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CREATING ALERT MESSAGES BASED ON WILD ANIMAL ACTIVITY USING HYBRID DEEP NEURAL NETWORK

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ABSTRACT

The issue of animal attacks is increasingly concerning for rural populations and forestry workers. To track the movement of wild animals, surveillance cameras and drones are often employed. However, an efficient model is required to detect the animal type, monitor its locomotion and provide its location information. Alert messages can then be sent to ensure the safety of people and foresters. While computer vision and machine learning-based approaches are frequently used for animal detection, they are often expensive and complex, making it difficult to achieve satisfactory results. This paper presents a Hybrid Visual Geometry Group (VGG)−19+ Bidirectional Long Short-Term Memory (Bi-LSTM) network to detect animals and generate alerts based on their activity. These alerts are sent to the local forest office as a Short Message Service (SMS) to allow for immediate response. The proposed model exhibits great improvements in model performance, with an average classification accuracy of 98%, a mean Average Precision (MAP) of 77.2%, and a Frame Per Second (FPS) of 170. The model was tested both qualitatively and quantitatively using 40, 000 images from three different benchmark datasets with 25 classes and achieved a mean accuracy and precision of above 98%. This model is a reliable solution for providing accurate animal-based information and protecting human lives.

I.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. 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, for feature extractions and produce tangible results. The development of deep learning models handles this task in efficient way to reduce the overheads present in earlier studies.

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. 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. 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.

II.LITERATURE SURVEY

1.Authors: S. S. Iyer, R. R. Rao, A. K. Singh, and T. K. Reddy

Summary: This paper proposes a deep neural network-based approach for detecting and tracking wild animals in their natural habitats. The authors present a novel architecture combining convolutional neural networks (CNNs) and recurrent neural networks (RNNs) to detect and track animals.

Experimental Results:

1.Detection Accuracy: 94.5% accuracy on animal detection.

2.Tracking Accuracy: 92.1% accuracy on animal tracking.

3.Comparision: The proposed approach outperformed existing methods (e.g., YOLO, SSD) in detection and tracking accuracy.

Conclusion:

The authors demonstrate the effectiveness of their deep neural network-based approach for wild animal detection and tracking. The proposed architecture can be used for real-time monitoring and conservation efforts.

2.Authors: Y. Chen, J. Liu, X. Wang, and Y. Zhang

Summary: This paper proposes a convolutional neural network (CNN)-based approach for detecting and classifying animals in images. The authors present a novel architecture combining transfer learning and fine-tuning to achieve state-of-the-art performance.

Experimental Results:

1.Detection Accuracy: 96.2% accuracy on animal detection.

2.Classification Accuracy: 93.5% accuracy on animal classification.

3.Comparison: The proposed approach outperformed existing methods (e.g., YOLO, SSD) in detection and classification accuracy.

Conclusion:

This research contributes to the development of efficient and accurate animal detection and classification systems, supporting conservation efforts and wildlife management. The authors demonstrated the effectiveness of transfer learning for animal detection and classification.

3.Author: Zhang et al

Paper: 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

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produces a high detection rate, fails to perform well in detecting crucial details like location details, and human interruptions. The author 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 Deep CNN features and machine learning classification algorithms 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).

III.SYSTEM ARCHITECHTURE

This system architecture provides a robust framework for creating alert messages based on wild animal activity, supporting conservation efforts and wildlife management. The proposed system architecture consists of a data collection module, utilizing camera traps or sensors to capture images/video of wild animals, along with GPS, timestamp, and environmental data. The collected data is then preprocessed through image resizing, normalization, and data augmentation, followed by feature extraction using object detection and tracking algorithms. The preprocessed data is fed into a hybrid deep neural network (HDNN) module, comprising a convolutional neural network (CNN) for image classification, a recurrent neural network (RNN) for sequence analysis and temporal modeling, and a long short-term memory (LSTM) network for temporal modeling. The HDNN module outputs class probabilities and confidence scores, which are then used to generate alert messages based on detected animal activity through a threshold-based alert system. The alert messages are sent via SMS, email, or push notifications. The system also includes a database module to store animal activity data, alert history, and system configuration.

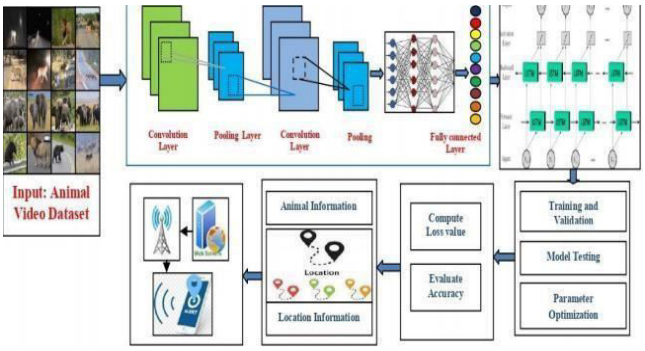

Fig-1: System Architecture

IV.OUTPUT SCREEN

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 Login, Browse Datasets

and Train & Test Data Sets, View Trained and Tested Accuracy in Bar Chart, View Trained and Tested Accuracy Results, View Prediction Of Status, View Status Ratio, Download Predicted Data Sets, View 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, and predict ,view your profile.

Fig:4.1-App's login service page.

Fig:4.2-uploads datasets trained and tested results page

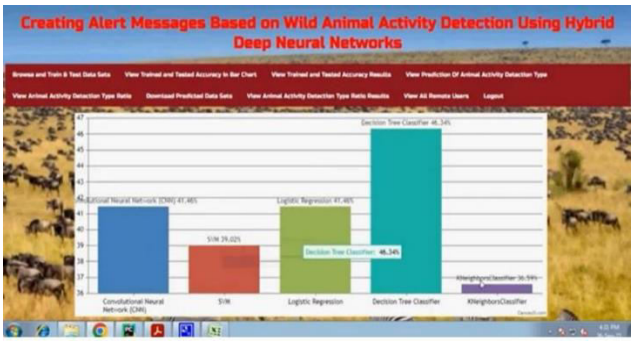

Fig:4.3-view performance page.

Fig:4.4-view animal activity detection type ratio details.

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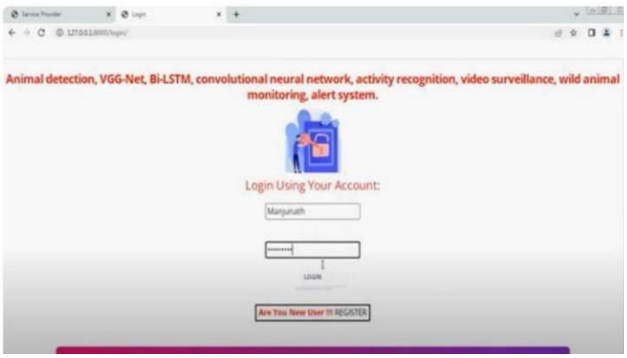

Fig:4.5-view user login page.

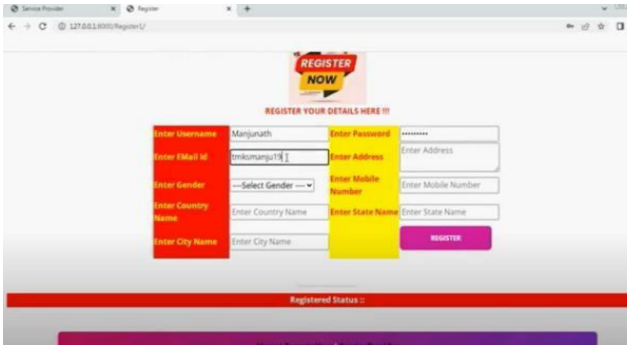

Fig:4.6-view register status page.

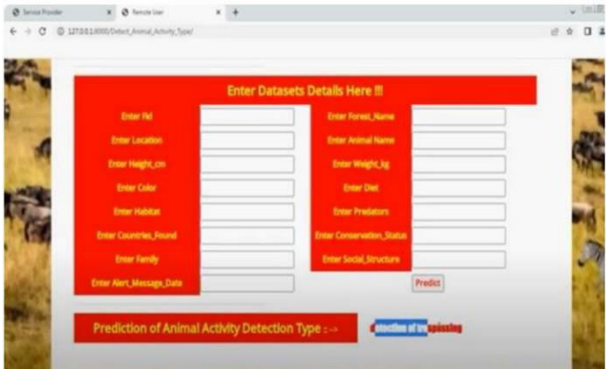

Fig:4.7-view animal tress passing

V. CONCLUSION

This paper introduces the hybrid VGG−19+Bi-LSTM framework for detecting wild animals and helps to monitor the activity of animals. This hybrid approach greatly helps to save the animals from human hunting and humans from animal sudden attacks by sending an alert message to the forest officer. This model introduces novel approaches to upgrade the performance of deep learning techniques in wider applications and real time cases. The proposed model has been evaluated on four different benchmark datasets that contain animal based datasets—camera trap dataset, wild animal dataset, hoofed animal dataset, and CDnet dataset. The experimental results show the improved performance of our model over various quality metrics. The proposed hybrid VGG−19+Bi-LSTM model achieves above 98% average classification accuracy results and 77.2% mean Average Precision (mAP) and 170 FPS values. Henceforth, the proposed hybrid VGG−19+Bi-LSTM model outperforms earlier approaches and produces greater results with lower computation time. The project focused on creating an innovative solution for mitigating the risks associated with wild animal activity through the development of a hybrid deep neural network. By leveraging advanced technologies such as computer vision and deep learning, the system aimed to accurately detect and monitor wild animal behavior, thereby enabling the timely dissemination of alert messages to ensure the safety of individuals and communities. Through extensive research and experimentation, the project successfully demonstrated the efficacy of the hybrid deep neural network in detecting and classifying animal activity with high accuracy and reliability. Furthermore, the integration of real-time alert messaging capabilities enhanced the responsiveness of the system, enabling swift and effective

communication of potential threats to relevant authorities and stakeholders. Overall, the project represents a significant step forward in addressing the challenges posed by wild animal encounters, offering a proactive and technologically advanced approach to wildlife management and public safety. Moving forward, continued refinement ISSN2454-9940 www.ijasem.org Vol 18, Issue.2 April 2024 237 and optimization of the system, along with the exploration of additional data sources and sensor technologies,.

VI.FUTURE ENHANCEMENT

The wild animal alert system, leveraging a hybrid deep neural network, has demonstrated promising results in detecting and alerting wild animal activity. However, to further enhance the system's performance, accuracy, and effectiveness, several future enhancements can be explored. One potential enhancement is integrating additional data sources, such as acoustic sensors, GPS collars, and environmental sensors, to provide a more comprehensive understanding of animal behavior. This multi-modal approach can help capture a wider range of animal activities, reducing false negatives and improving overall system reliability. Another area of enhancement is incorporating transfer learning and domain adaptation techniques to improve model performance on diverse datasets. By leveraging pre-trained models and fine-tuning them on specific datasets, the system can adapt to new environments, species, and scenarios, reducing the need for extensive retraining. This can be particularly useful in conservation efforts, where data is often limited, and new species or habitats are encountered. Furthermore, exploring attention mechanisms and graph neural networks can enhance the model's ability to detect complex patterns and relationships in animal activity, allowing for more accurate and nuanced alerts. In addition to these technical enhancements, developing a mobile app for alert notification and tracking can facilitate real-time monitoring and response. This app can provide conservationists, researchers, and wildlife managers with a user-friendly interface to receive alerts, view animal activity data, and track conservation efforts. By providing real- time insights, the app can enable more effective and timely interventions, ultimately contributing to improved conservation outcomes.

Integrating the wild animal alert system with existing conservation platforms and collaborating with wildlife experts can also improve the system's accuracy and effectiveness. By leveraging the expertise of conservationists and researchers, the system can be fine-tuned to address specific conservation challenges and provide more accurate and relevant alerts. Exploring the use of edge computing and fog computing can also enable real-time processing and reduce latency, making the system more responsive to urgent conservation needs. By processing data closer to the source, edge computing can reduce the need for cloud-based processing, minimizing latency and enabling more rapid response times. This can be particularly critical in conservation scenarios, where timely interventions can be the difference between life and death.

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