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Identify Bird Species Using Deep Conventional Neural Networks (DCNN) Algorithm

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ABSTRACT: Now a days birdwatching is a common hobby but to identify their species requires the assistance of large bird books. Naturally, birds present in various scenarios appear in different sizes, shapes, colours, and angles from human perspective. Manually segregating the bird features and requires a lot of research for the identification the bird species. To provide birdwatchers a handy tool to admire the beauty of birds, we developed a deep learning platform to assist users in recognizing species of birds using a software based on the concept of image recognition. This proposed system based on the image augmentation of birds, extraction of bird features and classify the images of birds by using convolutional neural network. After the classification the prediction of bird species is happened with best probability. Thus, the proposed system tends to reduce the computational time involved in obtaining the results and the overall cost of designed system, thereby increasing the overall accuracy of system.

KEYWORDS: Image augmentation, Convolutional neural network, deep learning

I.INTRODUCTION

In our system we have developed a best accuracy application by using Convolutional neural network(CNN). This technology would recognize the input image by comparing the model with a trained model and then predict the bird species. Initially, the bird species is selected and do image augmentation for the extension of dataset images and for best performance.By using deep conventional neural networks (DCNN) algorithm we classify the species, where the multiple nodes of comparison are generated. After classification means by generating the trained data model the CNN layers and then predict the model by using our own training and testing images. Finally, we get the probability for the given bird is belongs to our own consider species or not.

II.EXISTING SYSTEM

To identify the bird species there are many websites produces the results using different technologies. But the results are not accurate. For suppose if we will give an input in those websites and android applications it gives us multiple results instead of single bird name. It shows us the all-bird names which are having similar characteristics. So, we aimed to develop a project to produce better and accurate results. In order to achieve this, we have used Convolutional Neural Networks to classify the bird species.

III.PROPOSED SYSTEM

Convolution neural network algorithm is a multilayer perceptron that is the special design for the identification of two-dimensional image information. The key era of CNN is the local receptive field, sharing of weights, subsampling by using time or space, with a purpose to extract features and reduce the size of the training parameters. The advantage of CNN algorithm is to avoid the explicit feature extraction, and implicitly to learn from the training data. Adopting sub-sampling structure by time robustness, scale, and deformation displacement. Inputinformation and network topology can be a very good match. It has unique advantages in image processing.

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WORK FLOW

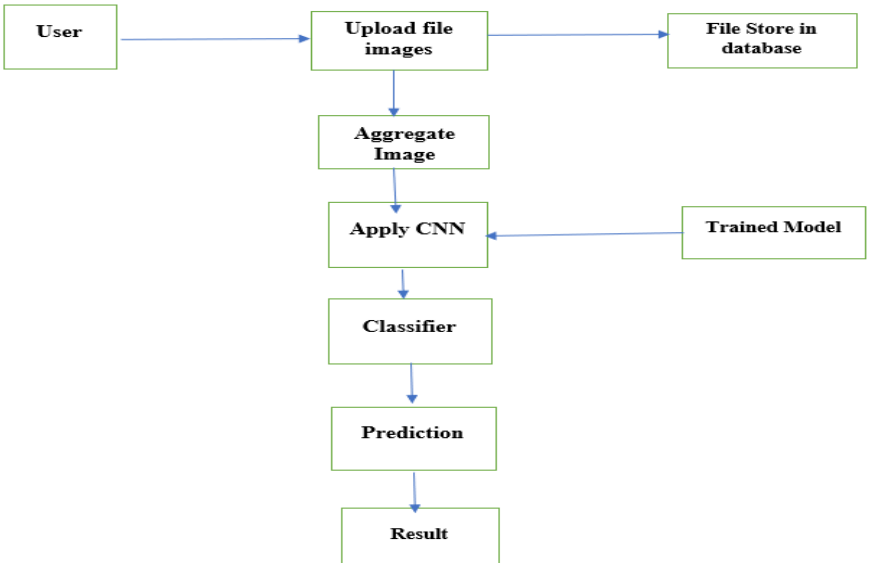

Fig.1 Work Flow

TECHNOLOGIES and TOOLS USED

Image Data Generator- Data augmentation is what Kera's' "ImageDataGenerator" class implements. Using this type of data augmentation, we want to ensure that our network, when trained, sees new variations of our data at each and every epoch. An input batch of images is presented to the ImageDataGenerator. The ImageDataGenerator transforms each image in the batch by a series of random translations, rotations, etc. The randomly transformed batch is then returned to the calling function.

Convolutional Neural Network- A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which 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. The preprocessing required in a ConvNet is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn these filters/characteristics.The convolutional layers are performed pooling operations on the image.

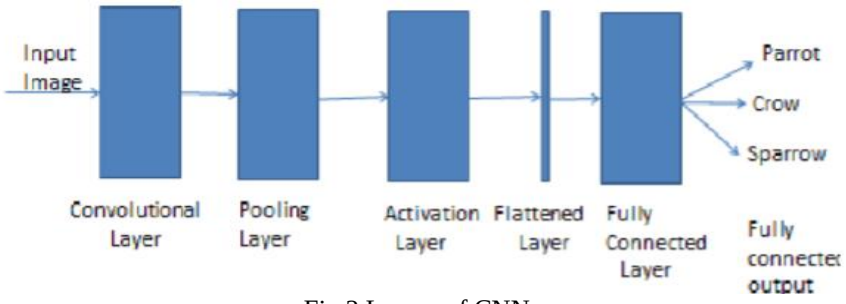

Fig.2 Layers of CNN

Pooling- The Pooling layer is responsible for reducing the spatial size of the Convolved Feature. This is to decrease the computational power required to process the data through dimensionality reduction. Furthermore, it is useful for extracting dominant features which are rotational and positional invariant, thus maintaining the process of effectively training of the model. In pooling we use max pooling operation that selects the maximum element from the region of the feature map covered by the filter.

ReLU (Rectified Linear Unit) Activation Function-The ReLU is the most used activation function in the world right now

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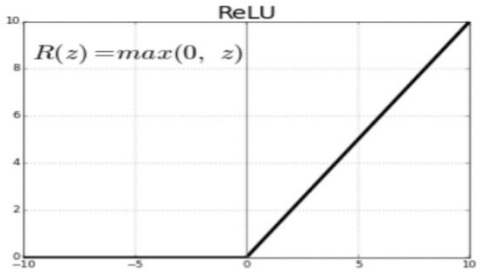
Equation: f(x) = max (0, x)
Range: (0 to infinity)



Sigmoid Activation Function – The **sigmoid function** used is f (s) = 1 /1 + e ^(-x), where s is the input and f is the output. The output of a **sigmoid function**, superimposed on that of a threshold **function**.

Dataset- The dataset we used here are Caltech UCSD Birds 200(CUB-200-2011) is a well-known dataset for bird images with photos of 200 categories. The dataset contains birds that are mostly found in Northern America. Caltech-UCSD Birds 200 consists of 11,788 images and annotations like 15 Part Locations, 312 Binary Attributes, 1 Bounding Box. Classifying birds pose an additional challenge over categories, as a result 2 of the massive similarity between classes. additionally, birds are non-rigid objects which will deform in many ways and consequently there's also an oversized variation within classes and gives best accuracy.

ALGORITHEMIC STEPS

The identification of bird species happened by the following steps
Step 1: Start
Step 2: Collect the bird image dataset
Step 3: Upload the image dataset for predicting the species of bird
Step 4: Make image augmentation for that dataset which gives the best performance after extending the dataset
Step 5: Train the model by performing CNN operations on the trained dataset by splitting x and y values for prediction
Step 6: Fits the model into sequential format
Step 7: Predicting the probability
Step 8: Getting result
Step 9: Stop

IV.EXPERIMENTAL RESULTS

Highest Probability Prediction

Here we predict the warbler classes in the dataset. There are nearly 30 warbler classes in the dataset which is having 200 classes. So after train all images we are getting a highest prediction average score of the all 30 classes from top rate to low rate. After performing the output looks like

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```
bird_class
161.Blue_winged_Warbler                0.908222
180.Wilson_Warbler                     0.907790
177.Prothonotary_Warbler               0.885702
168.Kentucky_Warbler                   0.880060
162.Canada_Warbler                     0.878792
167.Hooded_Warbler                     0.875741
182.Yellow_Warbler                     0.872957
170.Mourning_Warbler                   0.870711
169.Magnolia_Warbler                   0.844334
176.Prairie_Warbler                    0.836423
200.Common_Yellowthroat                0.807398
172.Nashville_Warbler                  0.788124
175.Pine_Warbler                       0.778490
020.Yellow_breasted_Chat               0.773604
163.Cape_May_Warbler                   0.734990
173.Orange_crowned_Warbler             0.710515
181.Worm_eating_Warbler                0.699448
179.Tennessee_Warbler                  0.693873
178.Swainson_Warbler                   0.679112
174.Palm_Warbler                       0.640080
166.Golden_winged_Warbler              0.602417
164.Cerulean_Warbler                   0.583381
158.Bay_breasted_Warbler               0.519813
160.Black_throated_Blue_Warbler        0.508750
184.Louisiana_Waterthrush              0.481186
183.Northern_Waterthrush               0.478949
165.Chestnut_sided_Warbler             0.464464
171.Myrtle_Warbler                     0.419817
159.Black_and_white_Warbler            0.322498
Name: pred, dtype: float32
```

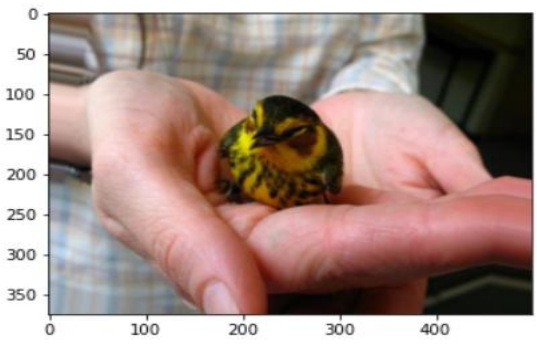
Bird image Probability Prediction- The prediction of the bird which the user given is belongs to given dataset of warbler bird.

```
C:\Users\DELL\Desktop\myprogram\image1.jpg
1/1 [==============================] - 0s 2ms/step
prob it is warbler:0.918
```


```
C:\Users\DELL\Desktop\myprogram\images3.jfif
1/1 [==============================] - 0s 2ms/step
prob it is warbler:0.868
```

The worst-case scenario, means the bird is too small and other stuff is high, in that case also we get the best accuracy.

```
C:\Users\DELL\Desktop\myprogram\image4.jpg
1/1 [==============================] - 0s 2ms/step
prob it is warbler:0.883
```



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IV.CONCLUSION

The main purpose of the project is to identify the bird species from an image given as input by the user. We used CNN because it is suitable for implementing advanced algorithms and gives good numerical precision accuracy. It is also general-purpose and scientific. It also caters to the need of simplifying the bird identification process and thus making bird-watching easier We achieved an accuracy of 85%-90%. We believe this project extends a great deal of scope as the purpose meets. In wildlife research and monitoring, this concept can be implemented in-camera traps to maintain the record of wildlife movement in specific habitat and behaviour of any species.

V.FUTURE SCOPE

Create an android/iOS app instead of website which will be more convenient to user. System can be implemented using cloud which can store large amount of data for comparison and provide high computing power for processing (in case of Neural Networks).

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