Conservation of Wildlife from Poaching by using Sound Detection and Machine Learning

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***Abstract* - In the ecosystem, various living beings live in exact harmony with each other. Co-existence of both in the respective habitat makes the environment stable, but due to globalization and industrialization these animals are losing their habitats and entering the human habitats in search for shelter. In this paper we cogitate to safeguard wildlife as it is an emerging issue to heal and restore forest habitat. According to Wildlife Protection Society of India, in 2019 number of leopards and tiger's death increased to 34% due to poaching. Mass reduction in numbers of wild animals because of illegal hunting leads to an unbalanced ecosystem. This paper proposes the idea to detect the foot sound of various animals and humans in forest. Nowadays, because of advance technology sound recording of very low frequency 1 Hz to 1000 Hz has become easy. This paper is to propose a model to analyses the ambient jungle sounds generated by humans which may be foot sounds, vehicle sounds etc. and nature sounds by using machine learning algorithms. The work studies threats to animals by humans in forest and analysis the safety for animals. Appropriate action may be initiated or alarms may be raised once the presence of human is detected in forest areas. This paper proposes a model, which if implemented can lead us to having safer habitat for wild animals.**

***Keywords*: *Wildlife, sound identify, machine learning, illegal hunting, conservation*.**

I.INTRODUCTION

Wildlife is an essential component that integrates an ecosystem. Conservation of wildlife has become a salient feature as it is a vital link between the survival of humans and the ecosystem. Wildlife also plays a keen role to maintain the balance and stability of natural process of the environment. This topic has gained an increasing relevance in the recent times. Although there are reserved areas such as wildlife sanctuaries and laws enforced but still there are certain constituents like stalkers or hunters whose intrusions in such regions leads to further reduction in the numbers of the endangered species. Poaching of animals is one the main reason that has led to the extinction of animals. Detecting of such intruders and monitoring of wildlife reserve has become an indispensable need to establish the better preserved and protected areas. The Wildlife protection society of India has done collaborative congregation of rigid information and provided the case evidences of poaching of tigers and leopards throughout India. Government provenance states that in 2019, 110 tigers and 491 leopard deaths were proclaim in India and many of them were due to poaching. In Madhya Pradesh out of 110 deaths of tiger in 2019, 38 were attributed to body part seizures and poaching. There was yearly rise of tigers and leopard's death due to poaching [1].

Name of animal	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Tiger	32	30	13	32	43	23	26	50	38	34	38
Elephant	87	89	106	82	105	80	80	69	44	-	-
Leopard	-	-	-	-	331	339	440	431	460	500	491
Rhino	122	333	448	668	1004	1215	1175	1054	1028	769	-

Fig. 1. Yearly count of poaching of various animals [2][3][4][5].

Considering the way on the move towards the industrialization, which is leading to the deforestation and poaching of animals for the ivory trade tends to buzzing alarm for the depletion of environment with the future aspects. Statisticians have extrapolated that by 2050, there will be tremendous contradiction between the population of humans and animals. Human's population will increase half the per cent of animal population. The resources of the human needs are at the stake of overtire. It is here that the concept of conservation of wildlife comes into play, because anything that is not human or undomesticated is 'wildlife'.

The advancement in today's modern technology has transformed the world into techno-world. There is huge resemblance of human brain with the computers who learns by itself without using explicit instructions called as machine learning which automates analytical modern building. In our proposed system we will collect the data from the sound sensors and then we will apply classification machine learning algorithm to classify between the sounds of the animal's paws and humans' foot by analyzing the data gathered from the sound sensor. We will train our machine learning model with previous data of sound that was recorded or by recording it live. The sound of the foot and paws can be detected by removing all background echoes and noise. Foot sound is the most active, sensitive and main object of this

research. Hence in order to save the wildlife from the hunters or stalkers we in this research want to take an initiative to build a model by using the technologies like machine learning and artificial intelligence. The main contribution of this paper is detailed analysis of foot sound and reveals identity of human or animal to safeguard the wildlife.

II. LITERATURE SURVEY

Survey on reasons why poaching has come to pass [6]:	
As Reported By	Cause of poaching
Wildlife conservation society	In Africa 96 elephant killed for ivory each day
united states fish and wildlife service	US earns 20 billion per year by tracking of wildlife illegally
One green planate & international rhino foundation	Per day poachers kills 3 rhinos for their horns to make ornaments. Earlier there where dozens of rhino species and currently 5 are remaining
Born Free	In united states approximately 6000 tigers are kept as the pet and the ratio of those tigers are more than that of wild tigers.
Wildlife conservation society of India	Tigers and leopards are poached for the illegal trade of their claws.
Humane Society of the United States	In the united states 12,600 hunting trophies are imported each year.
National Geographic	From the wilds of Brazil poachers take more than 38 million animals to meet the global demand for illegal wildlife.
Wildlife protection act	The main reason behind the poaching of leopard was the skin of the big cat along with the bones and other body parts for trade and traditional oriental medicines.

Survey on Technologies and sensors used to detect poaching:

Perimeter Intruder Detection System (PIDS) are used to develop an Anti-Poaching System near the fence. For ex. There is solar power fence in most of the game park.

By using Perimeter Intruder Detection System:

Cambron et [8] al used Motion sensors and a laser curtain for fencing. Whenever the poachers cross the fence bordering the Kruger National Park (KNP) it detects the poacher. Segments up to 500 m can be covered by laser sensor and wide areas near the fence are covered by motion sensors.

Wittenburg et al [9] used Scatter Web sensor nodes. These nodes were attached to a fence. The goal was to detect and report security-relevant incidents, such as a person climbing over a fence. To detect the motion offence accelerometer was used. Information was shared within an n-hop neighborhood and distinguish a nuisance alarm from a real alarm

Mishra et al [10] used buried optic fibre, it is easy to track the intruder when someone enters the park. The direction of the intruder can be estimated by multiple lines of buried fiber.

He et al [11] used Surveillance wireless sensor network (WSN). In this magnetic sensor were used to detect the position of moving vehicle. Performance of the system was evaluated by the network of 70 MICA2 with dual axis magnetometers. This magnetometer senses a slow-moving car at a distance of 2.5-3m.

Sun et al used [12] BorderSense sensor. In this sensor multiple technologies can be collaborated with the such as unmanned aerial vehicles, ground sensors, underground sensors, and surveillance towers equipped with camera sensors to detect intruders.

Ground Based Technology: this technology is used to detect the intruder in larger area not in limited to linear zone. They can capture the direction of single or multiple intruder. They use volumetric sensor that cover the large omnimetric area.

By using ground-based technology:

Suman et al. [12] used acoustic signal. The use of acoustic signal was gunshot based and other alarming animal sounds to detect poachers in the wild. The authors implemented the Mel-Frequency Cepstrum Coefficients (MFCC)power spectrum of sound based on linear transform to extract and learn the signal. They have a learning phase to build a table of known sounds that can be matched in real time by a classification algorithm.

Mishra et al [13] used sound and light intensity sensors It is used to detect the intruder passing the perimeter. To enable intruder detector an artificial neural network was introduced. It was used to analyse intrusion incident in future.

Aerial Based Technology: It is very agile and can cover the large areas.

By using aerial based technology:

Mulero et al. used [14] Heat sensor and camera to detect the poachers in the national park with the help of the drain.

Wildlife Conservation UAV [15] was used to detect and locate poacher UAVs which were designed and deployed in wildlife park collaborated with the sensor.

Anti-poaching engine was developed by Park et al. He proposed a system in which the rangers on the ground coordinates with the air surveillance for that Geographically sensitive algorithms were used to coordinate.

Animal Tagging Technologies: With the high sensitivity large areas can be covered potentially.

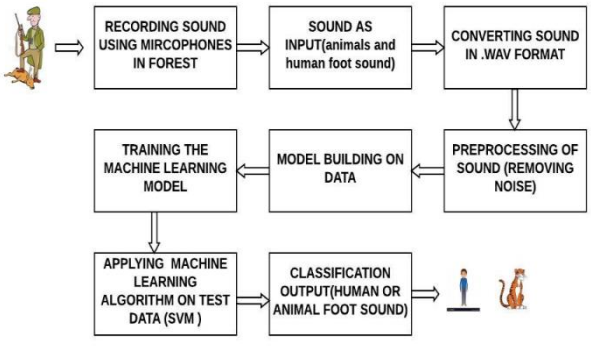
Yasar et. al. used Mobile Biological Sensor (MBS) In this paper the body sensor device is tagged to detect the behavioural changes of animals. Animal detection classifier were used to detect the sudden behavioural in the animals. Thermal detection is used to measure the temperature.

RFID was used to capture the poachers by notifying the rangers as soon as animal is poached.

III. USE OF MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE IN POACHING

Siddhartha Balemarthy [8] used machine learning algorithms to recognize species by voice. They used K-nearest neighbour classifiers and follow mean computation after extracting the audio datasets. Melfrequency cepstral coefficients are extracted from the audio datasets. To analyse a continuous acoustic signal and to extract the sound events present in the acoustic scene Audio event detection (AED) was used. Machine learning algorithm (Hidden Markov Model) using Tensor Flow was used to design the system. Marius Vasile Ghiurcau, Corneliu Rusu [9] proposed a model to detect the wildlife intruder using sounds captured by acoustic sensors. Time Encoded Signal Processing and Recognition (TESPAR) algorithm combined with archetype technique is used for sound encoding and classification. Following the band pass filtering they performed a downsampling from 8 kHz to 6 kHz of the original recordings. Classification rates for the 94% of the accuracy for the matrix. Po-Sen Huang [10] distinguish human from animal footstep by using class discovery problem such as mixture of labelled and unlabelled training data. In the experiment Support vector machine classifier, the generative class discovery algorithm using Gaussian Mixture Models (GMM) was used which gives the best performance in distinguishing mixed vs. unmixed test token. Enrico Di minin [11] proposed a machine learning model to monitor or investigate illegal wildlife trade in social media. Neural Network model was trained with large set of labelled data in the form of images taken from the various social media. Neural Network rates 96.6% accuracy for the model.

IV. MACHINE LEARNING MODEL APPROACH



V. PREVENTION OF POACHING

Annihilation of poaching is huge challenge. Prevention of poaching in four disciplines [7]:

- Diplomacy: Diplomacy to stop poaching is orchestrated through organizations and governments.
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement between government. Through this agreement, government attempts to stop illicit wildlife trafficking on multiple levels and ensure that the international trade in specimens of wild animals and plants does not threaten of their survival. A major part of TRAFFIC's program is working collaboratively with law composer, law enforcers, and the court system to make sure that appropriate laws are in place, fully understood by those enforcing them and violators receive appropriate penalties
- Law enforcement: To prevent poaching officers from being stationed inside wildlife parks to perform patrols and pursue poachers. Along with interdict patrol routes, the proposed solution pursuit to generate optimal routes to intercept fleeing suspects. When signs of poachers are found, patrol officers begin the pursuit by following a route that is generated by the tool. The proposed routes can be updated as new information is given from the field.
- Negative reinforcement: Some of the accession to negative reinforcement are obtrusive to the endangered animals because they involve direct physical contact with the animal's body, that discourage poachers from killing animals.
- Demand reduction: Worldwide, lots of money has been spent annually on studying and protecting rhinos in the wild, while very little has been spent on addressing the underlying demand for the product that drives poaching.

They create high quality media that is advertised on many different types of media channels such as TV, social media, billboards, and LCD screens in public places. Through mass media campaigning, there goal to reduce demand for Wildlife products with their slogan "when the buying stops, the killing can too".

VI. FUTURE WORK

In the future, demeanor the precocious of advance technology like video can be used to detect the poachers. It will acquiesce to disclose the human who can create the unreal sound of animals with the help of GPS and camera, the data can be collected and by using artificial intelligence it can analyzed to find frequent pattern of the poacher, in the particular region of the forest. The location of the poacher tent can also be detected and inform to the forest department. The area which is most frequently hunted can be tracked by referring to the previous data and can be marked as hunting area.

VII. CONCLUSION

Considering the fact where wildlife habitat and species around the world are facing crisis if we take the conventional reason why wildlife animals are being

affected, poaching comes out to be one of the vital reasons which leads to unbalanced chain contributing to extinction of species. For this issue to be solved. In this paper, we provided the survey-based idea for classifying variations of

Sound generated by animals and humans specially foot sound. This detection will further help in identifying poaching scenarios in wildlife habitat which when prevented can help in providing contribution to our wildlife conservation. So, it has been necessary to stop poaching so that we can balanced ecosystem

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