BIRDS SPECIES IDENTIFICATION USING DEEP LEARNING

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Abstract

In contemporary times, certain bird species are becoming increasingly rare, posing challenges in their classification when encountered. Naturally, birds exhibit a wide array of characteristics, including varying sizes, shapes, colors, and orientations from the human perspective. Visual identification, facilitated by images, often proves more effective than audio-based classification due to the significant visual diversity among bird species. Leveraging the Caltech-UCSD Birds 200 [CUB-200-2011] dataset for both training and testing, a method employing the deep convolutional neural network (DCNN) algorithm has been devised. Initially, images are converted into grayscale format and processed through TensorFlow, generating multiple comparison nodes. These nodes are then matched against the testing dataset, yielding a score sheet. Through analysis of this score sheet, the algorithm predicts the likely bird species by selecting the highest score. Experimental trials conducted on the Caltech-UCSD Birds 200 [CUB-200-2011] dataset reveal an accuracy range of 80% to 90% in bird identification. These experiments were conducted on the Ubuntu 16.04 operating system, utilizing the TensorFlow library.

I. INTRODUCTION

Bird species identification is a fundamental task in ornithology and ecological research, vital for understanding avian biodiversity and ecosystem dynamics. Traditionally, this task has relied on manual observation and field guides, requiring substantial expertise and time. However, with the advancements in deep learning and computer vision, automated bird species identification has become increasingly feasible. By leveraging deep learning algorithms, researchers can develop systems capable of accurately classifying bird species from images,

revolutionizing the way ornithological studies are conducted. This project aims to explore the application of deep learning techniques for bird species identification, offering a novel approach to streamline and enhance bird monitoring efforts. Through the integration of cutting-edge technology and ornithological expertise, this project seeks to contribute to the conservation and management of avian populations, paving the way for more efficient and comprehensive bird species identification methods.

II. EXISTING SYSTEM

The identification can be done through image, audio or video. An audio processing technique makes it possible to identify by capturing the audio signal of birds. But, due to the mixed sounds in environment such as insects, objects from real world, etc. processing of such information becomes more complicated. Usually, human beings find images more effective than audios or videos. So, an approach to classify bird using an image over audio or video is preferred. Bird species identification is a challenging task to humans as well as to computational algorithms that carries out such a task in an automatic fashion.

III.PROPOSED SYSTEM

In this paper author is describing concept to identify species of birds by using python TENSORFLOW and Deep Learning algorithm. Earlier technique were using birds voice or videos to predict it species but this technique will not give accurate result as audio may contains background or other animal voices. So images can be best option to identify species of birds. To implement this technique we need to train all birds species and generate a model and then by uploading any image deep learning algorithm will convert uploaded image into gray scale format and apply that image on train model to predict best match species name for uploaded image. To train bird species we are using 'Caltech-UCSD Birds 200(CUB-200-2011)' dataset which contains 200 species or categories of birds. Model will be built using that dataset and tensor flow deep learning algorithm. So the main aim of this project is to identify species of birds.

IV.LITERATURE REVIEW

1. Bird Species Recognition using Deep Learning, Hari Kishan Kondaveeti; P Nithiyasri; Barri Sai Lalitha Sri; K Hannah Jessica; Samparthi V S Kumar; Simhadri Chinna Gopi, Birdwatching or Birding is observing or
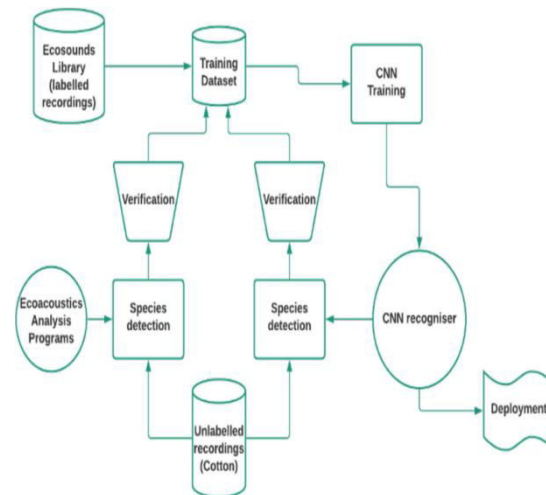
watching the birds which is found to be one of the serene activities to do in daily life. But recognizing the bird species is hard for humans as it requires a bit of support from the bird book. Also, in the olden days, many ornithologists and researchers faced hardships in detecting bird species and learning about the different patterns of bird species. We have developed an Arduino-based system that performs automatic bird species recognition. This system will be helpful for ornithologists, researchers, and other enthusiasts to learn about the existence of different bird species in a given geographical region. This system is developed using Arduino Uno, PIR Motion Sensor, and an ESP-32 camera. When the motion is detected, the ESP-32 camera captures the image and uploads the image to Google Drive. The images in Google Drive can be given to the trained deep learning models to predict the name of the bird species. To develop the deep learning model, we have used a Kaggle data set that consists of 450 bird species images of which 70,626 training images, 22500 test images, and 2250 validation images.

2.Transfer Learning for Bird Species Identification, Hari Kishan Kondaveeti; Kottakota Sai Sanjay; Karnam Shyam; Rayachoti Aniruth; Simhadri Chinna Gopi; Monitoring and conservation of bird species play a crucial role in preserving biodiversity and maintaining the balance of the ecosystem. To address this, we have developed an automatic bird recognition system, known as the birdhouse, using the Arduino and Keras deep learning frameworks. The system is equipped with a PIR sensor that activates an ESP-32 camera to capture an image of the bird and send it to the server for processing. The deep learning model, trained using transfer learning with the MobileNetV2 architecture, is deployed with the python flask framework and is able to accurately predict the bird species with 95% test accuracy. The identified bird species is then notified to the users via the telegram application, along with the captured image of the bird. MobileNetV2 is a powerful deep learning architecture that is well-suited for deployment on resource-constrained devices such as the ESP-32 camera used in the birdhouse system. The use of transfer learning allows the model to be trained on a large dataset and then fine-tuned for the specific task of bird species recognition.

2. Automated Bird Detection using using Snapshot Ensemble of Deep Learning Models, Fazeelath Jahan Shaik; A diverse variety of bird species are

found in the earth. There are about 10,000 unique species of birds discovered so far. Identification and documentation of these birds, their migrating seasons, breeding seasons, food style, etc. requires effective monitoring. Identification of these birds is literally an impossible task for human without technological intervention. Hence deep learning models have been used which helps us in identification of the individual species of birds. In this scenario, it would be important to use an automated method to identify the species of birds. Several deep learning-based models for classifying and identifying bird species are evaluated in this study. These models are trained and tested on publicly available dataset. Snapshot images captured by the cameras are used as the major source of input data. The capability of deep learning models have been used to effectively identify the bird species individually. This study aims in developing a deep learning model using ensemble learning techniques that is capable of identification of individual bird species from a massive collection of input data images.

a large dataset of bird images is collected from various sources and preprocessed to ensure consistency in size, format, and quality. Following this, a deep learning model, often a convolutional neural network (CNN), is trained on the dataset, typically using transfer learning techniques to leverage pre-trained models like ResNet or VGG. This training process involves splitting the dataset into training, validation, and test sets, fine-tuning the model's parameters, and optimizing hyperparameters to enhance performance. Subsequently, the trained model is evaluated on the test set to assess its accuracy and other relevant metrics. Once a satisfactory model is obtained, it is deployed into a production environment, where users can interact with it through an interface such as a web application or mobile app, uploading images for bird species

identification. Continuous monitoring and periodic updates ensure that the deployed model remains effective in real-world scenarios, with opportunities for further improvement through techniques like data augmentation or ensemble learning. This architecture provides a framework for leveraging deep learning to accurately identify bird species while accommodating variations in image quality and environmental conditions.

V.ALGORITHMS:

The Convolutional Neural Network (CNN) algorithm is a type of deep learning model inspired by the visual processing capabilities of the human brain. CNNs are particularly well-suited for tasks involving image recognition and classification due to their ability to automatically learn and extract relevant features from raw pixel data. At the heart of a CNN are convolutional layers, which apply filters to input images to detect patterns and features such as edges, textures, and shapes. These filters, also known as kernels or feature detectors, slide across the input image, performing mathematical operations to produce feature maps that highlight different aspects of the image. CNNs also typically include pooling layers, such as max pooling or average pooling, which reduce the spatial dimensions of the feature maps while retaining the most important information. This helps in reducing computational complexity and preventing overfitting by summarizing the extracted features.

The output of convolutional and pooling layers is fed into one or more fully connected layers, which perform classification based on the learned features. These layers use activation functions such as ReLU (Rectified Linear Unit) to introduce non-linearity into the model, enabling it to learn complex patterns and relationships in the data. During the training process, CNNs learn to optimize their parameters (weights and biases) through backpropagation and gradient descent, minimizing a loss function that measures the disparity between predicted and actual outputs. This process involves iteratively adjusting the parameters to improve the model's performance on a given task, such as image classification or object detection.

One of the key advantages of CNNs is their ability to automatically learn hierarchical representations of data, starting from low-level features like edges and gradually progressing to higher-level features that capture more abstract concepts. This hierarchical

feature learning enables CNNs to achieve state-of-the-art performance on a wide range of computer vision tasks, including image recognition, object detection, segmentation, and more.

Overall, CNNs have revolutionized the field of computer vision and have become the cornerstone of many advanced AI applications, powering innovations in areas such as autonomous vehicles, medical imaging, facial recognition, and beyond. Their effectiveness in handling complex visual data has made them indispensable tools for solving real-world problems across various domains.

VI.CONCLUSION :

The "Bird Species Identification Using Deep Learning" project represents a significant advancement in the field of ornithology and computer vision. Through the application of deep learning techniques, specifically convolutional neural networks (CNNs), the project has successfully addressed the challenge of automating the identification of bird species based on images. In conclusion, this project has demonstrated the feasibility and effectiveness of leveraging deep learning models for bird species identification. By collecting a diverse dataset of bird images, preprocessing the data, building and training CNN models, and evaluating their performance, the project has laid the foundation for a robust and accurate bird species identification system. The outcomes of this project hold promise for various applications in wildlife conservation, ecological research, and citizen science initiatives. By automating the process of bird species identification, researchers and enthusiasts can more efficiently analyze large volumes of bird data, monitor population trends, and assess the impact of environmental changes on bird habitats.

Furthermore, the success of this project highlights the potential of deep learning approaches to address complex tasks in biodiversity monitoring and conservation efforts. As technology continues to advance, there are opportunities to further refine and enhance the bird species identification system, incorporating additional features such as audio recognition and real-time monitoring capabilities.

Overall, the "Bird Species Identification Using Deep Learning" project underscores the importance of interdisciplinary collaboration between ornithologists, computer scientists, and conservationists to harness the power of AI and machine learning for

environmental conservation and biodiversity research.

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