International Journal of Research in Engineering, Science and Management
Volume-3, Issue-6, June-2020
www.ijresm.com | ISSN (Online): 2581-5792

Automatic Classification of Bird Traits

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***Abstract*: Many people are capable of hearing the creeping sounds of birds but most of the times it's difficult to exactly determine the sound of the particular bird. It is the wonder of our nature that numerous audio sounds of birds are existing presently, hence it's tough to differentiate the precise sound of the birds. With respect to this particular limitation it's necessary to develop a software-based product. Observations where done using audio sounds of birds by dynamic time warping and hidden Markov model. These are used for spontaneous song recognition by corresponding the spectrograms to predefined prototypes. The identification of species is using Support Vector Machine (SVM) classifier and extraction is by using Mel Frequency Cepstral Coefficients (MFCC).**

***Keywords*: Hidden Markov Models, MFCC, Spectrograms, SVM.**

1. Introduction

Human ear is able to recognize all the birds sounds and differentiating them from their source. But many other times it's difficult to recognize the kinds of a specific source. The chirping of birds is one such audio sound existing in our natural surroundings which isn't easy to differentiate and hence a software-based product will help to beat this limitation of human ear. Fowls are feathered, winged, bipedal, endothermic, egg-laying, vertebrate creatures.

Modern birds are characterized by feathers, a beak with no teeth, the laying of hard-shelled eggs, a light-weight but strong skeleton, a high rate and a four-chambered heart. Wings are developed forelimbs and most species can fly. Birds even have unique digestive and system that are highly adapted for flight. Research on different forms of environmental sounds are beneficial within the study of the wildlife and their evolution with time. supported such research, development of an automatic system for bird species identification from their sounds made in field conditions might be very useful attempts are made to acknowledge bird species automatically through their sounds. Method was to use dynamic time warping and hidden Markov models for automatic song recognition by matching the spectrograms to predefined prototypes.

In this study, creeping sounds of bird species commonly found in India were collected from the natural surroundings and some from the standard database like Xeon-canto. Mel Frequency Cepstral Coefficients based features were extracted for each recording. Further training and testing of data were performed using SVM. The main contribution being the combined approach of MFCCs and SVMs classification. A multiclass classification technique for the modelling of SVMs to perform audio classification with lower error rates is present. Advantages of both resulted in increased accuracy and faster classification method. Basic objective was to decrease error rate with simplified computations. Successful implementation of this software as a product can be very useful to oncologists as a powerful tool for monitoring birds' population density, identification of the natural habitats and tracking of several other species. Currently about 1,200 species of birds are intimidated with extinction by human activities, though efforts are underway to shield them. A user-friendly application can also be developed for nature lovers and environmental enthusiasts.

2. Literature Survey

Instantaneous division and organization of bird tune by CNN is used to clarify spontaneous animal vocal sound recognition and identification from audio tapes is an evolving subject for animal conservation. This research emphasis on bird bioacoustics, where the aim is to section bird syllables from the soundtrack and expect the bird classes for the syllables. Traditional methods for this task address the segmentation and species prediction separately, resulting in propagated errors. This work presents a replacement approach that performs simultaneous segmentation and classification of bird species employing a Convolutional Neural Network (CNN) [1].

In another method, wavelet transform digital sound processing to identify wild bird species [2], explain the applying of digital signal processing for detection and preservation of various species has been progressing rapidly. During this paper, one such better approach as applied to wild bird species is presented. Feature extraction is finished by first performing wavelet transform on sampled bird sounds.

In next method, bird species recognition using unsupervised modeling of individual vocalization elements [3], it's investigated acoustic modeling for recognition of bird species from audio field recordings. First, the acoustic scene is

decomposed into isolated segments, appreciate detected sinusoids. Each section is represented to by a grouping of the frequency and standardized extent estimations of the sinusoid. The transient development of those highlights is displayed utilizing hidden Markov models (HMMs). A one of kind strategies for an unaided demonstrating of individual winged creature vocalization components is proposed. The component models are initialized utilizing HMM-based clustering.

Another method, which uses, spectrogram segmentation for bird species classification supported temporal continuity [4], explains presented an enhanced approach for bird species classification from their recorded audio signals. There are plenty of rooms for the improvement of the syllable segmentation technique. The present technique still involves thresholds, which is always undesirable in signal processing techniques.

3. Methodology

A. Collection of database and pre-processing of audial recordings

Birds creeping noises of certain species where collected and changed into normal .wav arrangement. Before feature extraction, audio signals are pre-processed. 30% of the total collected samples where used as testing data while 70% was used for training. Under noise classifications performed, as there are different kinds of noises in environment.

B. Feature Extraction

Mel Frequency Cepstral Coefficients (MFCCs) are the features used to explain the spectrum of an audio recording in very compact yet different manner. They are denoted in mel units, which are calculated in logarithmic scale, instead of Hz. So, to make the speech signal nearly stationary uses the audio signal using hamming function. Spectrum of an audio recording in a very instructional manner is described using Feature Extraction MFCCs which is represented in Mel units, ad computed on logarithmic scale rather than Hz. audio signals are made stationary.

C. Classification by algorithm based on SVM

The decision tree method is humble and cool to understand, and the model of decision tree is not only effective but also has a great accurateness of sorting. Birds of similar characters are grouped into a set. SVM has advantages like powerfully generalizing ability and quick solving. SVM uses kernel function that classifies data by plotting the direction from low-dimensional space to high-dimensional space. It has one more advantage of tiny data for support vector to finish linear and nonlinear programming problem. According to their character, the SVM classifier and binary decision tree are united in paper the color feature, beak feature and moment invariants are merged for a feature, which is used to train the SVM classifier and classify.

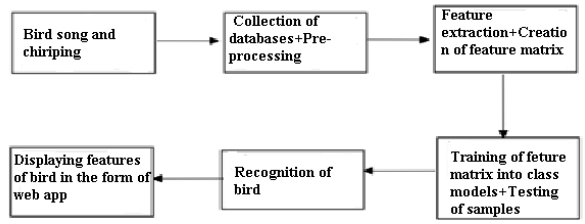

Fig. 1. System Architecture of Bird Species using Machine Learning

D. Pre-processing and Feature Processing Algorithm

Step 1: Read from metafile
Step 2: Read audio file based on file id
Step 3: Fetch audio data, sample rate, audio mask
Step 4: Determine window size
Step 5: Extract features from each audio file
For each audio frame get chroma_stft, chroma_n, chroma_cens,
mfce, RMS, spectral_centroid, update weight file
Step 6: write weight file to external csv file

E. Prediction Algorithm

Step 1: Read Input Audio File
Step 2: Fetch audio data, sample rate, audio mask
Step 3: Extract Features
Step 4: Import weight file
Step 5: Compare Model weights with Input audio features
Step 6: Display Bird Name

4. Results

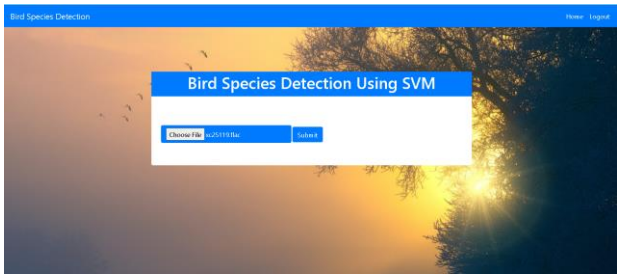

Fig. 2. Bird Species Detection Page

Fig. 2, shows us the bird species detection page where user needs to choose the audio file of birds.

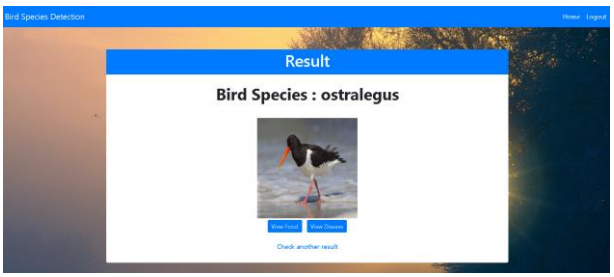

Fig. 3. Result Page

The above Fig. 3 displays the bird name of chosen audio file.

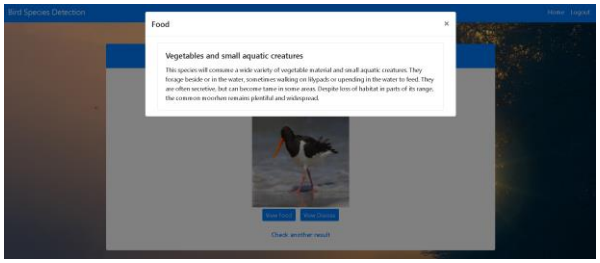

Fig. 4. Result Page

The above fig. 4 displays the bird species characteristics of chosen audio file.

5. Conclusion and Future Work

The overall bird species recognition problem is divided into three parts. Firstly, features from the audio in the training dataset are extracted using SVM algorithm. Secondly, it is trained using various machine learning classifiers. Finally, random test audio is given to the network for label prediction to evaluate the accuracy of the system. The bird dataset is split into training audio and testing audio. The other global feature descriptors are applied on the training dataset and assigned. The proposed work is a faster way to train with Support Vector Machine (SVM) a smaller dataset and limited computational resource such as CPU. As there are millions of bird species around the world, this system could easily be adapted by training a greater number of bird species audio recordings to recognize different species around the world.

In future, a greater number of classes can be worked upon using this technique and more accurate results can be obtained. Successful implementation of this software as a product can be very useful to oncologists as a powerful tool for monitoring birds' population density, identification of the natural habitats and tracking of several other species. A user-friendly application, can also be developed for nature lovers and environmental enthusiasts. Bird species identification can also be done by only using image which will not give much efficiency. Future location of the bird where it is creeping can also be included for better result in wildlife geography.

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