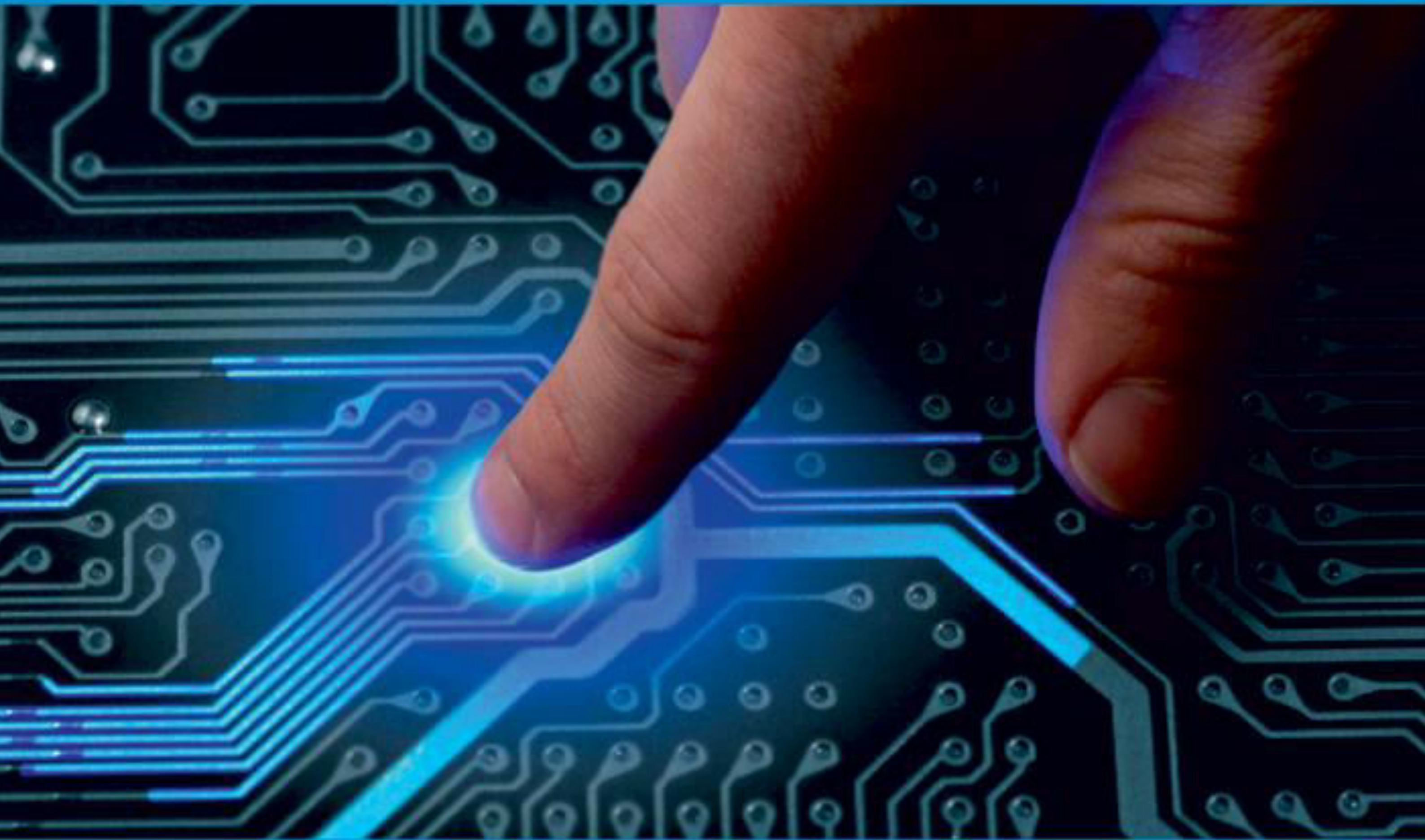
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 4, April 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.379

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.379 | Monthly Peer Reviewed & Referred Journal |

|| Volume 12, Issue 4, April 2024 ||

| DOI: 10.15680/IJIRCCE.2024.1204058 |

Wild Animal Classification and Recognition Using Activity Based Deep Learning Method

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ABSTRACT: The dangers that animals now face have dramatically escalated over time. L live-animal marketplaces, animal-human disputes, animal-vehicle collisions, and other unintentional deaths as a result of inadequate animal monitoring are some of the serious risks to animals. An automated animal monitoring system that uses both animal detection and categorization methods is a dependable response to all of these dangers. In the paper, we propose a number of animal classification and detection algorithms that are targeted at various image modalities for a number of applications related to animal conservation. Initially, the "Convolutional Neural Network" (CNN), a method for classifying animal breeds, is shown. Then, we demonstrate various animal detection methods using various visual modalities. An autonomous ground vehicle-based livestock monitoring system called "EfficientNetB4" is suggested for the third image modality—fusion images. Using "EfficientNetB4", the system combines visual and thermal pictures. The proposed solutions handle a number of camera trap issues as well as difficult animal traits to ensure robustness.

KEY WORDS: Computer Vision, Machine Learning, Twilio, CNN

I. INTRODUCTION

One of Mother Nature's sentient and intelligent organisms is the animal kingdom. They were assumed as fundamental spiritual entities at the dawn of civilization. They contribute significantly to the stable upkeep of the ecological equilibrium. Each and every animal whether it is domesticated or wild, is essential to the food chain. Despite the fact that humans are directly dependent on animals, people have unfortunately brought the majority of animal species to the verge of extinction. Human Inhumane treatment of animals is beginning to backfire. The continuing Coronavirus pandemic gives strong proof for this. The epidemic in the novel is a karmic consequence of humankind's treatment of animals through the ages. The human race has hit snooze and is now debating the best way to prevent the spread of the new Coronavirus through the live-animal market.

Animals have been facing threats of many different kinds over the years. The most significant risks to wildlife include climate change, habitat degradation or fragmentation, culling, overuse of natural resources, pollution, and criminal activities like smuggling and hunting. A million or so species are listed as endangered in the 2019 biodiversity report, and many more are extinct every day. So, keeping an eye on animals is essential to preventing their extinction.

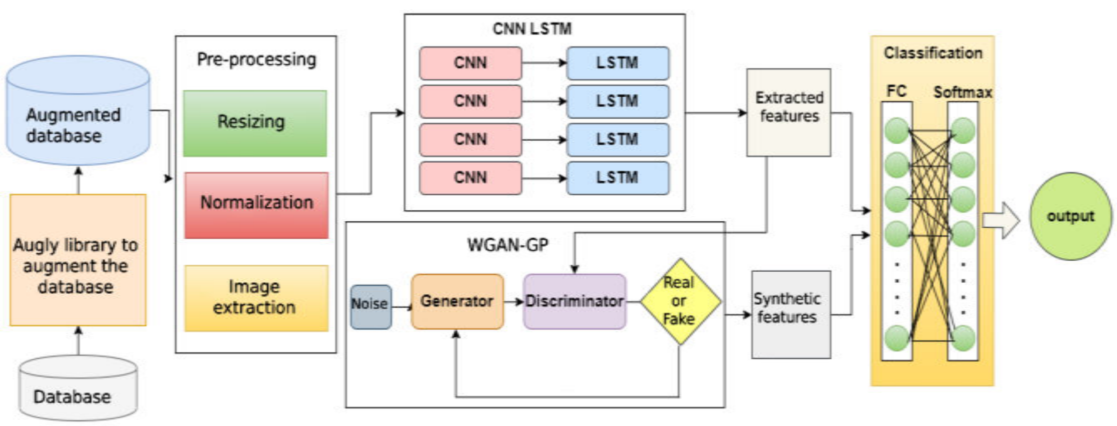

Fig 1: Work Flow

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The technique of continuously observing the animals, their habitat, and their behavior, is known as animal monitoring. Animals are observed for conservation purposes as well as to prevent vehicle-animal collisions and animal-human conflict. The issue of animal detection is then addressed in the context of animal monitoring. Animal detection in advance can protect people from several attacks and mishaps caused by human-animal attacks and animal-vehicle collisions. Unreported occurrences in cattle stations, animal contraband into the live-animal market, the discovery of endangered animal species, etc. are a few more major issues that need animal detection. An effective animal detection system can assist in finding the animals and consequently save them in any of these situations. Animal detection, on the other hand, isn't always enough because, in some situations, it's necessary to appropriately classify the creatures. If a Black Panther were mistakenly identified as a cat by an animal intrusion detection system at a village boundary, for instance, the results could be terrible for both people and nonhumans. This illustrates how some animal species share striking inter-class similarities, like in the instance of the Black Panther and cats that are black in hue. Classifying these creatures is a challenge for fine-grained classification (FGC) because they resemble one another so closely. A system for finegrained animal categorization is as essential as an animal detection system in the scenario described above. Using a bounding box, the animal detection method identifies animals after detecting them in images or recordings. Several methods have been used to detect animals, including Light.

II. RELATED WORK

CBIR (Content-Based Image Retrieval) [1] Detection & Ranging (LID) [2][3] texture descriptor [4] Animal face detection [5] motion of animal adaptive Threshold Segmentation [6] threshold segmentation [7] Only static backgrounds—which are frequently absent—are suitable for motion-based animal detection and threshold segmentation. On the other side, the adaptive threshold segmentation makes a lot of false detections and improperly recognizes other moving objects, as animals. Since animals cannot see the camera and so cannot pose for identification, face recognition is not a reliable tool for animal detection. The animal may be found using the texture descriptors method, which compares the animal's texture to a previously established database. But this method is only effective when there is only one kind of animal present and little background distraction. When the database is large, the content-based retrieval approach has poor searching performance. When dealing with a large database, the content-based retrieval algorithm's querying performance worsens. CNN [8] is widely credited for ushering in the current era of machine learning models. Moreover, animal detection systems began to perform better using transfer learning, even with little datasets [9]. The method of feature learning selected is crucial for a real-time application like animal identification. The majority of CNN-based models have the common flaw of having been trained using supervised learning methods, which are unsuitable for real-time applications since they cannot adjust to unlabeled classes [10]. Moreover, since it is impossible to validate the results, real-time applications cannot rely on unsupervised learning methodologies. There aren't many unsupervised learning models in the literature, and those that are available have poor accuracy. Semi supervised learning techniques were presented to fill the gap between these two approaches [11].

Xun Long Ng et.al (2022) The study of animal behavior has many practical implications. Existing animal behavior datasets, however, have some drawbacks. These include a lack of diversity in animal classes, data samples, and tasks offered, as well as in environmental circumstances and human observers' points of view. Animal Kingdom is a big and varied dataset designed to help with these gaps by providing a number of annotated activities that may be used to better understand animal behavior in the wild. The collection relies on the film of wild animals shot several times of day and in a wide variety of locales with varying backdrops, perspectives, lighting, and weather. To be more specific, their dataset contains 50 hours of annotated videos for the video grounding task, which aims to identify relevant segments of animal behavior in long videos, 30K video sequences for fine-grained multi-label action recognition, 33K frames for pose estimation, and 850 species spanning 6 major animal classes. This difficult and extensive dataset could help researchers test and improve cutting-edge techniques for studying animal behavior. They also provide a CAR (Collaborative Action Recognition) model that can learn both species-specific and generic features for action recognition with novel animals. They report encouraging results from their studies using this approach [13].

Identifying, monitoring, and ensuring the protection of animals in high-risk areas necessitates the development of new systems and technologies, which governments cannot afford to develop given the magnitude of the problem. There are existing databases regarding animals in the literature on computer vision, but they do not specifically target the species that are most often involved in vehicular accidents. Therefore, the purpose of this study is to provide a novel dataset of labeled photos called the BRA-Dataset, which tries to fill this need. This identification of the five most fatally injured medium and large animals on Brazilian roadways may be used to train future animal detection programs. The dataset includes 1823 photos labeled in the PASCAL VOC format and YOLO Darknet, all of which were collected using the suggested acquisition technique and then manually cleaned. Experiments were also carried out on the BRA-Dataset to

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verify its efficacy in training and testing YOLO models. Without any further data or application process improvements, the findings demonstrated a high average accuracy reached over the initial dataset [12].

III. METHODS

At the beginning user has to upload image i.e., any animal image including land animals, aquatic animals and birds. Preprocess is stage where raw image given by the user has to be processed before it is fed into learning purpose, to enhance the image for accurate prediction. The entire image is divided into tiny objects for which features are extracted using deeplearninglog4j. Then, Tensorflow is used to convert the extracted features into a graph value or pb(protobuf) values. This conversion is needed as the ImageNet datasets contains the image in form of pb values. CNN performs comparisons between the input data and the training dataset and predicts the output of the animal species with the accuracy percentage. Text to speech converter is used for converting output of the recognized animal species into human like voice.

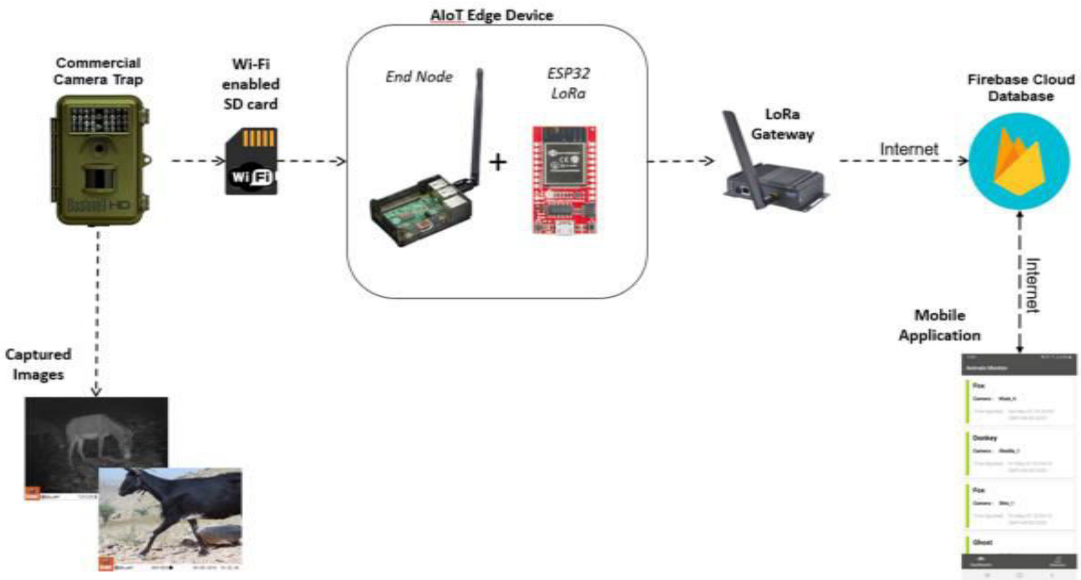

Fig 2: Animal Activity Analysis

An advanced deep convolutional neural network architecture and a single-labeled dataset were used to train a computer system that can recognise species and filter animal photographs on its own. Since the records are not updated, the biggest drawback of the wildlife spotter project's datasets is that hybrid animals cannot use them. J Deng et al[8] .'s deep research of ImageNet in its present state, which consists of 12 subtrees, 5,247 synsets, and 32 lakh images, is presented. It talks about a brand-new data-base called "ImageNet," which is a sizable ontology of images constructed using the worldnet architecture.It discusses a brand-new database called "ImageNet," which is a substantial concept of images built on top of the worldnet architecture. ImageNet aims to contribute 500-1000 clear, high-resolution photographs to each of the worldnet's 80,000 synsets. Akshay Kapoor et al. [9] propose several design principles and alterations offered in the GoogLeNet and inception networks. The computational efficiency of these modifications is investigated, and network features and performances are compared on the ImageNet dataset. A critical assessment of inception networks is also provided.

proposes that instance search should not produce only nearly identical photos while also providing fine-grained results, which is typically what a user wants. It creates a large-scale database with the reference pictures compressed at consistent bit rate levels using JPEG encoders using various optimization techniques, introducing a baseline system employing fine-grained classification scores. In subjective tests, the comparison approach is used to rank them in order to identify tiny differences. The primary problem with fine-grained findings is that classification of items that belong to the same species duplicates the data. The following paper discusses the template matching [3] algorithm, which is used to pinpoint certain details in a picture that should match the template image. Information regarding the locations of the image's interesting items is given, along with a list of those things.

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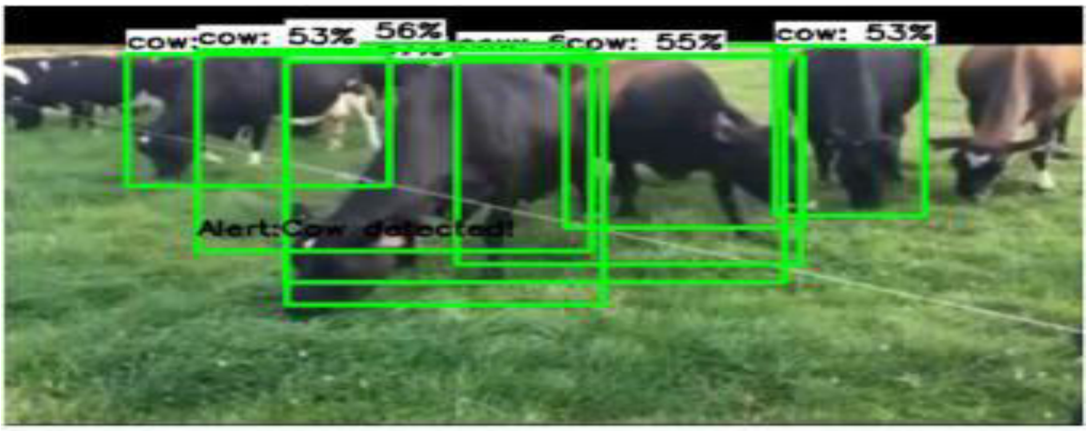
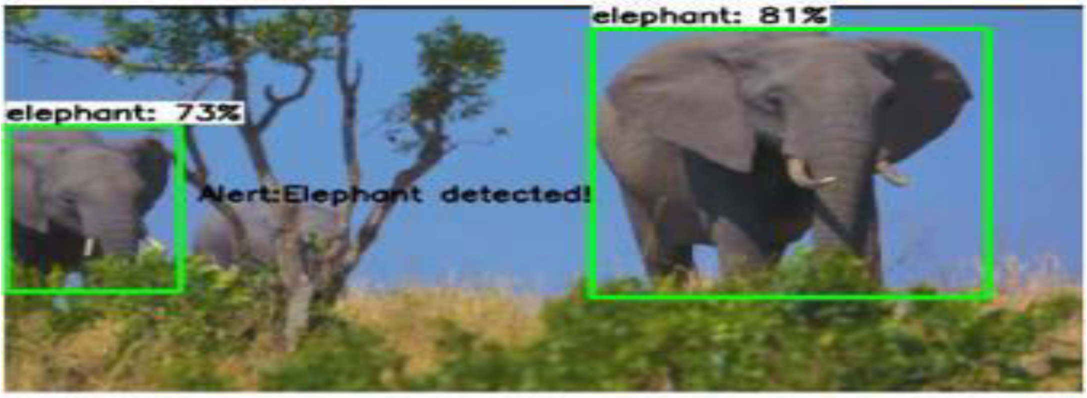
IV. RESULT ANALYSIS

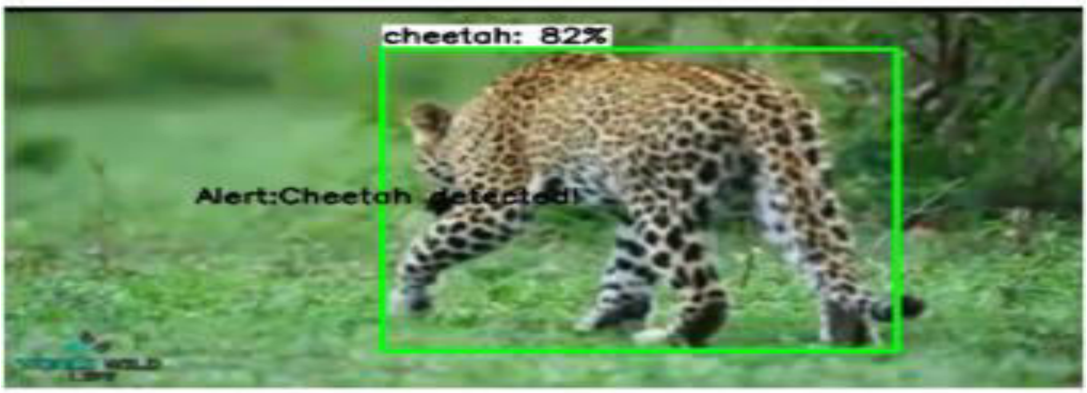
The ImageNet LargeScale VisualRecognition Contest is the industry benchmark for object recognition and classification, including millions of photos and hundreds of item classes. The winner, GoogleNet, had the best performance to date, bringing the classification error down to 0.06656 and raising the average object detection accuracy to 0.439329. Its network had roughly 30 layers. Convolutional neural networks performed similarly to humans on the ImageNet tests. We utilise GoogleNet to get images of animals as training samples for our program since there are many different animal species.



(a)



(b)



(c)

Fig 3: animal Activity Result Analysis

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With the remarkable potential of neural network, the proposed system can recognize animals of all species this includes land animals, aquatic animals and birds. Training datasets obtained from GoogleNet inception model will be in terms of graph values so the graph values for the input image is obtained by using the algorithm specified. Animal species recognition system is implemented with the help of CNN, Google Net inception v4 helps to achieve a higher learning rate and results in faster overall performance.

V. CONCLUSION

In this paper, the different images and videos-based object detection techniques are studied and compared in different environments to analyze the performance. From this table, Deep Convolutional Neural Networks has low accuracy. Automatic Wild Animal Detection has Low F-measure value, Detecting Kangaroos in the Wild: The First Step towards Automated Animal Surveillance has low precision and so on. Hence, Wild Animal Detection using Discriminative Feature-oriented Dictionary Learning and clustering has high true positive rate. The comparison table shows how images and videos-based object detection techniques performed in different environments with different datasets. Thus, due to the high accuracy the proposed work is on wild animal detection using Discriminative Feature-oriented Dictionary Learning and clustering.

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