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AVES SPECIES IDENTIFICATION USING DEEP LEARNING

Mr. Jagadeesh B N
Assistant Professor
East West Institute of Technology
Bengaluru, India
jagadeesh.nagaraj.nl@gmail.com

Abdul Saqib
UG Student
East West Institute of Technology
Bengaluru, India
abdulsaqib29@gmail.com

Syed Nasrulla
UG Student
East West Institute of Technology
Bengaluru, India
syednasrulla085@gmail.com

Dawood Mir
UG Student
East West Institute of Technology
Bengaluru, India
dawoodmir82@gmail.com

Sagar P Padia
UG Student
East West Institute of Technology
Bengaluru, India
sagarpadia7@gmail.com

Abstract: Although there are many species of aves that are not commonly seen, it is hard to classify them properly due to their unique features. For instance, in one-of-a-kind scenarios, aves can come in different sizes and colors. They also have special features that humans can use to capture their audio attention. In addition, it is very easy for people to identify aves in the pictures. There are around 9500 species of aves in our world, and most of these species are not commonly seen. This means that finding these species is very challenging. With the help of artificial intelligence, we can now easily identify these animals by their unique features. Humans are capable of understanding aves through images more easily than audio recognition. We have used a Deep Convolutional Neural Networks framework to perform this task. DCNNs are a group of machine learning algorithms that have been able to gain a deep knowledge of the subject.

Keywords: DCNN, Deep Learning, Aves Species Identification, TensorFlow, Image Processing.

I. INTRODUCTION

Nowadays, identifying the species of aves might be challenging due to uncertainties. Because they react swiftly to changes in the environment, aves help us hunt for specific creatures in the environment (for example, the bugs on which they feed). However, getting information from aves needs significant human work and is a far more opulent approach. Numerous bird species have seen a dramatic fall in population as a result of habitat degradation brought on by human activity and localized global climate change. A variety of conservation initiatives have recently been launched to safeguard these species. The majority of these initiatives begin with observing and surveying aves in their native environments, for which acoustic monitoring is an easy and passive technique. There are several different varieties of aves in India. Even the names of all the aves around us are unknown to us. Aves continue to hold a significant position in our society. They may be heard chirping everywhere, including in cities and small towns, and most people can even see them because to their songs. A constant source of inspiration and ideas for composers worldwide is provided by aves ily categorize aves species, while a computer has a difficult time doing so. To gather information about aves requires a great deal of work, which is also an expensive operation. In this instance, a device that will benefit governmental organizations, researchers, etc., and provide large-scale aves data processing is desired.

An image, an audio recording, or a video can all be used to identify different species of aves. By detecting the acoustic signal of separate aves, an audio processing technology makes understanding possible. Nevertheless, handling of such facts becomes increasingly difficult owing to the mixed noises in the condition, such as creepy crawlies, real-world items, and so on. Humans often comprehend images more accurately than sounds or recordings. Therefore, it is preferable to categorize aves using an image as opposed to voice or video. Identifying the species of aves is a challenging task for both humans and the automated computing methods that automate the process.

II. LITERATURE SURVEY

The literature reveals a wide range of aves detection techniques based on audio recognisation, image processing, which entails numerous steps to complete the algorithm. Data capture, segmentation, feature extraction, representation, and matching are examples of such procedures.

There have been numerous attempts to use convolutional neural networks to recognize Aves. Many of them, however, were unable to identify aves because of some backgrounds which matches with the colors of the aves.

The challenge of recognising bird species from recordings is the main topic of this essay. We suggest a multi-layered, alternating, sparse, dense scaffold for identifying bird species in light of current advancements in deep learning. Moment and Period Aves modulation A series of spectrogram frames are used to record the vocalisations,

producing a high-dimensional superframe-based representation. These superframes show a significant degree of sparsity. Therefore, we suggest compressing these superframes using random projection. Following that, a prototype study of the particular classes utilised by these compressed superframes is shown. For convex sparse representation, use acoustic modelling. Compressed Convex Spectral Embedding (CCSE) is the name of this convex sparse representation. Is being tracked the discriminative information peculiar to each species can be successfully captured by these representations. The experimental findings provide strong evidence in favour of the suggested approach. Performance equivalent to that of known techniques like dynamic kernel-based SVM and deep neural network (DNN) [1].

This research explores approaches for bird identification and develops an automated system for recognizing bird species. Significant study on taxonomy and other subfields of ornithology has been a challenging and difficult attempt for automatic identification of bird sounds without physical interaction. A two-stage identification approach is used in this work. The first step was creating an ideal dataset that included all of the bird species' sound recordings. The sound snippets were then put through a variety of sound preprocessing procedures, including pre-emphasis, framing, silence removal, and reconstruction. For each reconstructed sound clip, spectrograms were produced. In the subsequent stage, a neural network was set up and given the spectrograms as input. The Convolutional Neural Network (CNN) categorises the sound sample and determines the species of bird based on the input characteristics. For the system mentioned above, a real-time implementation model was also created and put into practice [2].

Many bird species are now extremely uncommon, and even when they are discovered, they might be difficult to categorize. For instance, Aves exist in a variety of sizes, shapes, and colors, as well as from a human perspective, from various perspectives. Indeed, the photos depict various variations that call for the auditory identification of several bird species. Additionally, it is simpler for people to recognize Aves in the images. Deep convolutional neural network (DCNN) technology may now be used to classify different bird species using the GoogLeNet framework. For this experiment, a grayscale version of a bird image was created, which produced the signature. Following carefully scrutinising each and every signature, the score sheet is calculated from each node, and after the score sheet analysis, it forecasts the appropriate bird species. The Caltech-UCSD Aves200 [CUB-200-2011] data collection was utilised in this project for both testing and training reasons. 200 unlabeled data are utilised for testing while 500 labelled data are used for training. Deep Convolutional Neural Networks are employed for classification, and GPU technology was leveraged for parallel processing. The final findings demonstrate that 88.33 percent of bird species can be predicted using the DCNN algorithm. Utilizing an NVIDIA Geforce GTX 680 with 2 GB RAM and the Linux operating system, the experimental investigation is carried out [3].

Convolutional Neural Network has lately achieved exceptional success in the field of overall picture categorization. Pretrained Convolutional Neural Networks (CNN) have recently been used to provide a far better representation of an input picture. One of the most popular pretrained CNN networks used in deep learning as a pretrained CNN model is ResNet. In this article, we suggest a deep learning model that can recognize certain Aves from an input image. To further encrypt the pictures, we frequently use pretrained CNN networks as well as pretrained ResNet networks. Aves are typically seen in a variety of situations and may be viewed from a human perspective in a variety of sizes, shapes, and colors. To evaluate recognition performance, trials will be run employing entities of various casts, dimensions, and velocities. On our classifications, we attained a top-5 accuracy of 97.98 percent [4].

Outages caused by Aves are now the third reason for overhead transmission wires to collapse. Diverse line faults may result from various bird species. Inspectors must be able to recognise various bird species in order to increase the relevance of bird-related outage prevention. The approach for identifying Aves proposed in this work uses machine learning, feature extraction, and image processing. In order to remove the foreground from bird photos, the Grabcut algorithm is utilised. The bird head is chosen as the discriminative portion for feature extraction on the basis of principles for fine-grained categorization. Color moments, gray-level co-occurrence matrix (GLCM), and geometric descriptions, respectively, are used to describe the colour, texture, and form aspects of the avian head. The bird species are characterised by a total of 25 traits. A multi-class support vector machine is used to create an intelligent classification model using these attributes as input parameters and the matching bird species as outputs (SVM). Five different bird species that pose a risk to the safe functioning of electricity lines are categorised using this methodology. For feature dimension reduction, the kernel principal component analysis (KPCA) is used. The recognition accuracy reaches 88 percent after feature selection and model training. This study serves as a guide for creating a bird identification system that transmission line inspectors may use to identify potentially dangerous bird species [5].

The one-shot learning paradigm is presented in this paper for the computational bioacoustics domain. Although the majority of the relevant literature assumes the availability of data characterising the complete class of the problem at hand, this is rarely the case because we only have a limited understanding of the species composition of a habitat. Therefore, the issue requires approaches that can deal with non-stationarity. In order to do this, we provide a framework able to track changes in the class dictionary and instantly add new classes. We create a Siamese Neural Network working in the logMel spectrogram space for our one-shot learning architecture. Using appropriate figures of merit, we thoroughly evaluate the suggested technique using two datasets of different bird species. It's interesting to note that such a learning strategy displays cutting-edge performance despite accounting for severe non-stationarity instances [6].

In this work, the author discusses a method for classifying Aves species using Python's Tensor Flow and Deep Learning algorithm. In an earlier method, Aves's voices or videos were used to determine their species, however this method will not produce reliable results since audio files can contain background noise or the voices of other animals. Therefore, using photos to identify Aves species may be the best solution. To use this approach, we must first train every Aves species and create a model. Then, when any image is uploaded, a deep learning algorithm will convert it to grayscale format and use it to train the model, predicting the best species name for the image. [7].

III. PROBLEM IDENTIFICATION

Even for seasoned birders, identifying an Aves can be difficult. It might also be overwhelming to figure out where to start searching in the hundreds of pages of species if you are new to using area guides. Aves can be categorized based on characteristics including size, shape, and color. We may categorize the Aves species by using CNN. The identification of aves species is a challenging task presently and causes

ambiguity occasionally. Due to their fast responses to environmental changes, aves enable us to hunt for certain creatures in the environment (for example, the insects on which they feed). However, collecting aves statistics is a far more time-consuming and expensive process that involves significant human work.

For long years, ornithologists have struggled to identify aves species. They must research every aspect of aves, including their climate, genetics, distribution, effects on the ecosystem, etc.

IV. PROJECT OBJECTIVE

The task objectives to quantify the qualitative description of distinctive Aves species using computing device getting to know techniques and use it as a fantastic device for Aves species identification from pictures and to appoint the energy of computer mastering to help beginner Aves watchers discover Aves species from the photographs they capture. Identification of Aves species is a challenging venture frequently ensuing in ambiguous labels. Aves species Identification is a predominant difficulty in ornithologists.

V. SYSTEM DESIGN

A. SYSTEM ARCHITECTURE

The conceptual model that describes a system's structure, behaviour, and other aspects is called a system structure. Device components and designed subsystems that operate together to enforce the standard system can make up a machine structure.

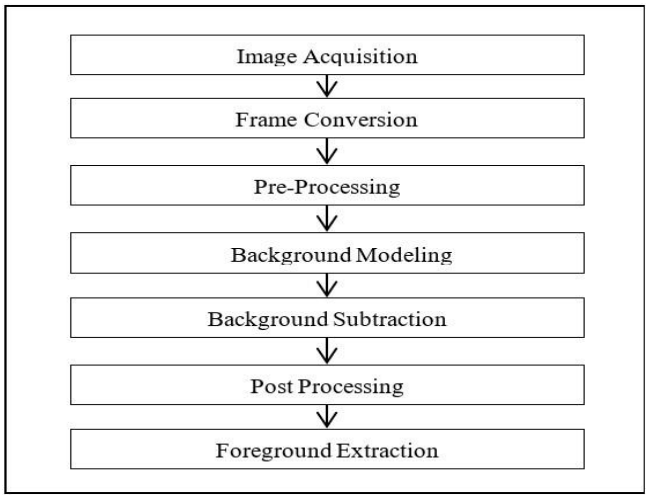

Fig 1. System Architecture

B. SEQUENCE DIAGRAM

Match diagrams and tournament scenarios are other names for sequence diagrams. A sequence diagram displays many processes or objects that continue concurrently as parallel vertical stresses (lifelines), and the messages that are passed between them in the order that they take place, as horizontal arrows.

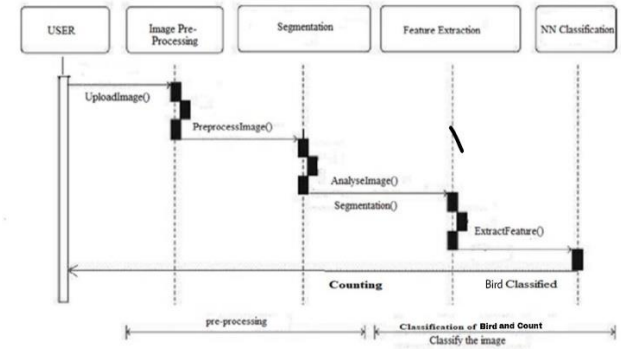

Fig 2. Sequence Diagram

C. FLOW CHART DIAGRAM

A flowchart is a visual representation of a machine, process, or computer programme. They are widely used in a few industries to visualise regularly complex processes in order to investigate, plan, enhance, and convey them. Flowcharts, which are sometimes known as glide charts, employ connecting arrows to identify waft and sequence in addition to rectangles, ovals, diamonds, and perhaps a few more forms to delineate the type of step. They can range from basic charts created by hand to detailed computer-drawn diagrams showing several phases and pathways. If we consider all the many types of flowcharts, they rank among the most utilised diagrams worldwide, being used by both technical and non-technical persons in a variety of sectors.

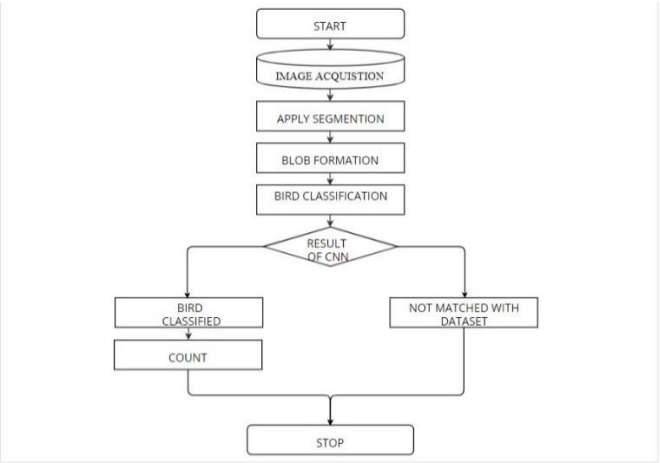

Fig 3. Flow Chart

D. USE CASE DIAGRAM

At its most basic level, a use case diagram is an illustration of a user's engagement with the system that shows their link to the many use instances they are involved in. A use case discovery may identify the many use cases and the various sorts of users for a device, and it frequently comes with various types of diagrams as well. A use case layout can assist provide a higher-level picture of the system even though a use case itself may go deeply into many aspects of each scenario. It has been stated earlier than that "Use case diagrams are the

blueprints for your system". They provide the system a graphical and simplified picture of what it has to achieve.

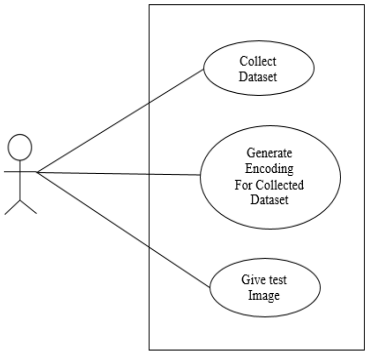

Fig 4. Use Case Diagram

E. ACTIVITY DIAGRAM

Every other crucial UML drawing used to depict the system's dynamic components is an activity diagram. A flowchart used to depict the transition from one activity to another is an activity diagram. The exercise may be categorised as system operation. The manage glide transitions between operations.

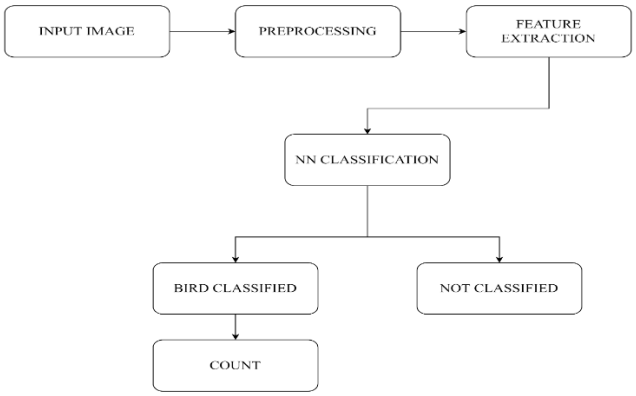

Fig 5. Activity Diagram

F. ALGORITHM

On a variety of difficult visual analysis tasks, deep convolutional neural networks have been consistently outperforming other methods. Deep models with parameter-heavy architectures have been successfully trained and deployed on a wide range of applications, and they owe some of their success to the ongoing development of graphics processing units that are getting stronger and stronger. However, the size and power requirements of such models make it difficult to use them in robotics applications. Therefore, recent research has focused on optimising deep learning architectures for use on hardware with constrained resources. In order to train models that are both efficient and effective, this calls for the use of modules with fewer parameters and floating point operations as well as careful optimization of such models. This introduces lightweight models that may be used on embedded devices and then goes on to discuss several techniques for enhancing the performance of deep lightweight neural networks. Then, a variety of tactics, including regularisation methods and architectural alterations, are described in an effort to increase the efficacy of such models.

VI. ABOUT SOFTWARE

Python:
Python is a high-level, all-purpose programming language that is interpreted. Python's design philosophy, created by Guido van Rossum and originally made public in 1991, places a strong emphasis on code readability through the liberal application of whitespace. Its language elements and object-oriented methodology are designed to aid programmers in creating clean, comprehensible code for both little and big projects. Python has garbage collection and dynamic typing. It supports a variety of programming paradigms, including procedural, object-oriented, and functional programming, particularly structured programming. Python is sometimes referred to be a "battery-inclusive" language due to its large standard library.

Keras:
In addition to TensorFlow, Microsoft Cognitive Toolkit, R, Theano, and PlaidML, Keras is a free and open-source neural network toolkit developed in Python. Its main goals are to be modular, expandable, and user-friendly. Layers, objectives, activation functions, optimizers, and tools to make working with picture and text data easier are just a few of the code blocks included in Keras that are utilised in standard neural network topologies.

TensorFlow:
One of the complete open source machine learning platform is called TensorFlow. It has a robust, adaptable ecosystem of tools, libraries, and community resources that lets academics improve the state of the art in machine learning and allows developers to quickly create and deploy ML-driven applications. In addition to offering stable Python and C++ APIs, TensorFlow also offers APIs for additional languages that are not guaranteed to be backward compatible.

Matplotlib:
To integrate plots into functions using all-purpose GUI toolkits as wxPython, Tkinter, GTK, or QT, Matplotlib offers an object-oriented API. Even though its usage is prohibited, there is a procedural "pylab" interface based on a home computer (like OpenGL) that is supposed to closely match that of MATLAB. Matplotlib is used by SciPy.
The Matplotlib package Pyplot offers a MATLAB-like user interface. With the ability to utilise Python and the benefit of being free and open-source, Matplotlib is designed to be as user-friendly as MATLAB.

OS Module:
A portable means to employ OS-dependent features is made available through OS modules. Open() may be used to simply read or write a file, the os.path module can be used to change paths, and the File input module can be used to read all lines in all files at once. For information on establishing temporary directories and files, go to the Temporary Files Module; for information on using advanced files and directories, refer to the Shutil Module.

VII. RESULT AND DISCUSSION

The input is given as a photo in pixels. Features are extracted in convolutional layers. In the pooling layer, the image size is reduced by multiplying the pixel array by a possibly small filter or kernel. These filters are used to make portraits smaller. The first layer produces output in the form of a one-dimensional array. Filters are used multiple

times to reduce size. Finally, a reduced-dimensional feature map is obtained.

In image recognition, it usually carries information about grayscale, appearance, structure or state. This is a key area of CS dealing with image recognition. We use the CNN algorithm to classify the data. Gain high-level knowledge about objects through image classification.

In the classification phase, the unknown species in the query image is compared with each sample of the same or different item used for training. The aves training set named Train Set has 90% accuracy, while the aves test set named Test has 97% accuracy.

VIII. CONCLUSION

The major purpose of developing the identification application is to raise awareness of ave-watching, ave-identifying, and specifically ave-observations in India. It also satisfies the desire to streamline the Aves identification process, making Aves-watching simpler. Convolutional Neural Networks(CNN) are the technical tool employed in the experimental configuration. For photo recognition, it uses function extraction. The method employed is suitable enough to extract features and categorize pictures. The main goal of the task is to identify the Aves species from a photo that the user has entered. We chose DCNN because it is suitable for enforcing complex algorithms and provides accurate numerical precision. It is also scientific and all-purpose. Our accuracy ranged from 95% to 97 percent. We concur that this mission's scope is greatly expanded as the need for it grows. This idea may be applied to camera traps in flora and fauna research and monitoring to capture flora and fauna mobility in precise habitat and behaviour of any species.

IX. FUTURE ENHANCEMENT

- Develop an Android/iOS app rather than a website since it will be more user-friendly.
- A system may be constructed using the cloud, which can store a large amount of information for comparison and provide powerful computation for processing (in case of Neural Networks).

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