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Bird Species Image Identification using Transfer Learning

Prof. N.V. Gawali[1], Tanmay V. Agavile[2], Aditya G.Dalvi[3], Shreyas S.Joshi[4],

Computer Engineering Department,
PDEA'S College Of Engineering Manjari(BK), Pune-412307, India

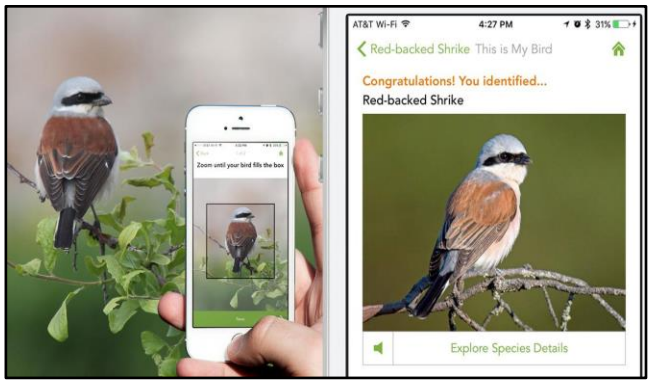
***Abstract*- Nowadays, many new fellow Bird Watchers are having a hard time remembering all the bird species and identifying them. Also, common people and newly joined rescue team members are not able to identify bird species to be able to rescue them and treat them. They have to go through a hard way of identifying thick books like "Birds of Indian Subcontinent". In this project paper, we evaluate and show the result of Deep Learning based AI Model which is useful for identifying birds using their images. The paper shows a Simple Web App which uses Transfer Learning, which is one of the best Deep Learning techniques, to identify images. We are going to use the InceptionV3 model made by google to get trained on the dataset of 325 different bird species having 1000 images per species with labels.**

***Keywords*-** Deep Learning, InceptionV3, Bird Identification, Computer Vision, ImageNet

I. INTRODUCTION

BIRD behavior and population trends have become an important issue nowadays. Birds help us to detect other organisms in the environment (e.g. insects they feed on) easily as they respond quickly to the environmental changes. But, gathering and collecting information about birds requires huge human effort as well as becoming a very costly method. In such a case, a reliable system that will provide large-scale processing of information about birds and will serve as a valuable tool for researchers, governmental agencies, etc. is required. So, bird species identification plays an important role in identifying that a particular image of bird belongs to which species. Bird species identification means predicting the bird species belongs to which category by using an image.

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 the environment such as insects, objects from the 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 birds 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 carry out such a task in an automatic fashion.



There are around 1700 birds in India. Many researchers or newbies are unable to identify species of birds. Also, sorting this big amount of data will cost human effort and time. This system is proposed to Identify Bird Species using different deep neural network techniques based on Images. Deep Learning techniques include.

This study organized into six sections. Section II introduces the overview of previous studies on all related subjects. Section III describes the used database. Section IV
Discusses the model design and the methodology for the experiment. Then Section V discusses the results of the experimental, and finally, Section VI presents paper conclusion.

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In this paper, instead of recognizing a large number of disparate categories, the problem of recognizing a large number of classes within one category is investigated that of birds. Classifying birds pose an extra challenge over categories, because of the large similarity between classes.

II. DATA COLLECTION

Finding annotated and labeled data of such a small and rare domain is pretty hard to collect. There are a lot of Instagram and Facebook handles of different photographers who post regularly with labels and information. Web scraping is one way to collect data. But, websites like Bird, Instagram and Facebook don't allow you to scrape the information. So, we collected Data from open source website for world of data, i.e. Kaggle.

We collected and sorted the labeled data of 325 different bird species. The birds have origins from all over the world. This dataset consists of a minimum 400 images to a maximum of 1000 images per species. We have cleaned and resized the data. Cleaning consists of getting rid of redundant data, converting images into standard and same pixel size to ensure ease of training and speed, removing where there is too much data which can cause AI Model to get overfitted, and balancing the samples

III.BACKGROUND

Basically bird identification is done visually or acoustically. The main visual components consist of the bird's shape, its wings, size, pose, color, etc. However, while considering the parameters, time of year must be taken into consideration because birds' wings change according to their growth. The acoustics components comprise the songs and calls that birds make. The marks that distinguish one bird from another are also useful, such as breast spots, wing bars which are described as thin lines along the wings, eye rings, crowns, eyebrows. The shape of the beak is often an important aspect as a bird can be recognized uniquely. The characteristics of birds such as shape and posture are the most used to identify birds. Most experts can identify a bird from its silhouette because this characteristic is difficult to change. A bird can also be differentiated using its tail. The tail can be recognized in many ways such as notched, long and pointed, or rounded. Sometimes legs are also used for recognizing an image in format long, or short.

IV.METHODOLOGY

To develop a generic system, certain methods are tried and tested. In this paper, we will list out the tried methods and explain about the most efficient and accurate result we got through. Tried methods are as follows:

- Using Machine Learning Classification algorithm like **SVM ONE vs REST**
- Developing own neural network architecture and training with different sizes of images.

However, both of these methods had a hard time and needed a lot of research and preprocessing on images. Google has developed different AI Model Architecture to implement object detection. They used a big dataset of Images and developed many models which can be used to perform

Transfer Learning.

IV. Transfer Learning

Transfer learning generally refers to a process where a model trained on one problem is used in some way on a second related problem.In deep learning, transfer learning is a technique whereby a neural network model is first trained on a problem similar to the problem that is being solved. One or more layers from the trained model are then used in a new model trained on the problem of interest.

The pre-trained model or desired portion of the model can be integrated directly into a new neural network model. In this usage, the weights of the pre-trained can be frozen so that they are not updated as the new model is trained. Alternatively, the weights may be updated during the training of the new model, perhaps with a lower learning rate, allowing the pre-trained model to act like a weight initialization scheme when training the new model.

We can summarize some of these usage patterns as follows:

Classifier: The pre-trained model is used directly to classify new images.

Standalone Feature Extractor: The pre-trained model, or some portion of the model, is used to pre-process images and extract relevant features.

Integrated Feature Extractor: The pre-trained model, or some portion of the model, is integrated into a new model, but layers of the pre-trained model are frozen during training.

Weight Initialization: The pre-trained model, or some portion of the model, is integrated into a new model, and the layers of the pre-trained model are trained in concert with the new model.

VI. Models for Transfer Learning

There are perhaps a dozen or more top-performing models for image recognition that can be downloaded and used as the basis for image recognition and related computer vision tasks.

Perhaps three of the more popular models are as follows:

VGG (e.g. VGG16 or VGG19).
GoogLeNet (e.g. InceptionV3).
Residual Network (e.g. ResNet50).

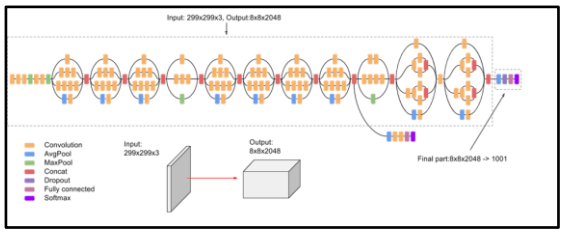

Fig 2: Inception V3 Architecture

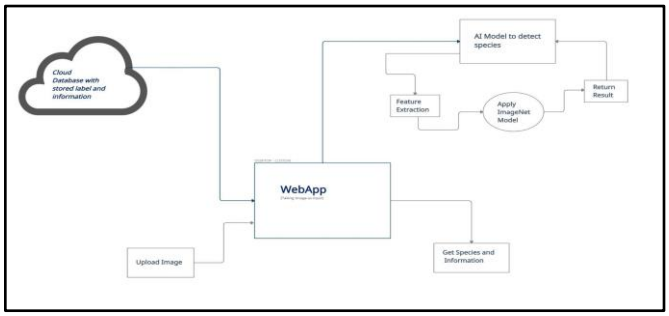

Fig 3 : System Architecture

VII. RESULTS

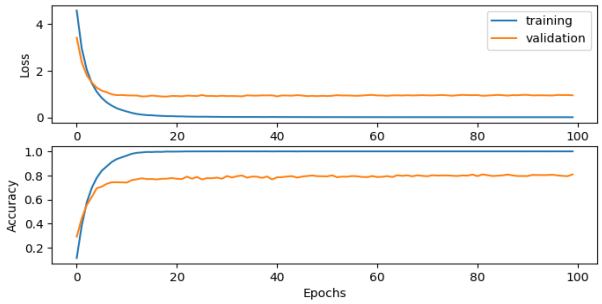

Fig 4: Training Loss vs Validation Loss

With every new epoch of training, we found that model can give accuracy of up to 82% on the validation data. These results can be improved by using more dense pixels. Currently, the pixel size chosen is 250 x 250 pixels. But, by having a better GPU, pixel size can be increased to 398 x 398, which can give more than 90% accuracy.

CONCLUSION

This project examined the use of modern deep learning algorithms to solve the problem of identification of bird species. Transfer Learning has given the best result by outperforming conventional Deep Learning Techniques like RNN, CNN and many more. Open source image dataset of kaggle which consists of 325 species and balanced 600 images per species has been used to train the model. Also, one of the best model architecture i.e. InceptionV3 has been used to achieve the desired accuracy. Future research will emphasize on developing the same system to be able to use on Smartphones.

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Output:

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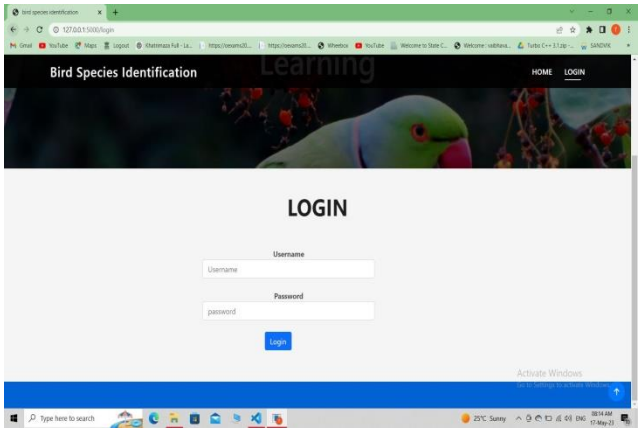

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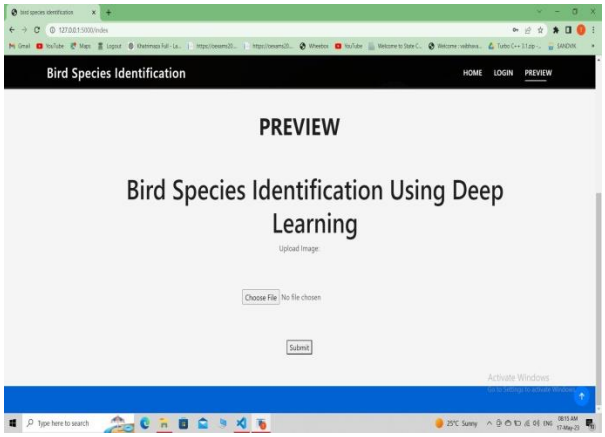

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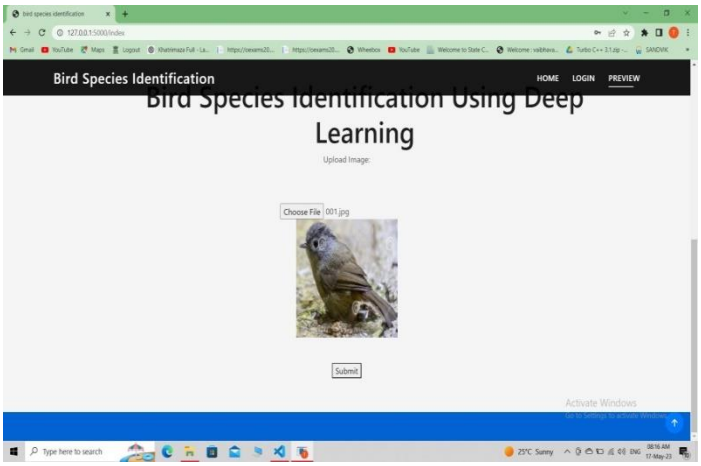

- The image will be detect and finding the bird name