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BIRD SPECIES IDENTIFICATION - A SURVEY

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Abstract : Birds are regarded as the most valuable aspect of God's creation. Birds contribute to Earth's biodiversity in various ways. They indicate environmental hazards as they are very much sensitive to habitat and climatic changes. They are considered as a driving force in promoting conservation and also contribute to the economy. Birds aid to control rodent populations and are extremely efficient insect pest controllers. Ornithologists who often work on reporting bird activity need some kind of assistance to deal with the reporting. Numerous bird books have been published to assist birdwatchers and ornithologists in order determining the correct species. However, the identification of birds is an impractical piece of work to be done manually. Image-based bird species identification involves various techniques like Open CV, CNNs and few more which are the most important image processing techniques to predict the type of bird species. Few of the applications have been built to counterbalance the usage of bird books. Nevertheless, they have few drawbacks of their own. This paper performs a survey on the existing systems, the techniques adopted and the challenges faced.

Keywords **- Bird Identification, Convolutional Neural Networks (CNN), Ornithologists, Deep Learning, Image Recognition.**

I. INTRODUCTION

In today's world, most identification systems rely on images to identify species. After being exposed to enough training data, classifiers can correctly identify the trained species. They are trained by using accurately identified datasets. Accurate identification of birds is the basis for all aspects of bird activity reporting and research. Most studies used less than 275 bird species in a dataset. Software for image recognition requires knowledge of Convolutional Neural Network (CNN) which is one of the Deep Learning neural networks. It is quickly becoming the most popular tool. The CNN takes an image as an input and allocates weights to objects based on their importance. Deep Learning enables us to recognize complex relationships among many variables. It can also help you solve complex problems, such as discovering hidden patterns in your data. Bird species identification is considered as one of the confusing issues that often leads to ambiguity. Recognizing birds manually is based on a few characteristics. Due to limitations of birding such as such as location, distance, and equipment, classification according to specific characteristics is often cumbersome. The existing models comprise of four steps: 1. Collecting and bounding the bird dataset 2. Applying CNN architecture 3. Training CNN model 4. Testing the effectiveness of the trained model.

II. EXISTING MODELS

Yo-Ping Huang and Haobijam Basanta developed a model that deals with the recognition of bird species with dataset about 27 bird species endemic to Taiwan.This was achieved with the aid of a mobile application i.e., the Internet of Birds (IoB). This model was implemented using CNN with skip connection. CNNs are studying images of birds to determine their characteristic features. Bounded regions of interest have been created to refine the color and shape of object details. In addition, skip connections were used to linearly combine the outputs of previous and current layers. To enhance the feature extraction skip connections were implemented. To obtain probability distribution a function named softmax was utilized. The output layer outputs: (a) Chunks of the image having birds, (b) type of bird species, and (c) Portion of the input image not containing a bird . The strategy of multiscale sliding window was applied to detect output of images with or without birds. The CNN model will skip connections achieved an accuracy rate of 99.00% whereas CNN without skip connections achieved 93.98% accuracy. SVM achieved an accuracy of 89% [1].

Satyam Raj, Saiaditya Garyal, Sanu Kumar developed a model by using a Deep Learning algorithm i.e., Convolution Neural Network. Convolution followed by Rectified Linear unit is the primary step taken in this project as it helps in decreasing the size of the image which we provide as an input. The main goal of this application is to identify the characteristics of every individual bird by uploading an image. It involves the following steps:

1. Collecting the dataset of all the bird species which included around 60 bird species which had around 8220 images.
2. The CNN architecture which is to be developed more detachable version of VGG network.
3. The CNN model is trained after the deployment of CNN model using Keras and Adam Optimizer respectively. The split ratio was 80:20 random split. 80% and 20% data id for training and testing was allocated.
4. Testing the capability of the model that is trained as the client-server architecture maneuver the image of the bird to the testing script and the script extract the information and identify the bird image.

The experimented result of CNN training set is 93.19% accurate and on testing set was around 84.91% [2].

A V Shiva Krishna Reddy, Dr. M A Srinuvasu. K, Manibabu, Ch B V Sai Krishna, D Jhansi implemented the model with the help of the Convolution Neural Network along with Residual Network (ResNet). With the intention to improve the accuracy and performance additional layers were stacked up. The idea behind stacking up additional layers was to gradually learn most of the complex features. The dataset consisted of 275 different bird species. It was split into training set, testing set and validation set. About 70% was allocated to the training dataset. This was implemented on Windows operating system and used Python3 along with libraries such as TensorFlow, numpy, sklearn and Keras. Mathplotlib was used to plot visualizations. With the help of ResNet 152 v2 model the image dataset was trained. The proposed system detects a part and extracts CNN features from multiple layers which are then aggregated and given to the classifier for classification. The test accuracy observed was 95.71% and loss function was 15.06% [3].

Anisha Singh, Akarshita Jain, Bipin Kumar Rai implemented the model with the aid of OpenCV and CNN. With the trained model the input image would be compared and outputs the bird species. If in case the image uploaded by user is not available in the dataset then the image is added to the dataset. In order to identify the bird species accurately image processing which is a part of Deep Learning was implemented. Features such as beak, body and color were given to Deep CNN to extract features which are then forwarded to the classifier. After the input image is compared with the pre-trained dataset the score sheet is generated. Species with highest value in the score sheet is predicted as output. It is also noticed that at some angles the results were not accurate beyond a certain range of camera. The trained dataset was created using 50000 steps with about 93% accuracy. The main intention behind increasing the steps is to increase accuracy. The testing dataset showed an accuracy of 80% [4].

Saundarya Junjur, Punam Avhad, Deepika Tendulkar used Deep Learning algorithm victimization with CNN architecture. After transforming the image uploaded into grey scale this method was applied. The main goal of the application is to identify the name of the bird with image as an input. The dataset used here is Caltech-UCSD with across 200 different types of bird species. The accuracy of predicating the bird's name given image is about 83.3% [5].

Shriharsha, Tushara, Vijeth, Suraj, Dr Hemavathi P developed an application that uses CNN. In the convolution layer the features are extracted.This is done using the convolution feature matrix of an image. The size of the feature matrix is extracted in the pooling layer which is used for withdrawing the major features of the image. The fully connected layer is used for forming the neural network by connecting neurons from one layer to another. The softmax classification technique is used to distinguishing between dominating and certain low-level features. The model was
Tested on the test data set with accuracy of 98.75% [6].

Mahvish Ansari, Vrushali R.Waghmare,Sudarshan Bhandare, Amit Tambade developed an application that utilizes Deep Convolution Neural Network (DCNN) and Unsupervised learning calculation respectively. The data set preparation is completed by Google-Collab. The result of the application has the range of exactness between 80% to 90% respectively which utilized Tensor Stream library [7].

Aditya Bhandari, Ameya Joshi, Rohit Patki used data set Caltech UCSD 200 bird species. The entire design was based on a python library Scikit and algorithms like Naive Bayes, Support Vector Machines (SVM), KNN, etc were tried out. The final observation was that the highest accuracy obtained was for Logistic Regression method using Mturks as an extraction method. The accuracy obtained is higher compared to modules when SVM or SVM+CNN - Learning method but lower when compared Logistic Regression-Learning method. The proposed model generates output with an accuracy rate of 53.65 % where Mturks is the feature extraction method and Logistic Regression is Learning method [8].

Suleyman A. Al-Showarah, Sohyb T. Al-qbailat used VGG-19 module and the various operations were performed like combine, max, min and average between the f6/g7 based on VGG19. Based on the result of classifiers: The classification accuracy of ANN was 70.9908%, the recall was 0.71%, and the f-measure was 0.708. The VGG-19 module shows an highest accuracy of image identification of about 70.9908% with ANN [9].

Andreia Marini, Jacques Facon and Alessandro L. Koerich used Caltech UCSD-200 dataset in this module. First, a colour segmentation method for removing background elements and possible locations where the bird might be present. Thereafter, the image is split into planes, and normalised histograms are generated for each plane. The number of bins is then reduced via aggregation processing. An algorithm uses these histogram bins as feature vectors to discriminate between the number of species. The proposed module achieved a segmentation accuracy rate of 75% [10].

III. RESULTS

Based on the existing models few drawbacks have been noticed. They are:

i. Most of the dataset used is limited only for North American Birds which uses Caltech-UCSD Birds 200.
ii. There is no proper user interface for the application.
iii. There is no user management system hence the past queries and previous user data is not being recorded.
iv. The size of the data set ranges from 20-275 different type of bird species.
v. The use of Google Maps to track down the birds is not implemented.
vi. The model does not take environment into account.
vii. In-depth information of the bird is not provided.
viii. Information regarding the extinct species is not available.
ix. Making a distinction between images of birds and humans is not achieved.
x. Only the name of identified bird is being displayed but the information about the birds is not extracted.
xi. Text based Search is not available.

TABLE- I

This table summarizes the accuracy achieved by the existing models

Technique	Accuracy Obtained (%)
CNN without skip connections	93.98
CNN with skip connections	99
Simple Vector Machine (SVM)	89
CNN followed by Rectified Linear Unit	Training dataset - 93.19 Testing dataset - 84.91
CNN along with Residual Network	Testing dataset – 95.71
OpenCV and CNN	Training dataset – 93 Testing dataset – 80
DCNN & Unsupervised Learning	80-90

IV. CONCLUSION

The dataset can also include Asian birds in addition to those from North America. Rather than only predicting the name of a bird, the complete information regarding bird species could have been retrieved. Locations of bird flocks could also have been computed. The information regarding the users of the application could have been stored in database for maintaining purpose.

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