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Identification Of Bird Species Using ANN

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Abstract_ Monitoring the effects of human activities on the environment is now essential to prevent the environment from incurring permanent harm. One approach to keep an eye on these effects is to monitor biodiversity, population dynamics, and animal breeding behaviour. Since they are typically the most sensitive to environmental changes, such as deforestation or forest fires, birds are among the best species to study. Around 1,370 species of birds, or 13% of all bird species, are thought to be in danger of extinction. Even though they are numerous, many bird species are difficult for humans to identify. Professionals have been manually tracking the birds up until now, which is time-consuming and not a viable method. We propose a deep learning method to identify the species of bird based on audio recordings to address this issue and support ecologists. To achieve this, we want to employ the most recent Artificial Neural Networks model (ANN model) for automatic bird species identification using audio inputs. We wanted to improve the current bird species classifier's classification accuracy in this work. The accuracy for training was 100%, and the accuracy for validation was 97%, according to this data. Therefore, we can claim that ANN can successfully detect the bird species and easily defeat the present implementation model.

1.INTRODUCTION

Our residing ecosystem consists of a number of sorts of species such as humans, animals, birds, etc. Our lookup focuses on figuring out the species of the birds. By defending these fowl species its will create a massive superb have an effect on on ecological balance, agricultural as properly as forestry production. To guard these chook species, we first off require correct statistics about their species. For identification functions we growing a neural mannequin the place the consumer can add the photograph that photograph will be processed with the aid of the neural mannequin and presenting the output to the person the species of bird. Creating our very own neural community mannequin for the species identification project will require higher quantity of statistics i.e. photographs of a hen with their annotation as nicely as its wants big computing

electricity to create a neural mannequin from scratch however it will no longer grant assurance that it will function the higher result, so higher choice is to use the pre-trained mannequin and function the switch mastering on our dataset.

2.LITERATURE SURVEY

A. Support Vector Machines for Bird Species Recognition [1] The purpose of this paper is to investigate the use of vocalization in the computerized detection of bird species. A Support Vector Machine (SVM) classifier distinguishes between two species and performs recognition at each node of a selection tree. Two collections of hen species that have previously been studied using exclusive methods are used to examine recognition. In comparison to the reference models that were in use at the time, the proposed strategy produced output that was either higher or of equal quality.

B. Classification of Bird Species Using Color Features [2] The proposed method of classifying bird species primarily uses shade characteristics derived from unconstrained images. In the first step of the process, a shade segmentation algorithm is applied to the image to eliminate historical factors and delimit candidate areas where the chicken might also be present. After that, the image is divided into factor planes, and from these candidate regions, standard color histograms for each aircraft are calculated. Eventually, the large number of histogram intervals will be reduced to a constant number of bins through aggregation processing. Instead, these histogram containers are used as characteristic vectors by an algorithm to distinguish between the various bird species.

C. Using Deep Learning Techniques for Image Recognition[3] In this lookup work, the Deep Learning methodology was used to recognize images. Deep mastering neural networks have been thought of in two different ways: Deep Belief Network (DBN) and Convolutional Neural Network (CNN). The Caltech101 dataset was chosen once to educate and examine the aforementioned proposed models. Previously, the Caltech101 database issuer was regarded as the benchmark model for the SVM-KNN algorithm. Using the above-mentioned method, a right focus score of 67.23 percent was achieved after a number of methods for preprocessing the dataset. This was an increase of 1% over the awareness score obtained using the chosen benchmark algorithm.

D. Bird species awareness primarily based on a choice tree and a SVM classifier [4] In the past, exclusive chicken species were distinguished by comparing the distance between the eye and the beak's root and the width of the beak. Through the incorporation of these brand-new aspects into the multi-scale choice tree and the SVM framework, a brand-new chicken species awareness algorithm was previously proposed to achieve the desired final result. An approximately 84% right classification rate has been achieved using the proposed strategy.

E. Pose Normalized Deep Convolutional Nets for Bird Species Categorization [5] In this study, structure was proposed for fine-grained visible categorization. The method reflected the professional success of humans in identifying hen species. The structure begins by estimating the object's pose, which is then used to estimate aspects of nearby images. Additionally, these characteristics are used for classification. Deep convolutional nets are applied to photo patches that the pose finds and normalizes in order to select the points. Modern implementations of deep convolution techniques and finetuning characteristic research for fine-grained classification were the subject of a comprehensive evaluation. The experiments improve the current success rate for identifying chicken species, with a significant increase in the appropriate classification levels compared to the previous methods (75 percent vs. 55-65 percent).

F. Bird Distinguishing proof by means of Picture Acknowledgment [6] The premier plot of this mission used to be to arrange the fowl species from the client's picture as information. The science of fine-tuning a pre-trained model is known as transfer learning (AlexNet). SVM (Support Vector Machine), a supervised computer learning algorithm, is used for classification. In the past, MATLAB was used because it is suitable for the implementation of advanced algorithms and provides accurate numerical precision. The developer has achieved an accuracy of between 80 and 85 percent. This challenge accomplishes the goal and covers a wide range of ground. This way of thinking can be used with digicam traps in both natural world research and monitoring to keep records of every species' unique habitat movements and behaviors.

G. Automatic Classification of Flying Bird Species Using Computer Vision [7] This study set out to develop a reliable and automated machine that could successfully

classify distinct bird species by analyzing video data taken during flight. A new and extensive set of video-classification look features were included in this update. Curvature and the frequency of wing beat had been added as action features. The dataset was made up of seven organisms. The Normal Bayes classifier and a Support Vector Machine classifier were used to aggregate the experimental evaluations of the look and action points. Normal Bayes and SVM classifiers were utilized to achieve a classification charge of 92% and 9%, respectively.

H. Sound Based Bird Species ID the utilization of Profound Learning Procedures [8] This paper brought another method of sound grouping for the recognizable proof of fowl species. The authors of this paper utilized speech attention strategies from the field of deep learning, in contrast to the majority of methods, which utilized the nearest neighbor matching or choice timber for each individual bird species with extracted templates. After consolidation of all records preprocessing necessities and records make greater techniques, a Convolutional Brain Organization was once shaped. When heritage species were used as the greater target, the community structure scored 0.555 and achieved an accuracy of 0.686 when predicting the major species of each sound file..

3.PROPOSED SYSTEM

The initial stage in implementation is to collect data from the Kaggle dataset. This site includes audio recordings of the birds in.wav format. This dataset contains bird audio recordings in.wav format. Kaggle are open dataset platforms where individuals can add their own recordings. Because various features are provided in the dataset, a combination of them is utilised to construct classes (such as genus and species) and classify birds based on them..

A prominent method for analysing and recognising bioacoustics signals is an Artificial Neural Network (ANN) classification algorithm. The multilayer perceptron (MLP) is utilised as a classification model. The MLP takes as input a set of specified attributes and generates a unique output for each bird species to be detected. The two steps in this identifying technique are training and testing. During the training process, syllables from specific bird sounds were used to train the multilayer perceptron, resulting in the activation of the correct MLP output.

The training procedure involves repeatedly sending known sounds to the network and then iteratively modifying the weighting of the network. This training aims to reduce the overall error between the supplied and expected results until a preset error requirement is met. To analyse the species of bird, the user might utilise GUI, or Graphical User Interface. The GUI allows the user to upload the dataset, process it, and display the results.

3.1 IMPLEMENTTAION

Dataset:

In the first module, we developed the system to get the input dataset for the training and testing purpose.

Data set link: https://www.kaggle.com/datasets/vinayshanbhag/bird-song-data-set

The dataset consists of 5,422 Bird Sound Classification Using Deep Learning and can practice it on Kaggle itself.

Importing the necessary libraries:

Librosa is a highly significant and wonderful library that allows audio and music analysis. To install the library, simply run the Pip command. It gives the building elements needed to create an information retrieval model from music. TensorFlow is another fantastic package that we will use for deep learning modelling, and I hope everyone has already installed it..

Exploratory Data Analysis of Audio data

Under the urban dataset folder, we have five distinct folders. We will attempt to comprehend how to load audio files and how to visualize them as waveforms prior to implementing any preprocessing. You can directly provide the IPython library with a path to the audio file if you want to load the audio file and listen to it. The first audio file in the fold 1 folder that falls under the dog bark category has been selected by us.

We will now load audio data with Librosa. So, when we use Librosa to load an audio file, it gives us two things. The first is a two-dimensional array, and the second is the sample rate. Let's use Librosa to load the audio file above and plot the waveform with Librosa.

The number of samples that are recorded each second is referred to as the sample rate. The file is read by librosa at a sampling rate of 22050 by default. The library you choose affects the sample rate.

2-D Array: The first axis shows the amplitude of the samples that were recorded. The number of channels is also represented by the second axis. Stereo (audio with two channels) and monophonic (audio with one channel) are two distinct types of channels.

Librosa is used to load the data, normalize it, and then attempt to provide it at a single sample rate. The same thing can be done with the scipy python library as well. In addition, it will provide us with two pieces of information: the sample rate and the data.

Scipy-based printing of the sample rate differs from librosa-based printing. Let's look at the wave audio data now. One important distinction between the two is that normalization is possible when printing data retrieved from librosa, but not when reading audio files with scipy. There are three reasons why audio signal processing is becoming increasingly popular with Librosa.

1. It tries to make the signal mono (one channel) by combining it.
2. A regular pattern is observed because it can represent the audio signal between -1 and +1 (in normalized form).
3. It can also see the sample rate, which it converts to 22 kHz by default, whereas other libraries show it using a different value..

Imbalance Dataset check:

Now that we know about audio files and how to see them in audio format, we can do so. Moving arrangement to information investigation we will stack the CSV information document accommodated every sound record and check the number of records we that have for each class.

Let's look at the first file, which is in fold 5 and is classified as a dog bark because the data we have is its name and location. Now, check the records for each class with the value counts function.

When you look at the output, you will notice that the data is not unbalanced and that most classes have roughly equal numbers of records. Data preprocessing:

A different rate, such as 44KHz or 22KHz, is being used to record some audios. It will be at 22 kilohertz with librosa, allowing us to view the data in a normalized pattern. Now, what we need to do is extract some crucial information and preserve our data as independent (features extracted from the audio signal) and dependent (class labels) features. Mel Frequency Cepstral coefficients will be our method for

obtaining distinct features from audio signals.

MFCCs: The MFCC provides a synopsis of the frequency distribution over the window size. As a result, the sound's frequency and time characteristics can both be examined. We will be able to identify features for classification using this audio representation. As a result, it will attempt to transform audio into some kind of time and frequency-based feature that will assist us in classification.

First, we will apply MFCC to a single audio file that we are already working with to show how it works in practice.

Now we need to prepare the dataframe and extract features from each audio file. As a result, we will develop a function that accepts the filename (the location of the file path). It loads the file with librosa, giving us two details. To begin, we will determine the MFCC for the audio data, and in order to determine scaled features, we will determine the mean of an array's transpose.

Now, we need to use a loop over each row in the dataframe to extract all of the features for each audio file. Additionally, the TQDM python library is used to monitor progress. Within the loop, we will set a unique file path for each file and call the function to extract MFCC features and append features to corresponding labels in a new dataframe..

Splitting the dataset:

Split the dataset into train and test. 80% train data and 20% test data.

Audio Classification Model Creation:

1. In the train and test sets, we retrieved features from the audio sample and splitter. We will now use the Keras sequential API to create an ANN model. The number of classes is 10, which is our output shape (number of classes), and we will build an ANN with three dense layers, as explained below.

   1. There are 100 neurons in the first layer. We'll utilise the Dropout layer at a rate of 0.5 to avoid overfitting, and the input shape is 40 based on the amount of features with activation function as Relu.

   2. The second layer has 200 neurons with the same activation function as Relu and a drop out rate of 0.5.

   3. The third layer again has 100 neurons with activation as Relu and the drop out at a rate of 0.5.

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```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape
=================================================================
dense (Dense)                (None, 1000)
_________________________________________________________________
dense_1 (Dense)              (None, 750)
_________________________________________________________________
dense_2 (Dense)              (None, 500)
_________________________________________________________________
dense_3 (Dense)              (None, 250)
_________________________________________________________________
dense_4 (Dense)              (None, 100)
_________________________________________________________________
dense_5 (Dense)              (None, 50)
_________________________________________________________________
dense_6 (Dense)              (None, 5)
=================================================================
Total params: 1,322,905
Trainable params: 1,322,905
Non-trainable params: 0
_________________________________________________________________
```

Compile the Model

To build the model, we must first define the loss function, which is categorical cross-entropy, the accuracy metrics, which is accuracy score, and the optimizer, Adam..

Train the Model

We'll train the model and save it in HDF5 format. We will train a model for 250 epochs and 32 batches. We'll use callback, which is a checkpoint, to determine how long it took to train over data..

Check the Test Accuracy

We will now evaluate the model using test data. We achieved close to 97 percent accuracy on the training dataset and 100 percent accuracy on the test data..

Saving the Trained Model:

When you're ready to put your trained and tested model into production, the first step is to save it as an.h5 or.pkl file using a library like pickle.

Check that Pickle is installed in your environment.

Next, import the module and save the model as an.h5 file..

4.RESULTS AND DISCUSION

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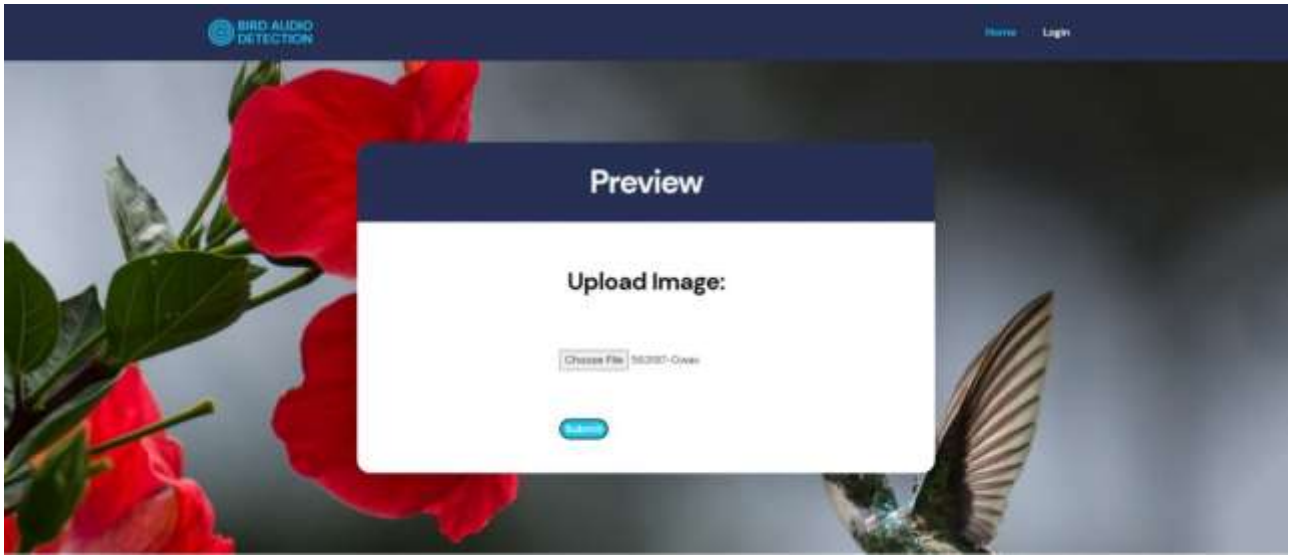

Fig 1:input audio

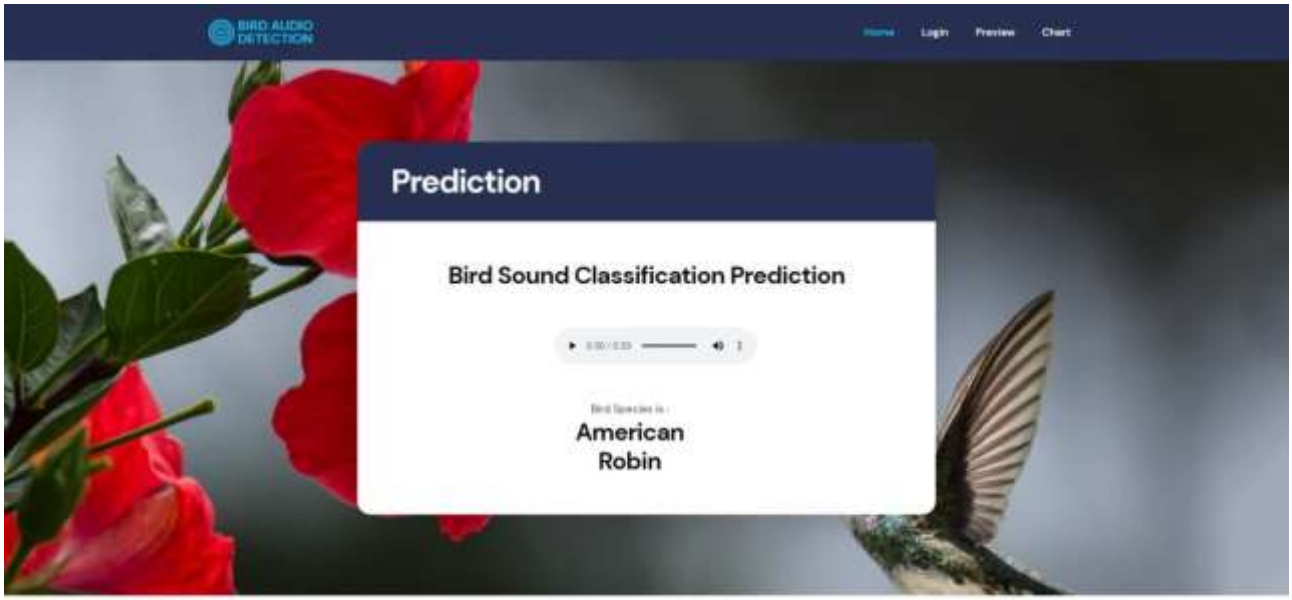

Fig 2:Predict output

5.CONCLUSION

This research proposes an Artificial Neural Networks (ANN) model for automatic bird species identification. Many researchers recommended an animal species recognition system to assist them in specialised studies due to the effect of climate change and the number of endangered animals. In this research, we used Artificial Neural Network (ANN) to create a system for identifying bird sounds. Each bird makes a distinct tone of sound. Python is used to classify and detect bird

sounds using ANN. . To begin, all necessary data in terms of power spectral density of bird is employed to obtain data for each bird type. The next step is to teach ANN to recognise bird species. Only one bird can be identified at a time. Finally, a graphical user interface (GUI) for bird sound identification was created, which needed the user to provide audio input of bird sounds in order to detect bird species. This study was a success, and it may now be used to identify bird species..

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