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Bird Species Identification Using Deep Learning and Image Processing

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***ABSTRACT*- A Bird watching is a recreational activity that can provide relaxation in daily life and promote resilience to face daily challenges. It can also offer health benefits and happiness derived from enjoying nature.**
Identification of bird and insect's species is a challenging task often resulting in ambiguous labels. Even professional bird and insect watchers sometimes disagree on thespecies given an image of a bird and insect. It is a difficult problem that pushes the limitsof the visual abilities for both humans and computers. Although different bird and insectspecies share the same basic set of parts, different bird and insect species can vary in shape and appearance. Interclass variance is high due to variation in lighting and background and extreme variation in pose.
Neural Network (NN)- Neural network has a gained a great attention. It is known that, mammal's brain, which consists of many interconnected neurons, that can deal with complex and computational tasks, like face recognition, body motion, and muscles activities control.

Index Terms: Image Processing, Histogram of oriented gradient, Test train and accuracy, Neural network, Feature extraction.

I. INTRODUCTION

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too. Image processing basically includes the following three steps:

- Importing the image via image acquisition tools.
- Analyzing and manipulating the image.
- Output in which result can be altered image or report that is based on image analysis.

Image acquisition is the first step in image processing. This step is also known as preprocessing in image processing. It involves retrieving the image from a source, usually a hardware-based source.

Image processing can be used to recover and fill in the missing or corrupt parts of an image. This involves using image processing systems that have been trained extensively with existing photo datasets to create newer versions of old and damaged photos.

II.RELATED WORK

Image-processing algorithms were developed and implemented to provide the quality parameters for tomato classification.
The parameters are color, defects, shape, and stem detection.
The vision system consisted of two parts: a bottom vision cell with one camera facing upwards, and an upper vision cell with two cameras viewing the fruit at 60°.
The bottom vision cell determines fruit stem and shape. The upper vision cell determines fruit color, defects.
As data generation is far outpacing data storage it proves costly for small firms tofrequently update their hardware whenever additional data is created. Also maintaining the storages can be a difficult task. It transmitting the file across the network to the client can consume heavy bandwidths. The problem is further complicated by the fact that the owner of the data may be a small device, like a PDA (personal digital assist) or a mobile phone, which have limited CPU power, battery power and communication bandwidth.

III.PROPOSED WORK

The proposed solution of the model is given below explains the working of the project, the user would be able to capture and upload the image to the system and can store the image in the database if that image is not available in the dataset.

Then the image wouldbe fed to the system and CNN would be applied. After that the features of the image such as face, expression, angle, beak etc. would be extracted and classifier would classifythe image and predict with the help of the trained dataset.

This study developed a platform that uses deep learning for image processing to identify bird species from digital images uploaded by an end-user. The proposed system could detect and differentiate uploaded images as birds.

With an overall accuracy is high for the training dataset using CNN model. This study ultimately aimed to design an automatic system for differentiating among bird images with shared fundamental characteristics but minor variations in appearance.

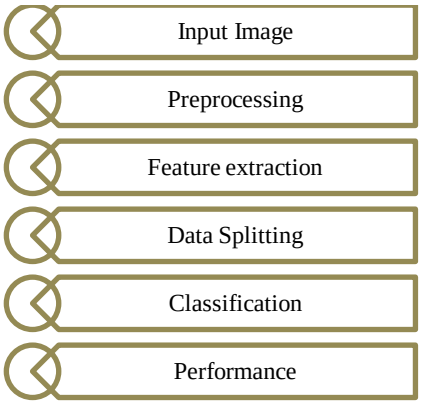

Figure 1: Framework of architectural design of the modules

This study developed a software platform that uses deep learning for image processing to identify bird species from digital images uploaded or captured by an end-user on a Smartphone in real time. To develop such system a trained dataset is required to classifyan image.
Trained dataset consists of two parts trained result and test result. The dataset has to be retrained to achieve higher accuracy in identification.
The trained dataset is created using 50000 steps, higher the number of steps higher its accuracy. The accuracy of trained dataset is 93%. The testing dataset has nearly 1000 images with an accuracy of 80%. Whenever a user will upload an input file, the image is temporarily stored in database.

This input file is then passed to the system and is given to CNN where CNN is coupled with trained dataset. Various features such as head, body, color, beak, shape, entire image of bird is considered for classification to have maximum accuracy.
Each feature is given through deep convocational network to extract features out. These features are then collected and forwarded to classifier.
The input will be compared with the trained dataset to generate results.
Image is compared with the pre trained dataset images and the score sheet is generated. The score sheet is an output of top 5 match results by which the highest matching value of score sheet is the result of bird species.
Consider below as input given to the system for classification of bird. Let's see the procedure.

Obtain from test image the location (A, B) and magnitude(R) of N strongest scatters.

1. Order (A, B, R) triples by descending R.
2. For each origin O from 1 to N do 4.
3. For each point M from O+1 to N do 5,6
4. dA = Ap – Ao; dB = Bp – Bo
5. For DA from dA-1 to dA+1 do 7
6. For DB from dB-1 to dB+1 do 8, 9, 10
7. Weighted vote = |DA| + |DB|
8. Look up list of model data entries at DA, DB
9. For each entry C in the list do 11
10. If |ta = Ao – Ae|< translational

limit and tb = Bo – Be|< translational limit and |1 - Reo/Ro|< magnitude limit and |1 – Rep/Rp|< translational limit THEN increment accumulator array [Specie, Az, ta, tb] by weighted vote.

11. Query accumulator array for each Specie, Az, ta and tb, summing the votes in a 3x3 neighborhood in translation subspace about ta, tb; record the maximum vote sum and the corresponding Specie.

12. IF maximum vote sum > threshold THEN result is Specie ELSE result is "Not found".

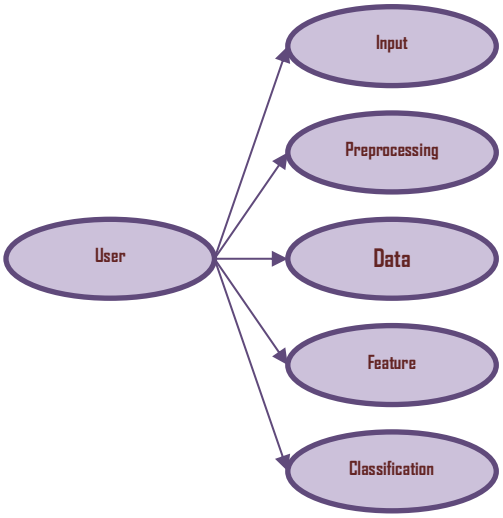

Figure 2: Case diagram of the working of image processing.

The implementation of the model is done with the help of OpenCV:
OpenCV- Object detection is related to computer vision and image processing that detects semantic objects of a certain class such as humans, buildings, or cars in digital images and videos. OpenCV is an open-source computer vision. It is an image processing library created by Intel and later supported by Willow Garage and now maintained by It.

It is available on Mac, Windows, Linux. It works in C, C++, Python. Library of OpenCV isa collection of algorithms and C/C++ functions. OpenCV was used for computational efficiency and real time applications in many areas like vision, factory product inspection, medical imaging, stereo vision, security, user interface, camera calibration and robotics.
The goal of OpenCV is to provide a simple use computer vision infrastructure that helps people build quite sophisticated vision applications quickly, vision research by providing open and optimized code for basic vision infrastructure, spread vision knowledge by providing a common infrastructure so that code would be more readily readable and transferable, advance vision based commercial applications by making portable, performance optimized code available for free.

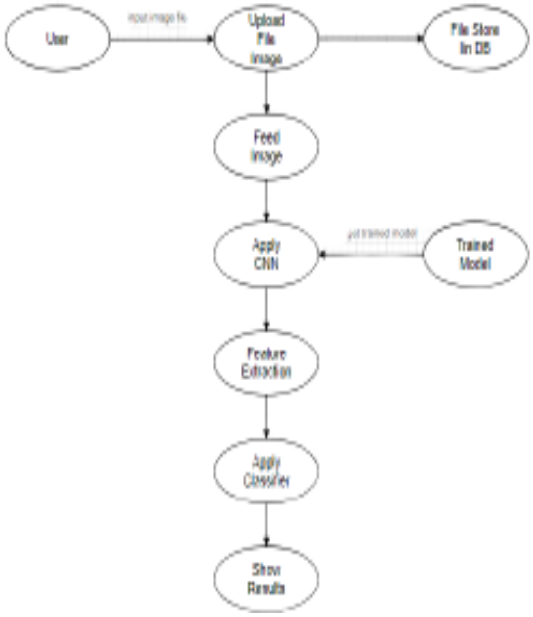

Figure 3: Sequential diagram for the formalized output.

This is how the Image Processing in the model will be done-

There are five main types of image processing:

- Visualization - Find objects that are not visible in the image
- Recognition - Distinguish or detect objects in

the image

- Sharpening and restoration - Create an enhanced image from the original image
- Pattern recognition - Measure the various patterns around the objects in the image
- Retrieval - Browse and search images from a large database of digital images that aresimilar to the original image.

1) Acquisition- It could be very simple. The main work involves Scaling Color conversion (RGB to gray or vice versa)

2) Image enhancement- It is the simplest amongst the all and most appealing in areas of Image Processing it is also used to extract some hidden details from an image.

3) Image restoration- It also deals with appealing of an image. It is based on mathematical or probabilistic model or image degradation.

4) Color image processing- It deals with pseudo color and full color image processing color models are applicable to digital image processing.

5) Wavelets and multi-resolution processing- It is foundation of representing images in various degrees.

6) Image compression- It involves in developing some functions to perform this operation. It mainly deals with the image size or resolution.

7) Morphological processing- It deals with tools for extracting image components that are useful in the representation and description of shape.

8) Segmentation procedure- It includes partitioning an image into its constituent parts or objects. Autonomous segmentation is most difficult task in image processing.

9) Representation and description- It follows output of segmentation stage, choosing a representation is only the part of solution for transforming raw data into processed data.

10) Object detection and recognition- It is process that assigns a label to an object based on its descriptor.

RESULTS & DISCUSSION

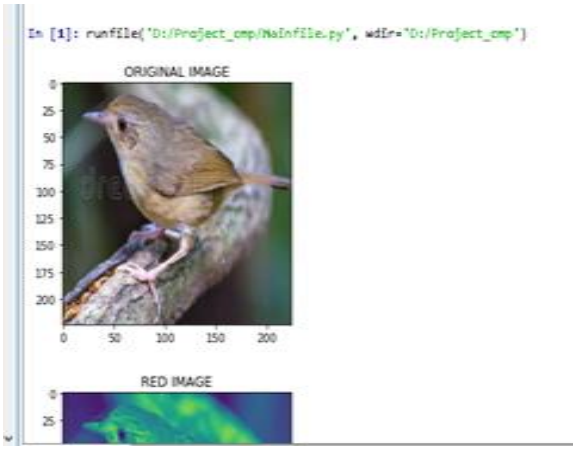

Figure 4: The overview of the project

In this project, the figure 4 shows the complete raw picture of the bird that is to be analyzed the image is of the certain kind for which the data is to be trained for the analysis of the bird.

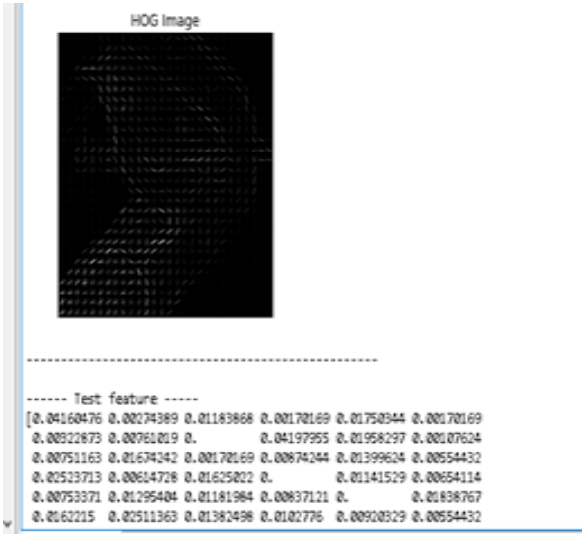

Figure 5: HOG Image of the Bird

The HOG (Histogram of oriented gradient) with the use of CNN the feature of the birds are extracted and listed in the test feature which matches with the trained and tested data. This feature extraction tends to give high performance, expandability and scalability and gives high throughput.

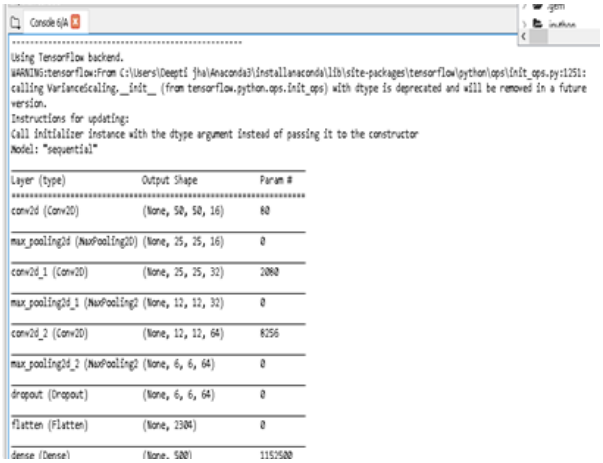

Figure 6: The Sequential Feature Extraction

In brief, the actual working of the project is shown in figure 6 where CNN algorithm is applied and features are extracted according to the trained data.

Features like the color, body, beak size, feather structure, body size are recognized and analyzed.

Based on the parameters the params are listed and the algorithm calculates the percentage of the matches.

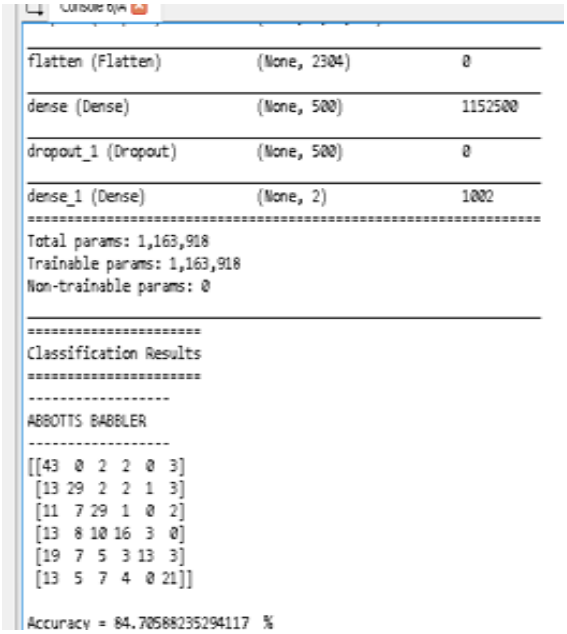

Figure 4: The final stage diagram of the project

Accuracy of the algorithm is based on the calculation of the total parameters matching from the trained data and testing data. This research can be based on various other products and items. Based on the similar functionality and the features.

IV. CONCLUSION

The future of image processing involves new intelligent, digital automated robots made by research scientists in various parts of the world.
It includes development in various image processing applications.
Due to changes in image processing and other related technologies, there will be millions of robots in the world in a few, transforming the way of living.

Researches in image processing and artificial intelligence will involve Voice commands, anticipating the information requirements of governments, translating languages, recognizing and tracking people and things, diagnosing medical conditions, performing operation & surgery, reprogramming defects in human DNA, and automatic driving all formats of transportation.
And for Image based species recognition of birds, we can further enhance the system with cloud feature which can store large amount of data for comparison and in case of neural network it can provide high computing power for processing.

Neural network is used to classify bird species based on data set. Multiple-width frequency delta data augmentation cannot be used to raise classification accuracy whencompared to raw spectral data, but the accuracy is close to the state-of-the-art and hasan advantage over raw spectral data when computational resources are limited.
Then,the use of additional meta-data raise the rank of the species in the predictions of the Models, but it does not seem to be enough to push it to the highest rank, which meansthat the model has to predict fewer species, but the actual top-1 accuracy does notseem to be affected.
Through an analysis of the data set we also found that the relativenumber of training samples for each bird species is quite uneven, which seems to lead toa favorite, from the model of bird species, and that some bird species are difficult toclassify than others.
This study will help the researchers to work on various fields such as image processing, fault detection in industrialized Industries, medical image segmentation. The biggest disadvantage of all these algorithms is that the accuracy of these algorithms is dependent on the quality of camera and view angle

between camera and the target object. It is also noticed that at some angles the results were not accurate beyond
a certain range of camera.

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