DETECTION OF BIRD SPECIES BY IMAGE PROCESSING WITH THE HELP OF DEEP LEARNING

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

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APPROVAL

This Research-Based Project titled " Detection of bird species by image processing with the help of deep learning", submitted by Nadim Mahamud Forhad 172-15-9805 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and engineering and approved as to its style and contents.
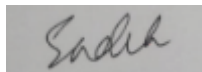
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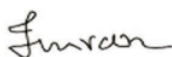Faculty of Science & Information Technology
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This is to certify that this project titled "Abusive Language Detection from Real-Time Radio message Gateway "has been done by us under the supervision of Mr. Ahmed Al Marouf, Senior Lecturer, Department of CSE, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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Finally, I must acknowledge with due respect the constant support and patients of my parents.

ABSTRACT

These days, countless species of birds are hardly found, besides it is problematic to categorize bird species once found. For instance, for diverse circumstances, birds come with altered dimensions, forms, shades, and as of an anthropoid lookout with diverse viewpoints. Certainly, the pictures display changed alterations that need to be noted by means of image recognition of bird classes. It is similarly tranquil for individuals en route for classifying birds in the images. In this paper, we were able to detect almost all kinds of bird species that are available by means of our dataset and deep learning networks. We collected the dataset from Kaggle which contains 30,000 data. We added a few more locally for more accuracy to be found. Detecting, learning, and studying bird species is easy with the help of images, that's what we aimed for in this paper to make it easy and accurate. We applied convolutional neural networks (CNN), recurrent neural networks (RNN), and artificial neural networks (ANN) to find the best result. One of the significant prospects of the work is that while the image is processed for the detection of species of the bird throughout the dataset, it searches the whole and shows the matched result if found. But If the image is not matched with any of the images used in the dataset then it shows the best closest related species in spite of not showing anything. As our project motivates the study purpose so we aim to give a result either the matched one or learning about a new species that are related to the image given. Now among the applied algorithms, we have found that the convolutional neural networks (CNN) have performed better than the other two by giving an accuracy of approximately 98%.

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INTRODUCTION

1.1 Introduction

These days, countless species of birds are hardly found, besides it is problematic to categorize bird species once found. Birds help us effectively identify the different life forms on earth because they respond quickly to ecological changes. Nevertheless, collecting data on bird species requires a huge effort by humans because it has become an extremely expensive technology. In this case, a solid framework is needed that will provide large-scale bird data preparation and will serve as an important tool for scientists, legislators, etc. In this way, the bird species identification certificate has undertaken important work in identifying which types of positions a particular picture of a bird has. Bird species recognition means predicting which category a bird belongs to by using images. Bird species recognition can be achieved through pictures, audio, or video. The audio processing method makes it possible to recognize by capturing the sound signals of different birds.

Nevertheless, due to the mixed sounds in the conditions, such as creepy crawlers, objects from the real world, etc. The results of processing such data have proved to be gradually complicated.

Generally, people find that images are more effective than sound or audio recordings. Therefore, it is preferred to use images rather than audio or video to classify birds. Bird species identification is a challenging task for both humans and computing programs that perform such tasks in an automated manner. We have found that the convolutional neural networks (CNN) have performed better than the other two by giving an accuracy of approximately 98%.

1.2 Motivation

Being a modern generation, we use smartphones, the internet, and computer systems a lot. We choose being domestic and the usage of the web for gathering expertise and understanding the world as a substitute than going outside. Our previous generation used to go out a lot, they have carried out a lot of adventurous things, they have been shut to nature, and they have viewed many birds and acknowledged many matters about birds. In the existing time, everybody is so busy with their very own existence that they cannot even go outdoors, excellent for getting shut to nature. Then how do they understand and analyze an animal? They can comprehend them solely by observing tv and thru the web via seeing their pix and videos. They are getting a laptop, web from their childhood. As a result, they do not go outdoors to gather knowledge, and they do not even discover many things.

1.3 Objective

So when this modern generation grows up and goes outside, they will see unique sorts of birds that have equal colors, and they will suppose that they are all equal birds. However, they solely have identical colorings and one-of-a-kind species for no longer having acceptable knowledge, and they will by no means apprehend the variations between them. So when they have some ideal gadgets, they can take pictures of all the birds, and soon, when we construct an app, the app will take the picture. It will provide us with the bird species, and if it cannot locate the bird in the dataset, it will exhibit us the different birds which have some similarities between them. As a result, their know-how is increasing, and they do not want to go outside, and they do not have to waste their time and can without difficulty join with nature.

1.4 Research Question

A decent exploration question is vital for guide your research paper, project on the thesis. It pinpoints Precisely what you need to discover and gives work clear concentration and reason.

- Can this research give accurate results of birds?
- Can the outcome distinguish all birds?
- How valuable it would be assuming that outcomes give 100% exactness?

1.5 Expected Outcome

This finds out about developing a software program platform that makes use of deep studying for photograph processing to perceive chook species from digital pics uploaded or captured through an end-user on a smartphone in real-time. To advance such a machine an educated dataset is required to classify an image. The educated dataset consists of two components: skilled end result and checks result. The dataset has to be retrained to gain greater accuracy in identification. Whenever a consumer will add an enter file, the photo is quickly saved in a database. This enter file is then exceeded to the device and is given to CNN the place CNN is coupled with the educated dataset. Various elements such as head, body, color, beak, shape, complete picture of the chicken are viewed for classification to have maximum accuracy.

1.6 Report Layout

Chapter 1: Introduction

In chapter one we examined objective, motivation, expected outcome in our project work, and the report layout.

Chapter 2: Background

Chapter two is background. We talk about the foundation conditions of our task. In this chapter, we also talk about related works. Scope of problems, comparative studies, and challenges in our project work etc.

Chapter 3: Research Methodology

In this section we discuss data collection procedure, data preprocessing, proposed methodology, representation test raw comments, and implementation requirements.

Chapter 4: Experimental Result and Discussion

In this chapter, we talk about the result of our study and analysis of the result of what we found by experiment.

Chapter 5: Impact on Society, Environment and Sustainability

In this section, we talk about the Impact on Society, Environment and Psychological state, and ethical aspects.

Chapter 6: Summary, Conclusion, and Implication for Future Research

Chapter six is Summery, Conclusion, and Implication for Future Research. Here we discuss the summary of our project, conclusions, and implications for future study.

CHAPTER 2

BACKGROUND

2.1 Preliminaries/Terminologies

The main idea of developing the identification website is to increase people's awareness of bird watching, birds, and their identification, especially the birds found in Bangladesh. It also caters to the need to simplify the bird identification process, thereby making bird watching easier. The technique used in the experimental setup is Convolutional Neural Network (CNN). It uses feature extraction for image recognition. The method used is sufficient to extract features and classify images.

2.2 Related Works

In this portion, we try to combine the literature review of the bird species detection process.

Image processing techniques to identify predatory birds in aquaculture settings [5], in this paper, generated a model with the help of an image processing technique that recognizes birds. They used three image processing algorithms: image morphology, artificial neural networks, and template matching were designed and tested. The ANN model acquired three minutes to train the images. However, results were achieved rapidly while testing the images. A comparison of image processing techniques for bird recognition.

Biotechnology progress [6], they have used bird detection with pattern matching and bird detection with the Viola-Jones Algorithms. The Viola-Jones algorithm can be competent for almost any object as long as many related positive images can be used for training the classifier.

Deep Learning Case Study for Automatic Bird Identification [7] they have composed the non-deep CNN for image classification and presented that the model is suitable for real-world use. The chief act of the image classifier was gained without using the limitations given by the radar, those limitations make available more and applicable knowledge to the classification and they can turn a

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wrong classification into the correct one. Data collection will be finished at the test site which gives a huge data set.

Detection of birds in the wild using deep learning methods [9], they have presented a relative study of state-of-the-art deep learning methods - YOLOv2, YOLOv3, and Mask R-CNN, for detection of birds in the wild. They have used the pre-trained model's dataset. They used F-score as one of the presentation metrics for the YOLOv2, YOLOv3, and Mask R-CNN correspondingly. YOLO v3 is more rapidly related to both YOLO v2 and Mask R-CNN. Their results YOLO v3 overtakes YOLO v2 but show only bordering expansions finished Mask R-CNN.

2.3 Analysis and Summary

In our paper, where we have CNN, RNN, and ANN. But CNN is the most preferable to all the other algorithms. An artificial Neural Network (ANN) is a group of various perceptrons or neurons at each layer. Recurrent neural networks (RNN) are a class of neural networks that are helpful in modeling sequence data—derived from feedforward networks; RNNs show similar behavior to how human brains function. Convolutional neural networks (CNN) are all the furor in the deep learning community at present. CNN models are being applied across different applications and domains, and they're remarkably accepted in image and video processing projects. But CNN is the most preferable to all the other algorithms.

2.4 Scope of Problem

We needed real-time data for our project. We will work with real-time data in the future. But it is a very challenging issue to collect all real-time data from a bird with various types of pictures.

2.5 Challenges

We face numerous challenges in managing this research project at every stage. It took us a while to collect the data and clean up that data. There were two types of data in some folder and resizing them and separating them was a challenging issue. The ratio of each image has to be kept the same. It took us a long time to use the algorithm.

The big challenge was to detect the species, apply the algorithm and make people understand that there are species of the same color.

CHAPTER 3

Research Methodology

3.1 Research subject and Instrumentation

We have described the simplest way (shown in fig. 1) to detect the birds of different species. The proposed mechanism can be divided into two sub-sections: data collection and data processing, applying the CNN, RNN, ANN algorithms to predict the input of which bird species.

We know there are three different types of deep learning algorithms for image classification. And we have applied all of them but as we already know, Convolutional Neural Network (ConvNet/CNN) can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. And while we trained the model using a one-cycle policy there we got 98% accuracy in just three epochs. So it performed the best, meeting all of our criteria and giving us an accuracy of 98%.

3.2 Data Collection Procedure/Dataset Utilized

Data set of 290 bird species.40930 training pictures, 1425 test images (5 pictures for each species), and 1425 approval images (5 pictures for every species). All pictures are 224 X 224 X 3 shading pictures in jpg design. The informational index incorporates a train set, test set, and validation set. Each set contains 285 directories, one for each bird species. NOTE: The test and approval pictures in the data-set were hand-chosen to be "best" pictures so your model will presumably get the most noteworthy accuracy score utilizing

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those informational collections as opposed to making your own test and validation sets. Notwithstanding, the last option case is more exact as far as model execution on unseen pictures.

Later the pictures were edited so the bird possesses basically half of the pixel in the picture. Then, at that point, the pictures were resized to 224 X 224 X3 in jpg design. The trimming guarantees that when handled by a CNN there is sufficient data in the pictures to make an exceptionally exact classifier.

All documents were likewise numbered consecutive beginning from one for every animal type. So test pictures are named 1.jpg to 5.jpg. Also for validation pictures. Preparing pictures are likewise numbered consecutively with "zeros" padding. For example, 001.jpg, 002.jpg …. 010.jpg, 011.jpg … ...099.jpg, 100jpg, 101.jpg, and etc.
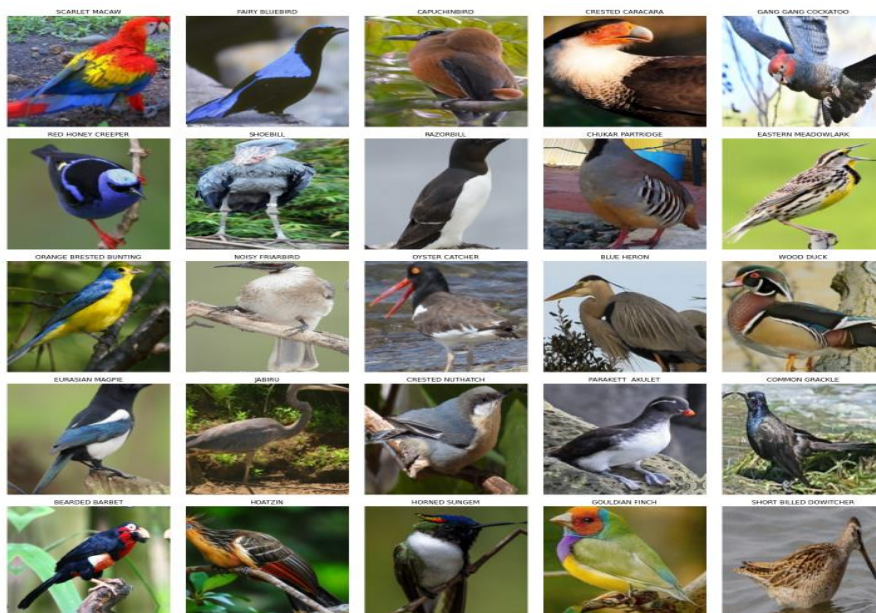

Fig1: Sample images dataset

3.3 Statistical Analysis

The training set isn't adjusted, having a fluctuating number of documents per species. In any case, every species has something like 100 preparing picture records. This imbalance didn't influence it as it accomplished more than 98% accuracy on the test set.
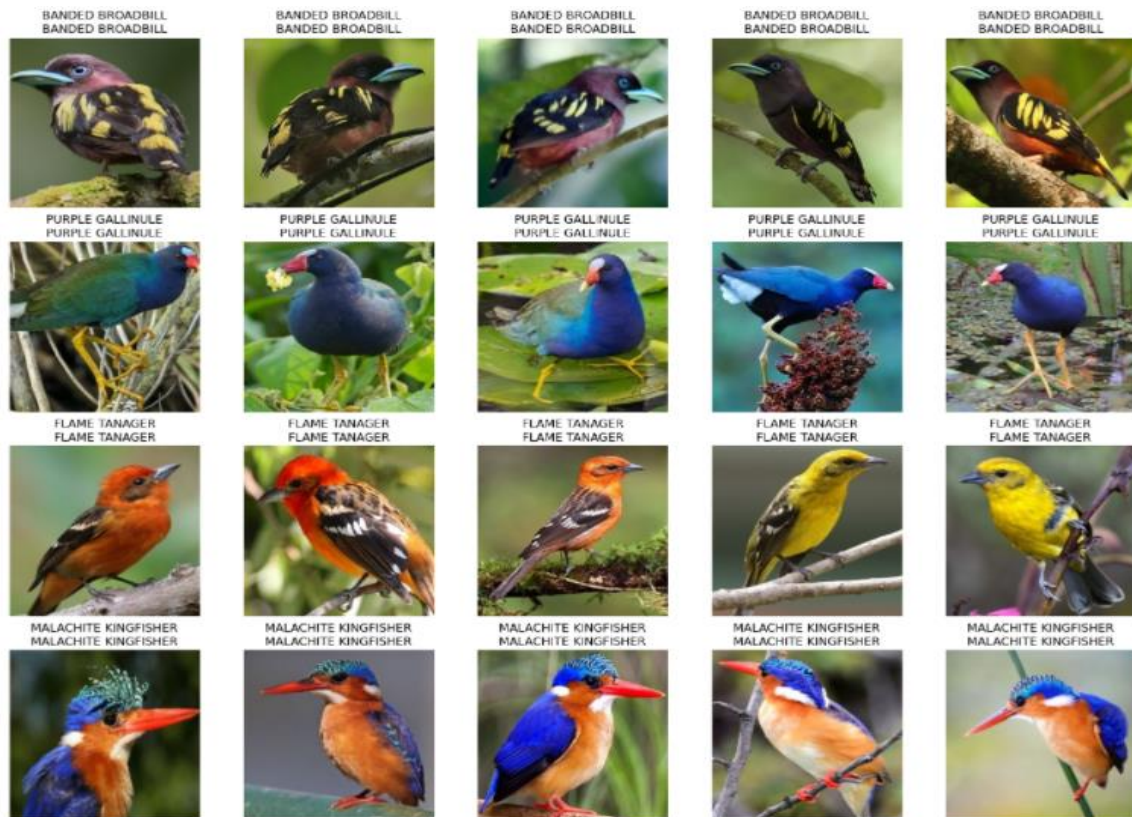

Fig2: Sample images of Different birds

3.4 Proposed Methodology/Applied Mechanism

The applied system flowchart we proposed for this is given below. This figure represents the proposed system. We need to train a dataset that is required to classify a picture for develop this system.
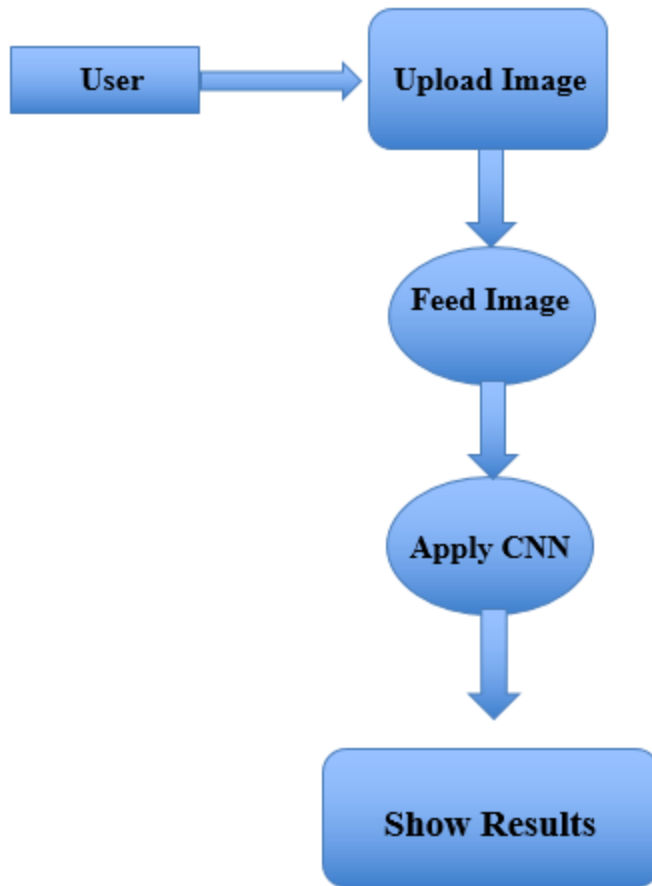
Fig3: system flowchart

3.5 Implementation Requirements

We need to follow some instructions for implementation. A platform is needed to write the code. The platform we choose is google colaboratory. We need to Maintain all data sets and libraries. Then, for processing the data, we need to train and preprocess and label, Augmentation, Neural Network training, testing. Creating a data model for accurate prediction which requires deep knowledge on various algorithms.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Experimental Setup

• CPU: Intel® Core™ i5-7200U

• RAM: 16 GB

• Clock Speed: 2.50GHz

• L3 Cache: 2 MB

• Operating System: Windows 10

• Language: Python (3.9.1+)

• Code Executer: Google Colaboratory, VS Code

4.2 Experimental Result and Analysis

We have divided This section into two parts. The First is the Initialization of Parameters and the second one is the representation. Also, we have presented the Bird species web solution and the deep learning experiments that have been performed on the processed dataset.

A.   Initialization of Parameter

Here is a list of parameter values that provided the best results in our experiments. All the images are formatted and re-sized with a width and height of 224*224 pixels. The horizontal and vertical resolution are 96*96 dpi. And not to forget the bit depth is 24. Our dataset can detect both RGB, Black, and white images.

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B.   *Representative Result*

Here we have stated the experimental results that we got from our web solutions while applying the CNN algorithm. And also a flowchart to explain how it actually works.
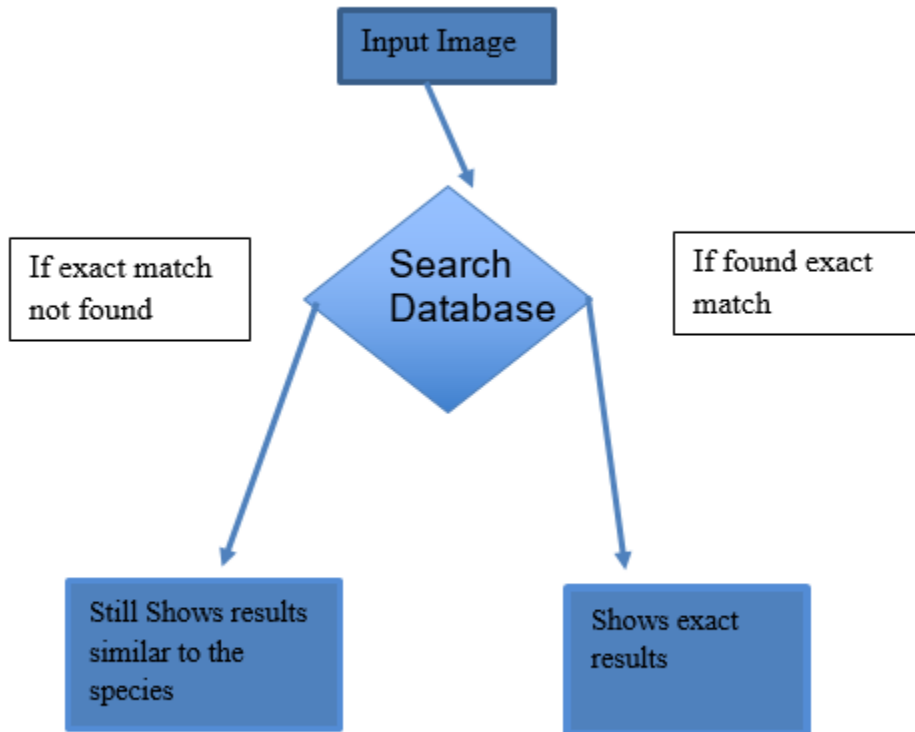
Fig 4: Flowchart of the experiment process

The above flowchart represents the backend process of the experiment in the dataset. While an image is given as an input the algorithm searches the database and if finds the exact match shows the exact bird name but of now then it shows a similar kind of bird's name which is close enough to the asked one.
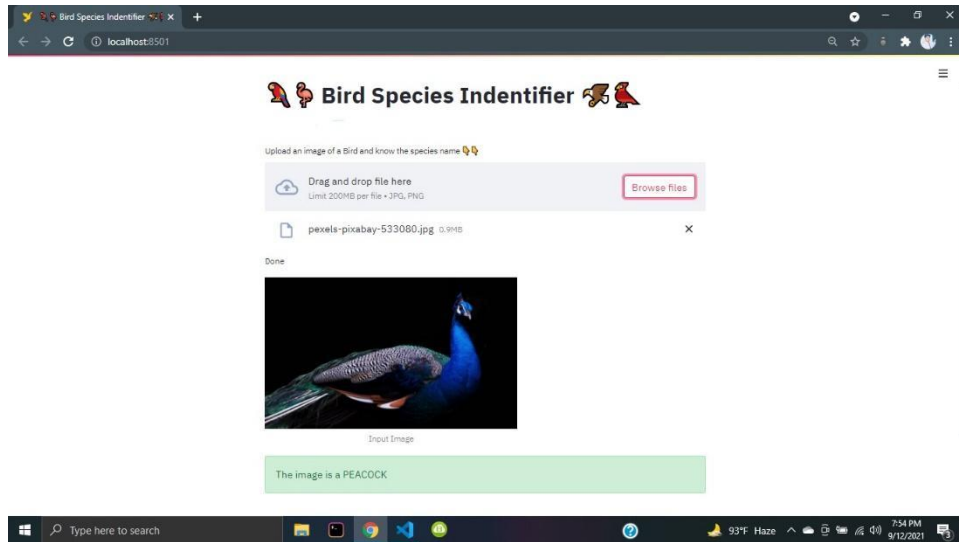
Fig 5: Detected a PEACOCK

Here you can see that in the interface of the web solution. When anyone wants to identify a bird they can drag and drop the image or browse files from their own device and our web solution will give them the exact name of the input bird. In fig4, it's detected as a peacock and it has given an exact accurate answer.

The below images (Fig5, Fig6, Fig7) are examples of the experiment done within the web solution. Here some of them are exact detected bird species and some are the closest enough names.
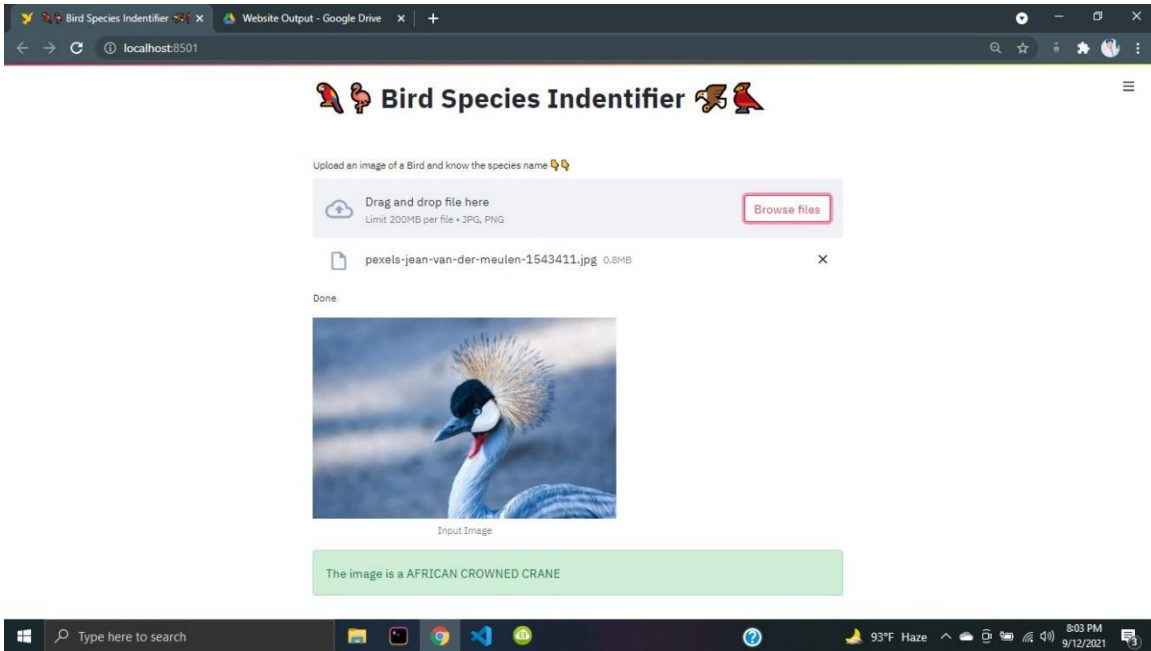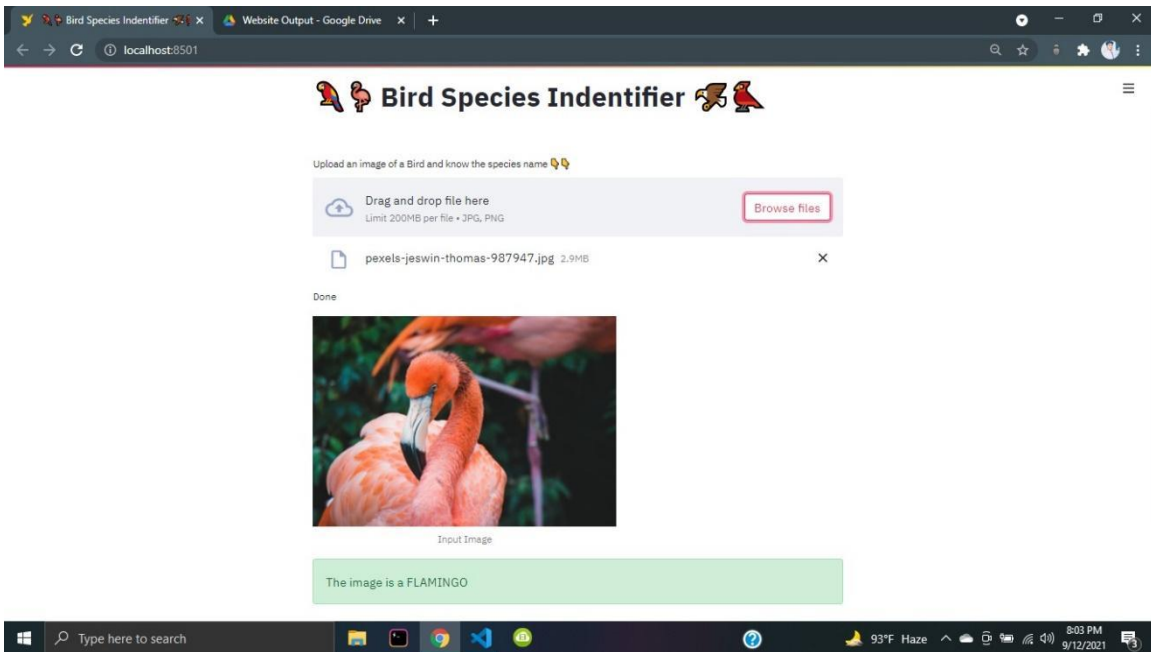
Fig 6: Detected a AFRICAN CROWNED CRANE
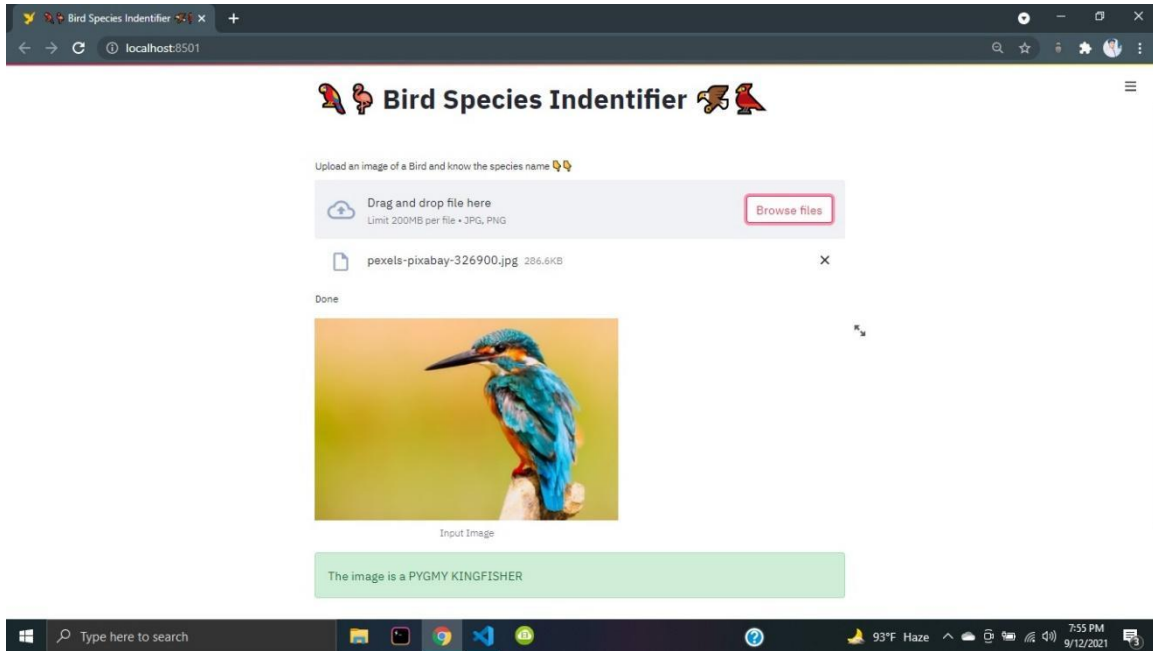

Fig 7: Detected a FLAMINGO

Fig 8: Detected a PYGMY KINGFISHER

4.3 Discussion

We searched and took 30,000 data from the Kaggle and we manually added some bird species in different categories. We arranged our data in JPG format and resized the data to 224 by 224 dimensions. This bird species folder has three sub-folders which are train, test, and valid. We have applied three different deep learning algorithms to find the best performance. But if the image does not match any image used in the dataset, it shows the closest species rather than showing nothing. Therefore, we decided to work with a local dataset for higher accuracy. To collect more data, we have added an empty dataset where all new species will enter directly for future use. Additionally, we are planning a further study for syntactic analysis.

CHAPTER 5

Impact on Society, Environment and Sustainability

5.1 Impact on Society, Environment and Psychological state

BIRD behavior and population patterns have turned into a significant issue these days. Birds assist us with distinguishing different creatures in the climate (for example creepy crawlies they feed on) effectively as they react rapidly to the natural changes.

However, maybe the main motivation to concentrate on birds is to further our comprehension of the biological systems that help all life on the planet, including people. Without clean air, water, and soil, and lively, between associated regular cycles, many regions of the planet's environments would flounder.

Bird watching and related eco-tourism are the main economic forces in many parts of the country. On a small number level, birds provide humans with pleasure, joy and spiritual inspiration only through their existence. Birds are also an excellent indicator of environmental health. Before "canaries in coal mines" became a cliché, underground workers did bring canaries to carry out early detection of carbon monoxide and other gases. In nature, birds can provide clues to other difficult-to-detect processes due to their relative abundance, easy observation, rapid metabolism, and high position in the food chain. The reduction of Peregrine Falcons and Bald Eagles provides important information about the dangers and spread of DDT and heavy metals. Today, changes in bird populations can tell us a lot about the impact of climate change, drought, weather, and habitat changes in the United States and around the world.

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In any case, maybe the main motivation to concentrate on birds is to further our comprehension of the environments that help all life on the planet, including people. To keep on living reasonably and have a solid planet, we should see how the normal frameworks on which we depend work. Birds are a basic component to practically every environment on the planet, and their destiny is interlaced with our own.

These days, birdwatching is a typical side interest however to recognize their species needs the support of bird books. To give birdwatchers a helpful instrument to respect the magnificence of birds, we fostered a profound learning stage to help clients in perceiving types of birds utilizing programming dependent on the idea of picture acknowledgment. This product would perceive the info picture by contrasting the model and a prepared model and afterward foresee the bird species. The subtleties would be given out as a result. Additionally, it will assist us with building the dataset assuming any picture caught or transferred by the client is inaccessible in the dataset then the client can add that picture to the dataset.

5.2 Ethical Aspect

The main idea of developing the identification website is to increase people's awareness of bird watching, birds, and their identification, especially the birds found in Bangladesh. It also caters to the need to simplify the bird identification process, thereby making bird watching easier. The technique used in the experimental setup is Convolutional Neural Network (CNN). It uses feature extraction for image recognition. The method used is sufficient to extract features and classify images

CHAPTER 6

Summary, Conclusion, and Implication for Future Research

6.1 Summary of the Study

The title of our proposed project is Detection of bird species by image processing with the help of deep learning. We create a dataset for our projects that are collected from Kaggle and the internet. We have created a website using python.

It will be used as an open/free website and we have connected our dataset to the website using machine learning, deep learning algorithms. Our algorithm will check the dataset when a user inputs a bird picture and it will show the result. Our dataset can detect both RGB, Black, and white images. if the image does not match any image used in the dataset, it shows the closest species rather than showing nothing.

6.2 Conclusions

We searched and took 30,000 datasets from the Kaggle and we manually added some bird species in different categories. We arranged our data in JPG format and resized the data to 224 by 224 dimensions. This bird species folder has three sub-folders which are train, test, and valid. We have applied three different deep learning algorithms to find the best performance. But if the image does not match any image used in the dataset, it shows the closest species rather than showing nothing. Therefore, we decided to work with a local dataset for higher accuracy. To collect more data, we have added an empty dataset where all new species will enter directly for future use. Additionally, we are planning a further study for syntactic analysis.

6.3 Implication for Future Research

Since there are obstacles in our project, the proposed strategy can be expanded in the future.

- if the image does not match any image used in the dataset, it shows the closest species rather than showing nothing.

- we decided to work with a local dataset for higher accuracy

- To collect more data, we have added an empty dataset where all new species will enter directly for future use

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