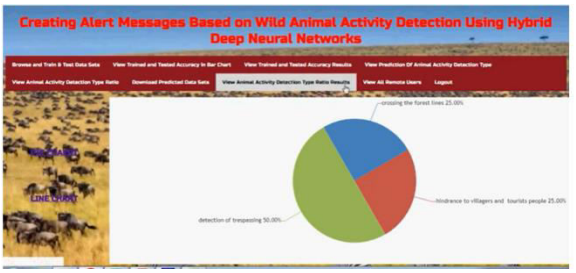

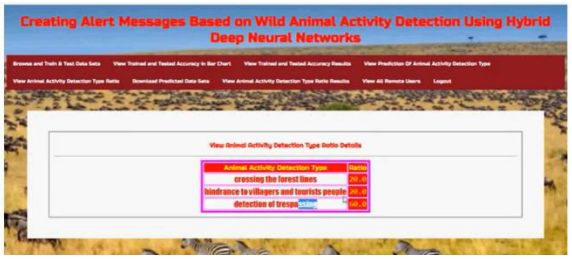

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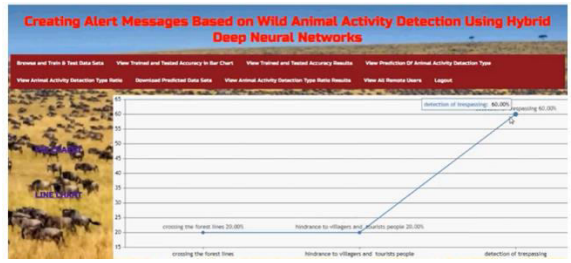

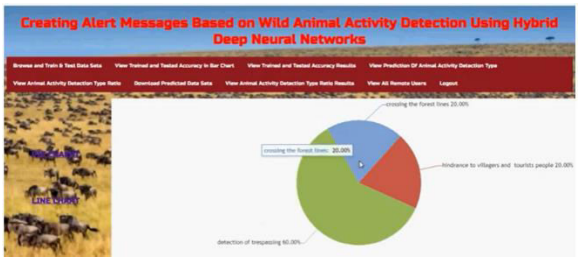

7. CONCLUSION

The hybrid VGG−19+Bi-LSTM framework for identifying wild animals and tracking their movements is presented in this article. By alerting the forest ranger, this hybrid technique significantly reduces the risk of human hunting and protects people from unexpected animal assaults. This model presents new ways to improve deep learning methods' performance in real-time scenarios and broader applications. Four distinct benchmark datasets including animal-based data—the camera trap dataset, the wild animal dataset, the hoofed animal dataset, and the CD net data set—have been used to assess the suggested approach. The experimental findings demonstrate our model's enhanced performance across a range of quality parameters. Above 98% average classification accuracy, 77.2% mean Average Precision (MAP), and 170 FPS are achieved using the suggested hybrid VGG-19+Bi-LSTM model. The suggested hybrid VGG-19+Bi-LSTM model now outperforms previous methods and yields better results in less computing time.

REFERENCES

[1] S. Aarthi and S. Chitrakala, ‘‘Scene understanding—A survey,’’ in *Proc. Int. Conf. Comput., Commun. Signal Process. (ICCCSP)*, Jan. 2017, pp. 1–4.

[2] N. Ahuja and S. Todorovic, ‘‘Connected segmentation tree—A joint representation of region layout and hierarchy,’’ in *Proc. IEEE Conf. Comput. Vis. Pattern Recognit.*, Jun. 2008, pp. 1–8. [3] T. A. Assegie, P. K. Rangarajan, N. K. Kumar, and D. Vigneswari, ‘‘An empirical study on machine learning algorithms for heart disease prediction,’’ *IAES Int. J. Artif. Intell. (IJ-AI)*, vol. 11, no. 3, p. 1066, Sep. 2022.

[4] N. Banupriya, S. Saranya, R. Swaminathan, S. Harikumar, and S. Palanisamy, ‘‘Animal detection using deep learning algorithm,’’ *J. Crit. Rev.*, vol. 7, no. 1, pp. 434–439, 2020.

[5] M. Cheng, Z. Zhang, W. Lin, and P. Torr, ‘‘BING: Binarized normed gradients for objectness estimation at 300fps,’’ in *Proc. IEEE Conf. Comput. Vis. Pattern Recognit.*, Jun. 2014, pp. 3286–3293.

[6] J. Dai, Y. Li, K. He, and J. Sun, ‘‘R-FCN: Object detection via region-based fully convolutional networks,’’ 2016, *arXiv:1605.06409*.

[7] M. De Gregorio and M. Giordano, ‘‘Change detection with weightless neural networks,’’ in *Proc. IEEE Conf. Comput. Vis. Pattern Recognit. Workshops*, Jun. 2014, pp. 409–413.

[8] B. Natarajan, E. Rajalakshmi, R. Elakkiya, K. Kotecha, A. Abraham, L. A. Gabralla, and V. Subramaniyaswamy, ‘‘Development of an end-toend deep

learning framework for sign language recognition, translation, and video generation,'' *IEEE Access*, vol. 10, pp. 104358–104374, 2022.

[9] W. Dong, P. Roy, C. Peng, and V. Isler, ''Ellipse R-CNN: Learning to infer elliptical object from clustering and occlusion,'' *IEEE Trans. Image Process.*, vol. 30, pp. 2193–2206, 2021.

[10] R. Elakkiya, P. Vijayakumar, and M. Karuppiah, ''COVID_SCREENET: COVID-19 screening in chest radiography images using deep transfer stacking,'' *Inf. Syst. Frontiers*, vol. 23, pp. 1369–1383, Mar. 2021.

[11] R. Elakkiya, V. Subramaniyaswamy, V. Vijayakumar, and A. Mahanti, ''Cervical cancer diagnostics healthcare system using hybrid object detection adversarial networks,'' *IEEE J. Biomed. Health Informat.*, vol. 26, no. 4, pp. 1464–1471, Apr. 2022.

[12] R. Elakkiya, K. S. S. Teja, L. Jegatha Deborah, C. Bisogni, and C. Medaglia, ''Imaging based cervical cancer diagnostics using small object detection—Generative adversarial networks,'' *Multimedia Tools Appl.*, vol. 81, pp. 1–17, Feb. 2022.