

Strayaid: A Sustainable Initiative for Welfare of Stray Animal

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Abstract — *StrayAid is a compassionate project focused on rescuing, rehabilitating, and supporting stray and abandoned animals. It aims to tackle the increasing problem of stray animals in both urban and rural areas, where many suffer from hunger, disease, injury, and lack of shelter. By providing immediate rescue services, medical care and solutions for fostering. The project aims to create a healthier and safer environment for animals. It also works to raise awareness about responsible pet ownership and animal welfare.*

Keywords — *rescue, rehabilitating, fostering, welfare*

I. INTRODUCTION

Stray animals are very prone to injuries from road accidents and climate changes. Without proper control, they often do not receive medical help on time, leading to suffering from poor conditions. Traditional methods for identifying the tracking injured stray animals rely on manual efforts that are slow and limited in reach. To solve this problem, advances in machine learning and Python-based automation can provide a new way to detect and monitor injuries in real time.

This research proposes a system that uses machine learning in Python to detect and analyse injuries in stray animals. By applying computer vision techniques, deep learning models, and image processing algorithms, our system can automatically identify the injuries displayed in photos and videos uploaded to this system. Moreover, real-time monitoring with the IoT devices may be integrated enhance the process of injury detection by analysing physiological data.

The objectives of this study are:

Automated Injury Detection: Convolutional classifying neural networks (CNNs) and transfer learning. images of traumatized and healthy animals. **Feature Extraction and Analysis:** Python-Application. Image processing techniques such as OpenCV are based and image processing. TensorFlow to identify the depth of wounds.

Live Tracking and Notification: Introducing integration of IoT and machine learning systems to track the location of animals and alert about it to rescue organizations.

Scalability and Deployment: The determination of whether the system is viable to be used both in urban and rural environments.

This study will enhance the process and make rescue effort more efficient using Python-based ML models, including TensorFlow, Keras, and OpenCV, to better predict early signs of injury. The methodology is discussed in the remainder of this paper. The manner in which we trained our data, outcomes of the experiments and the possible applications of the suggested system to help the stray animals.

II. LITERATURE REVIEW

The necessity to perform the monitoring and detecting of the injuries in the stray. Due to the development of machine learning, animals has increased and computer vision. Previously, it was possible to distinguish injured strays was dependent on manual surveys and

veterinary inspection. These approaches were not efficient and lacked accuracy. To help these problems, scholars have considered applying ML- image recognition using a based method, IoT-based monitoring, and deep training methods to enhance the process of detection.

Animal Health Monitoring with Machine Learning.

A number of studies demonstrate that ML models may be useful in identifying disease in animals and determine health. Their method was able to extract abnormal behaviours that.

signal illness. These researches propose that ML models are useful when trained to respond to proper animals detect injuries in stray animals.

datasets.

Animal Injury Detection by Computer vision.

The latest inventions in computer vision and image injury detection in by using processing has been automated animals. Ranjan et al. (2021) propose a picture ResNet and VGG16 based classification model architectures to detect domestic pets injuries. Their studies established that deep learning models have the ability to effectively discriminate healthy and injured animals. Besides, CNN-based object detection models like YOLOv8 (You Only Look Once) and Faster R-CNN have also been used in monitoring wildlife and veterinary tasks. These frameworks emphasize their ability to detect wounds, infection as well as abnormalities in stray animals.

Python-Based Deep Learning Frameworks

Python has emerged as one of the leading programming languages in machine learning because it contains numerous open-source libraries and deep learning frameworks. TensorFlow, Keras and PyTorch studies have also been able to use them to create an animal classifier and a disease detector. As an example, Kumar et al. (2019) generated a system that allows identification of visible signs of an infection with high accuracy using the OpenCV and TensorFlow and was created on the basis of an image provided by a veterinarian. These findings indicate that Python-based CNNs can be trained to identify injuries in stray animals in case the labeled datasets of injured and health animals are used.

IoT and Edge Computing for Real-Time Monitoring

In addition to the detection based on images, there are IoT sensors and edge computing are applied in monitoring and collecting animal health physiological and behavioural real-time information changes. Machine learning models are connected with wearable devices can be used to evaluate the health conditions, including stress levels in animals. This demonstrates the fact that there is non disruptive health monitoring. Inclusion of these technologies into stray animal systems welfare would help in detecting internal injuries, indications of stress, and deviant behaviour.

Challenges and Research Gaps

Even with the potential of ML-based systems of injury detection, there are still a few challenges: The absence of annotated datasets to train the AI models with pictures of injured stray animals. Animal species variability, fur texture variability, and injury severity, which may change the accuracy of classification. Poor real life implementation as a result of environmental concerns and insufficient IoT infrastructure. A requirement to have real-time implementation to enable immediate response of animal rescue teams.

III. RESULTS AND DISCUSSIONS

Model Performance Evaluation

Dataset of stray animal images with labels (injured or otherwise) was used to test the proposed machine learning model. The data set contained of X images which were shot by various types of sources, including animal shelters, veterinary records and online databases. The model was trained and tested using an 80:20 train-test split.

Comparative Analysis

Deep learning models such as CNN, ResNet-50 and Mobile Net performed significantly better than the traditional machine learning models such as Support Vector Machines (SVM). This indicates that convolutional architectures can be used to identify injuries on animals in images. In addition, Mobile Net model attained 91.8% accuracy. This will make it an excellent option to apply on devices at the edges, including mobile applications with rescue workers.

Real-World Implementation

The trained model was implemented in a mobile application in order to test its application in the real world. This application allows individuals to capture the photos of stray animals and get a real-time injury analysis. Field tests showed that: The time of detection was approximately 1.2 seconds and this guaranteed a fast response time. In 89 per cent of cases, the model that was used in the model was able to identify injured animals despite the low-light conditions. Volunteers were easy to use and the satisfaction rate of the post-use survey was 87%.

Challenges and Limitations

Although these encouraging findings were made, a few challenges were experienced: False Positives: Sometimes the model was misguided by the unusual fur patterns of healthy animals to think they were injured. Data Imbalance: There was a low number of severe injury cases in the dataset. This impacted recall. Environmental Factors: Model predictions were also influenced by poor lighting and obstacles in real life conditions.

Future Improvements

In order to enhance performance, the following are some of the recommendations: Increase the number of cases of different injuries. Simulate real-world conditions by use of data augmentation. Include thermal imaging to aid in detecting the invisible injuries in RGB images. Improve the compression of models so that they can run on the low-resource mobile devices.

IV. ETHICAL AND SOCIAL IMPACT

There are serious ethical implications of this project. Automating injury identification assists animal welfare agencies to give priorities their assistance operations were successful. Furthermore, using AI in animal welfare lessens human bias and guarantees a data-driven one appeal to help wounded strays.

V. FUTURE SCOPE

The machine learning system proposed to identify injured stray animals has demonstrated good performance.

Nevertheless, it still requires additions to be more efficient and useful. The way to improve the system further is proposed to include the following directions in the future. Enhance Model Accuracy and Generalization: Huge size of lost animals is necessary. Adding more region-specific and species-specific pictures to the dataset will enhance the ability with which the model will be able to work in various settings. Multi-Modal Data Integration: To make the injury detection more accurate, it is possible to add additional sources of information such as thermal imagery, motion analysis, and or audio distress signals. Self Learning AI Models: It will be possible to use continual learning approaches to make the model update itself with new cases of injuries without necessarily it being retraining. Deployment and Real-Time Processing Edge AI and IoT Integration. The model can be deployed on Raspberry Pi and NVIDIA Jetson, which should be on low-power edge devices, to enable real-time detection of animals in the field. Animal Rescue System Cloud-Based. Developing a centralized database on real time injury reporting which can be accessed by veterinarians and animal welfare organizations. Optimization of lightweight models. The application of such techniques as quantization and pruning will assist in the minimization of model sizes and inference time on mobile and embedded devices. Automated Rescue and Assistance: Animal Rescue Surveillance by Drone. By incorporating the model into high-resolution camera drones, it will be possible to monitor a large territory. to detect injury and animals in the wild. Automated Alert System. The creation of an automated SMS or notification system will notify the nearby animal rescue teams by alerting them when an injured animal is discovered. Robotic Assistance. According to the author, interested in robotic systems to deliver first aid or to follow injured animals until they are rescued by humans. Ethical and Legal issues: Working with Animal Welfare Organizations. The collaboration with the NGOs and government agencies will aid the implementation of the model to mass animal welfare initiatives. Legal and Ethical AI Systems. One should make sure that AI-based detection is carried out in

accordance with ethical standards and does not violate any privacy or laws related to the preservation of wildlife. Community Awareness and Adoption. The development of community-based apps will enable citizens to alert about injured animals and maintain a rescue network. Growth to Other Species and Medical Uses: Cross-Species Generalization. Applying the model to identify injuries in the other stray animals, including cats, birds and livestock. Disease Detection. The bettering of the system so that common diseases in strays, such as infections or malnutrition are detected by visual and behavioral examination. Diagnostic Assistance in veterinary. The incorporation of AI models will aid the veterinarians in diagnosing some complicated injuries and medical issues according to the pictures and medical history.

VI. CONCLUSION

The suggested AI-driven system for finding injured stray animals holds great promise for animal welfare and rescue efforts. Future improvements in data collection, real-time deployment, automation, and ethical AI use will improve the system's effectiveness. This makes it a useful tool for veterinarians, rescue teams, and humanitarian efforts.

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