Image-based Bird Species Identification Using ConvolutionalNeural Network

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***Abstract*—[Due to climate change, many species of plants and animals are at risk. To protect ourselves, we must first identify the species and the special care they need to survive. More than 10,000 species are part of the ecosystem. Identifying a bird species in a photograph is a challenging task as it requires techniques such as image processing and the Convolutional Neural Network (CNN). CNN is a very challenging research site with many problems as small differences in images are seen as completely new images. Along the way, we use a transfer learning method to train our neural model.**

Index Terms*—*Biological Neural Network, Convolutional Neural Network, Deoxyribonucleic Acid, ImageNet

I. INTRODUCTION

Our living ecosystem contains a wide variety of species such as humans, animals, birds, etc. Our research focuses on the identification of bird species. Protecting these bird species it will create a huge positive impact on ecological balance, agricultural production, and forestry. Toprotect these species of birds, first, we need accurate information about their species. For diagnostic purposes, we create a neural model where the user can upload an image that image will be processed by a neural model and give the user a bird-type output. Creating our own neural network model for animal identification function will require a large amount of data i.e. bird images and their annotations and its high computer power requirements to create a neural model from scratch but will not guarantee it will work. a better result, so the best option is to use a pre-trained model and perform transfer readings on our database.

Personally identifying bird species is a very tedious task and he is not very reliable as his knowledge may be shallow and limited to a variety of local birds. This process is time consuming and may contain some flaws. There are a number of books published on the process of helping one to misjudge bird species. The current process of identifying bird species is involved in the use of recorded and recorded bird sounds. However, it takes hundreds of hours for careful analysis and classification of species. Because of such a process, the large-scale identification of birds is almost impossible. So, performing the procedure automatically is a very useful method.

Since there is no software available for identifying Bird Species, we have decided to upgrade the Birds Identifier which will identify the bird species in the uploaded image. This program helps to clear the information barrier and streamlines the animal identification process. As there are many apps that provide bird information but none of them offer the identification feature we will give you. To a large extent, accurate bird recognition is essential to the conservation of bird species. It helps us measure the impact of land use and land management on bird species and is important for bird watchers, conservation organizations, park rangers, conservationists, and bird experts around the world. The main purpose of designing this program is to create a framework with the tools needed to overcome the errors facing the current system. In this study, we attempt to create a learning process of deep, automatic emotions that are able to overcome these problems. We have explored our approach to the largest public database containing more than 11,788 recordings of 200 different genres. We plan to develop software that will accurately identify the bird species and provide a summary of the species identified.

Neural Network (NN) - The Neural Network has gained a lot of attention. [1] It is well-known that the mammalian brain, which is made up of thousands of interconnected neurons, is able to handle complex and complex tasks, such as facial recognition, body movement, and muscle control.

The NN model consists of three layers, namely, the input layer, the hidden layer, and the output layer. A neural network is a series of algorithms that attempt to identify the basic relationships in a set of data through the process in exactly the way the human brain works. In this way, neural networks refer to neuron systems, which can be organic or synthetic environment.Image processing by NN [17] involves a number of processes, such as:

1. Pre-image processing shows an image the same size as the original. Purposeof photographypre-processing by NN involves the development, restoration or reconstruction of images.
2. Feature removal helps to extract a number of features smaller than the number of pixels ininputwindow. Elements include feature removal of eagles, corners, joints, facial features, etc.
3. Separation of image into regions.
4. Recognition involves the determination of the objects in the image and their subdivision.

II. CONVOLUTIONAL NEURAL NETWORK

Convolutional neural network (CNN) feedforward networks in which the flow of information occurs in only one place, from inputs to outputs. CNN properties include layers of integration and integration. CNN properties are used for image separation function. Image, network input, followed by conversion and merging. Thereafter, these activities feed one or more fully connected layers. Finally a fully integrated layer removes the class label. First, raw input data for most bird semantic components were collected and localized. Second, the characteristics of each common component were identified and sorted based on shape, size, and color. Third, the CNN model was trained with images in a graphics processing unit to extract a feature with predefined features, and separate, trained data was stored on a server to direct the object. Then, the information obtained from the last user-uploaded image, captured using a camera, can be scanned for information and prediction from a trained model.

Nadimpalli et al. [4] created a model with the help of image processing techniques seen birds in Aqua cultural ponds is a novel concept that facilitates flexibility in the distribution of birds of prey. Three image processing algorithms for image morphology, neural processing networks, and image comparisons have been designed and tested. They developed an algorithm to detect birds in real-time scenarios and developed algorithms needed to be used using image processing and toolbox neural tools for the MATLAB 6.5 version to improve algorithms. The ANN model took three minutes to train the photographers. However, the results were immediately obtained during the photographic examination. Christienen et al. [5] use digital imaging processing techniques to automatically detect and learn animals on the basis of video recording. The heat of the study animal radiation exceeds the radiation from the back, making the animal appear brighter in the video footage. But during sunlight, the temperature difference between the animal and the background may be small, and some grass spots may produce temperatures similar to those of animals. If so, filtering techniques can be used to improve the appearance of animals. For this purpose, they have used the Laplacian of Gaussian filter to process it further to improve the appearance. Under most circumstances, adoption rates were close to 100% even though dense vegetation can interfere with animal sightings. Nadimpalli et al. [6] focuses on bird detection and analyzes motion detection by image removal, bird detection by comparison and bird detection by Viola-Jones Algorithms. By all means, the detection of birds by the Viola Jones Algorithm had very high accuracy (87%) and low accuracy.

good measure. This step-by-step process can be combined with hardware to create a smart scarecrow system. Although object editing training is slow, real acquisition is faster which is why there has been a web browser use and mobile usage.

The Viola-Jones algorithm can be trained for almost anything as long as there are many similar good images that can be used to train a separator.Moreira et al. [7] represents the state of the art in video capture and tracking of marine vehicles. Marine weather is very challenging and changing. The detection and tracking algorithm, when used in the marine environment without proper stability, so does not produce effective results. Errors in detection and tracking may occur due to noise, turbulence, waves, inconsistent and unpredictable ocean appearance, sunlight, adverse natural conditions and image variability, the presence of floating objects on the ocean, white foam, large variations in the ocean. car

features such as size, appearance, geometric shape and the presence of birds, clouds, fog and planes from over the horizon. Algorithmit seems unlikely in some real-time situations where small vessels with low contrast and rear appear in the camera view area. Shalika et al. [8] are concerned with observing animal behavior in wildlife using face recognition and tracking. Animal detection and tracking algorithm for wildlife videos. The discovery is based on the way to find a person's face, using features like Haar using the Ada Boost separators. Tracking is done using Canada-

The Lucas-Tomasi tracker as well as the use of a specific model on the detected surface and combine the two methods into a specific tracking model, a reliable and temporary detection of animal faces is obtained. In order to detect a particular species of animal, the information collected by the tracker can be used to improve it as a classification of wildlife videos. The aim of this project is to create an automated wildlife self-discovery program. This research paper focuses on classification and recognition. Nguyen et al. [9] uses the Wildlife Spotter database, which contains a large number of photographs taken by Australian cameras, which have been developed and show the usefulness of an in-depth learning approach to building an automated wildlife monitoring system. With different settings such as balancing and balancing tests, it shows that the system is robust, stable and suitable for handling images. They have worked in many different ways to improve system performance by enhancing the database, on requestCNN models are in-depth and use some camera features. With an automated wildlife monitoring system, we can tap into transfer learning to address data inequality. In the future, they will create a “mixed” wildlife segregation system with its own default module.

III. LITERATURE SURVEY

To produce a Better Identity there are many techniques, Making a Bird's DNA Barcode, Bird Sound Analysis, Identifying Bird Species Based on Image Features, etc.

In 2005, University of Guelph student Paul Hebert, a Canadian taxonomist specialist, published the concept of DNA barcoding [1], part of its DNA used for the mitochondrial gene cytochrome c oxidase (COI) genetic model. it. DNA barcoding is a technique used by an Ornithologist who can get the whole picture and can only get the bird's DNA through the hair or blood of a bird, etc. But these methods cannot be used by ordinary users who can use a scientific tool. Therefore, this technology only applies to scientific research instead of the general public.Recently, a number of projects have been launched to automate the bird-separating process that involves the use of sound such as audio data instead of images. This process has some advantages over the image as it does not require a line view and each type has different callswhich can be used for identification. But this procedure is unreliable as the bird may not make any noise at all for a long time and it does not help to calculate the bird's accuracy accurately.

To overcome such challenges, more research has been done on techniques such as visual and computer-assisted visual techniques. Several researchers have aimed at methods such as using the moving features of bird bends and wingbeat frequency. Atanbori et al [14] conducted an extended study in this way. Cheng et al [2] aimed at a system that used discriminatory features in the classification of bird species based on the segment of birds using the support system and the Normal Bayes category. Another researcher Marini et al [9] proposedhow to eliminate background elements using color separation and then combine standard color histograms to remove the vector element for separation. Classification of Positive Photos - Strategy to discriminate against classes with positive characters (such as animal species orplants and man-made objects) that can be divided into two main groups. The previous group of methods uses different visual indicators from parts of the acquired area orthrough the method of separation. Another group of methods focuses on finding the interclass label dependence with the help of a predefined structure for sequencing labels or visual-defined visual attributes. Performance is greatly improved with the help of convolutional neural networks (CNNs), but in order to train CNNs a large data set of high quality images is required. Segmentation with low resolution images is a very challenging process. Peng et al. [10] aims to transform the detailed texture of information from high-resolution images into low-resolution images with the help of fine-tuning to increase the accuracy

of the well-defined objects in low-resolution images. This process has some limitations as it requires High-resolution images of model training that limit their normal use. A similar error is found in Wang's work [12]. Chevalier et al.

[13] Their CNN-based fine-grained classifier is designed with a variety of clear images, this model adapts to flexible and fully connected conditions but does not.Different layers of high resolution in their CNN segmentation network.Layers of Convolutional Super-Resolution - Yang et al. [14] compiled the various Super Resolution algorithms into four groups: edge-based methods, model-based methods,

prediction model and image mathematical methods. High performance has been achieved in the Convolutional Neural Network as CNN was adopted for a very recent refinement. Dong et al. [10] attempted to use convolutional neural networks for image super-resolution. In their approach, a deep map is created between low- and high-resolution images. An additional deconvolution conversion layer has been added to avoid the usual increase in input to speed up training and testing at CNN. Another researcher Kim et al. [15] uses a deep repetitive layer to avoid additional layer layers, which reduces computing time in the event of expanding network parameters. Another way is to learn how to make a map between the image of the Minority and its remnants withLR and HR image acceleration training at CNN in deep network. The Super resolution-specific Convolutional network has been instrumental in improving image quality.

In-depth learning - In-depth learning of real-world applications made more and more popular in recent times. In-depth reading is different from machine learning as it attempts to learn high-quality features in big data. By using the unattended or partially monitored feature, we automatically extract the data features. Although the machine learning model requires a design of manual features that are time-consuming and error-prone. A challenging part of in-depth learning is data dependence. In-depth study requires a large amount of training comparison data

in the machine learning model. As it needs to map out features data without human intervention. It is a line pattern i.e. a larger model scale, the amount of data it needs also increases. In in-depth learning, the first layers identify the top features in the training data, while the final layers contain the information for final decision making.

Transfer of learning is an important development in machine learning and an in-depth learning environment. It solves the problem of lack of data for training purposes. Learning transfer is intended for the transfer of information from the neural source model to the user model if the source model and user model have the same domain.To produce a better Identity than many techniques, Making a Bird DNA Coding, Bird Sound Analysis, Identifying Bird Species Based on Image Features, etc.

In 2005, University of Guelph student Paul Hebert, a Canadian taxonomist specialist, published the concept of DNA barcode [1], part of its DNA used for the genetic model of mitochondrial cytochrome c oxidase (COI). it. DNA barcoding is a method used by a bird specialist who can get the whole picture and can only get bird DNA by the hair or blood of a bird, etc. But these methods cannot be used by ordinary users who can use a science tool. Therefore, this technology applies only to scientific research on behalf of the general public.

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which can be used for identification. But this procedure is unreliable as the bird may not make any noise for a long time and it does not help to calculate the bird's accuracy accurately.

To overcome such challenges, further research has been done on techniques such as computer-assisted visual techniques. Several researchers have focused on methods such as using moving bird bending features and wingbeat frequency. Atanbori et al [14] conducted an extended study in this way. Cheng et al [2] aimed at a system that used discriminatory features in classifying bird species based on segment of birds using the support system and the Normal Bayes category. Another researcher Marini et al [9] proposed

how to eliminate background elements using color separation and then combine standard color histograms to produce a vector element for separation. Classification of Positive Images - Strategy to classify categories with positive

characters (such as species of animals orplants and man-made objects) that can be divided into two main groups. The previous group of methods uses different visual indicators from parts of the acquired area orthrough the method of separation. Another group of methods focuses on finding the interclass label dependence with the help of a pre-defined structure for sequencing labels or visually defined attributes. Performance is greatly improved with the help of convolutional neural networks (CNNs), but in order to train CNN a large set of high-quality image data is required. Separation of low-resolution images is a very challenging process. Peng et al. [10] aims to transform the detailed texture of the information from high-resolution images to low-resolution images with the help of fine-tuning to increase the accuracy of well-defined images in low-resolution images. This process has some limitations as it requires high definition images of model training that limit their normal use. A similar error is found in Wang's work [12]. Chevalier et al.

[13] Their CNN-based fine-grained classifier is designed with a wide variety of clear images, this model adapts to flexible and fully connected conditions but it is not.Different layers of high definition in their CNN segment network.Layers of Convolutional Super-Resolution - Yang et al. [14] combined the various Super Resolution algorithms into four groups: edge-based methods, model-based methods,prediction model and image mathematical methods. High performance was achieved on the Convolutional Neural Network as CNN was approved for recent development. Dong et al. [10] attempted to use convolutional neural networks for image super-resolution. In their approach, a deep map is created between images with low and high resolution. An additional deconvolution conversion layer has been added to avoid the usual increase in input to speed up training and testing at CNN. Another researcher Kim et al. [15] uses a deep repeating layer to avoid additional layer layers, which reduces computer time in the event of expanding network parameters. One way is to learn how to make a map between the Little Image and its remnantsLN and HR image acceleration training at CNN is an in-depth network. The Super resolution-specific Convolutional network has contributed to improving image quality.

Deep Transfer Learning

Deep learning of real-world applications made very popular in recent times. In-depth reading is different from machine learning as it attempts to learn high quality features in big data. By using the unattended or partially monitored feature, we automatically extract data features. Although the machine learning model requires the design of time-consuming and faulty manual features. A challenging part of in-depth learning is data dependence. Extensive research requires a large amount of comparative training data in the machine learning model. As it requires separating data features without human intervention. It is a line pattern i.e. the larger model scale, the amount of data it needs also increases. In in-depth learning, the first layers identify the top features in the training data, while the final layers contain the information for final decision-making.

Transfer learning is an important development in machine learning and an in-depth learning environment. It solves the problem of lack of data for training purposes. Learning transfer is intended for the transfer of information from the neural source model to the user model if the source model and user model have the same domain.

IV. METHODOLOGY AND IMPLEMENTATION

System Input: Data already captured within the information is used as Associate in Nursing input. The user can transfer the image within the desktop application.

Expected: The system will be able to recognize a loaded bird and provide a bird's frame.

Expected Behavior: Discovering on the basis of a set of professional information. All the square measurement features extracted from a given image and subdivided are supported.

Invalid requirements:

Ineffective requirements are those that do not directly affect the functioning of the system and yet have an impact, on the performance of the system. Functional requirements are those requirements, such as data limits, management methods. for example, the duration of the program. Service level requirements are measurable service quality. the level of service,

set, yet soon the fruit images are separated. Not applicable needs may take care of a complete system integrated with the whole system or take care of one useful need. The identification of realistic, measurable values intended for all levels of service, is another unmet need.

Accuracy: Accuracy is very important in any environment.
The average accuracy of our gift system is eighty.3%, Background Features: 79%. may be higher as we tend to reduce training | level of teaching} step by step and increase the number of sessions while training automated installers.

Scalability: The system will work well on any software package such as Windows, Linux, Ubuntu and the raincoat software package.

Performance: The system works by swimming on a laptop computer with 4GB RAM to 6GB RAM.

Model implementation is done with the help of
OpenCV:
OpenCV - Object discovery is related to computer recognition and image processing that finds semantic objects of a particular category such as people, structures, or vehicles in digital photos and videos. OpenCV is an open source computer view. It is a photographic library built by Intel and later sponsored by Willow Garage and now maintained by Itseez. Available on Mac, Windows, Linux. Works on C, C ++, Python. The OpenCV Library is a collection of algorithms and functions for C / C ++. OpenCV is used for computer efficiency and real-time applications in many areas such as vision, factory product testing, medical imaging, stereo vision, security, user interaction, camera and robots.
The OpenCV goal is to provide easy use computer vision technology that enables people to build sophisticated software applications quickly, concept research by providing open and optimized code of vision infrastructure, disseminating vision information by providing standard infrastructure for easy-to-read and transfer code, pre-programmed applications by making portable, customizable code available for free.
Here is how the image processing in the model will be done:

1) Finding- It can be very easy. The main task involves
i) Measurement
ii) Color change (RGB to gray or vice versa)
2) Image Enhancement- It is the simplest and most attractive in the Image Processing and is also used to extract some hidden information from an image.
3) Photo Restoration- It also deals with the attraction of the image. Based on a mathematical model or probability or image degradation.
4) Color image processing- It is about color rendering and full color image processing 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.

Deep learning operational working is similar to the human brain. It learns from the data and makes inferences on the data feature based on trained data. Therefore to develop a good neural model having a diverse as well as a huge dataset is necessary. For this purpose, In our research, we are using the data augmentation technique which helps to increase the number of training samples per class and reduce the effect of class imbalance. Relevant image augmentation techniques are chosen so that the neural model can learn from the diverse dataset. Those techniques are Gaussian Noise, Gaussian Blur, Flip, Contrast, Hue, Add (add some values to each channel of the pixel), multiply (multiply some values to each channel of the pixel), Sharp, Affine transform. The large dataset also help to avoid the problem of overfitting which happens quite

often in deep network learning. As the image dataset requires higher computational capability as compared to the text-based dataset. In our research, we try to reduce this computational requirement by removing the unwanted part from the image so that the neural model needs to deal with a lesser amount of pixel in the image for processing. So to eliminate background elements or regions and extract features from the only body of the birds, pretrained object detection deep nets are used. For this model, we are using Mask R-CNN to localize birds in each image in training phase as well as in the inference phase. We have used the pre-trained weights of Mask R-CNN, trained on the COCO dataset [6] which contains 1.5 million object instanceswith 80 object categories (including birds)

The performance of Mask R-CNN is divided into two categories. The first stage creates speculation about the region where there is a high probability of the object in the picture. The second category predicts the category of the object that belongs to it. Both phases are connected with the help of a method also known as the spinal cord which is a deep neural network of FPN style. Creating a neural model for the purpose of identifying a bird species instead of creating a neural model from scratch that makes a complex and expensive computer. We use the transfer method to learn the features of small and large objects drawn from bird pictures for classification. We used ImageNet's pre-trained weights to launch our Deepnet model for training. ImageNet contains 1.2 million images for 1000 classrooms. Training using ImageNet pre-trained weights helps us to study grain and global features in advance and to learn the clear and distinct depths of each bird species leading to increased accuracy of our model.

Bird Detection:

When a bird detects the R-CNN Mask algorithm in an image, the entire image is removed except for a separate component. Then the cut image is examined by the neural network. After testing, the predictable vectors are compared and the top 5 predicted species are shown by their probability percentage.

No Bird Detection

If the bird is not found in the image it will mean that the whole image is transmitted as an argument to the model and the model is tested and if the estimated value is less than 20% then it will help the user to insert a valid image. otherwise it will display the top 5 predicted types and their possible percentages.

Algorithm:

- Step 1: Users will be prompted to enter the image of the bird whose species need to be identified.
- Step 2: After the image is uploaded, the uploaded image is resized and grayscale.
- Step 3: A preprocessed image is passed to the Mask R-CNN algorithm to detect the Bird.
- Step 4: If the Bird is detected then other than the segmented part of the image is removed, so as to reduce the burden on the neural model.
- Step 5: The cropped image is passed as an argument to the neural model for inference purpose.
- Step 6: Top 5 accuracy is inferred from the model and a graph is formed representing the probability of each top 5 species.
- Step 7: Finally, the graph is displayed to the user.

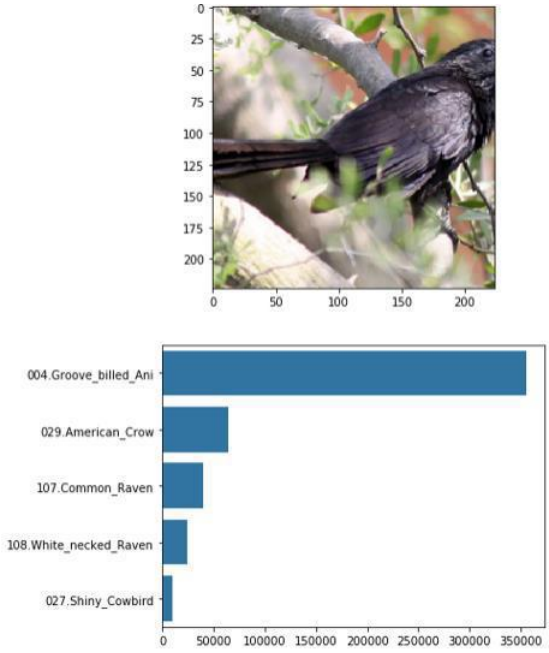

Fig.1 Output of a bird

V. RESULTS

This study has developed a software platform that uses in-depth learning of image processing to identify bird species in digital images uploaded or captured

by the end-user on a smartphone in real-time. Developing such a system requires a trained set of data to separate the image. A professional data set consists of two parts a qualified result and a test result. The database must be re-trained to achieve the highest accuracy in identification. The trained database is created using 50000 steps, increasing the number of steps higher for its accuracy. Qualified database accuracy is 93%. The test database contains approximately 1000 images with 80% accuracy. Whenever a user downloads an input file, the image is temporarily stored on the website. This input file is then transferred to the system and submitted to CNN when CNN is integrated with a qualified database. Various features such as head, body, color, beak, shape, the whole image of the bird are considered to be separated for maximum accuracy. Each feature is provided with an in-depth convocational network to extract features. These elements are then collected and passed on to the classifier. Input will be compared to a trained database to produce results. The image is compared to the images of a pre-trained data set and a point sheet is produced. A score sheet is the result of the top 5 results where the highest corresponding score of the score sheet is the result of bird species.

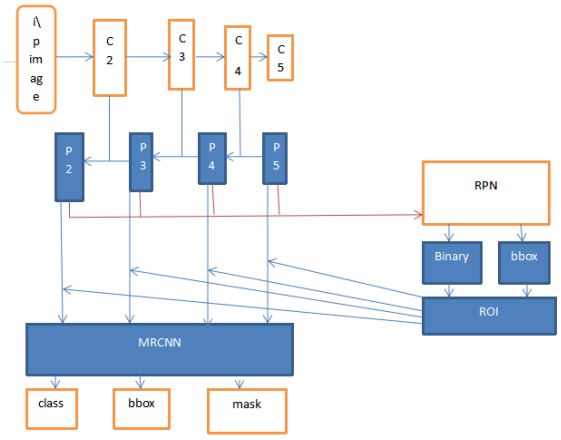

Fig.1 Working of R-Mask CNN

Fig.3 An Elegant Tern

S.No	Species	Score Obtained
1	Elegant tern	0.00943
2	RedFaced cormorant	0.00924
3	Brant cormorant	0.0082
4	Pelagic cormorant	0.0082
5	White pelican	0.00808

Table 1: Score Sheet Table

VI. CONCLUSION AND FUTURE SCOPE

Neural network is used to classify bird species based on a set of data. Multi-width frequency delta data augmentation cannot be used to elevate phase accuracy compared to raw spectral data, but accuracy is closer to state-of-the-art and more profitable than raw spectral data where calculation resources are limited. Then, the use of additional meta-data raises the level of species in model predictions, but it does not seem sufficient to push it to a much higher level, which means that the model has to predict a few species, but the actual accuracy of the top-1 does not appear to be affected. By analyzing the data set we also found that the relative number of training samples per bird species is not equal, which seems to lead to the choice of bird species, and that some species of birds are difficult to distinguish from the species of birds. others.This study [15] will help researchers to work in various fields such as image processing, error detection in Industrial Industries, and classification of medical imaging. The biggest disadvantage of all these algorithms is that the accuracy of these algorithms depends on the quality of the camera and the viewing angle between the camera and the target object. It is also noted that at some angles the results were more accurate than the specific camera range.

Future Scope

The future of imaging technology includes intelligent, digital robots designed by research scientists in various parts of the world. [15] Includes the development of various image processing applications.

As a result of changes in image processing and other related technologies, there will be millions of robots in the world, altering their way of life. Research on image processing and practical intelligence will include voice commands, anticipation of government information requirements, language translation, monitoring and tracking people and objects, medical identification, performance and surgery, human DNA sequencing, and automatic manipulation of all human DNA. transportation. Now with regard to the recognition of bird-based bird species, [6] we can continue to improve the system with a cloud component that can store large amounts of data for comparison and if there is a neural network it can provide high computer computing power.

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