DIGITAL NATURALIST - AI ENABLED TOOL FOR BIODIVERSITY RESEARCHERS

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ABSTRACT:

A naturalist is someone who studies the patterns of nature, identifies a different kind of flora and fauna in nature. Being able to identify the flora and fauna around us often leads to an interest in protecting wild spaces, and collecting and sharing information about the species we see on our travels is very useful for conservation groups like NCC.

When venturing into the woods, field naturalists usually rely on common approaches like always carrying a guidebook around everywhere or seeking help from experienced ornithologists. There should be a handy tool for them to capture, identify and share the beauty to the outside world.

Field naturalists can only use this web app from anywhere to identify the birds, flowers, mammals and other species they see on their hikes, canoe trips and other excursions.

In this project, we are creating a web application which uses a deep learning model, trained on different species of birds, flowers and mammals (2 subclasses in each for a quick understanding)and get the prediction of the bird when an image is been given.

INTRODUCTION:

The ever-growing number of digital sensors in the environment has led to an increase in the amount of digital data being generated. This includes data from satellites, weather stations, data from "internet of things" devices, and data collected by members of the public via smart phone applications, to name but a few. These new sources of data have contributed to the era of "Big Data" characterized by large volumes of data, of numerous types and quality, being generated at an increasing speed. This presents challenges and opportunities across a number of domains, including water management, camera trapping, and acoustic analysis. To process these data into useful information there are many tools available, including classical statistical analyses and classification by citizen scientists. However, at some point traditional approaches may become inefficient or even impossible given the volume, diversity, and heterogeneity of these data. Storage, exploration, duration, and revision of data may have to be re-thought to allow for their quick and efficient transformation, annotation, or analysis. This is particularly

difficult for multimedia data which are typically much more complex than other data types. For example, biodiversity and environmental records in the form of audio, video, or image files are typically larger and more complex than text or numeric data. Large-scale analysis of multimedia data has only been possible in recent years since the development of large computational facilities, both academic and commercial. Regardless, the analysis of multimedia data is often further complicated because of their nonstandardized methods of acquisition, with highly diverse devices, sensors, formats, scales, environmental contexts, and taxonomic scope. Building efficient, scalable, and robust approaches to solve these problems is a difficult scientific challenge at the forefront of data science and machine learning specifically.

Artificial intelligence (AI) techniques have profoundly transformed our ability to extract information from visual data. AI techniques have been applied for a long time in security and industrial domains, for example, in iris recognition or the detection of faulty objects in manufacturing. They were nevertheless only recently made more widely accessible after their use in smart phone apps for face recognition and song identification. Combined with increasing access to cloud-based computation, AI techniques can now automatically analyze hundreds of thousands of visual data every day.

AI naturalists, just like their human counterparts, may have their own biases which must be fully understood if the information that they generate is to be trusted and suitably utilized. For example, most AI systems can only detect or recognize already seen (or learned) objects or concepts. Benchmark datasets of images can be organized to precisely assess the limits of AI systems' ability, highlighting where human expertise is still required. Deep learning models (some of the most advanced AI algorithms) are developed with training datasets that allow them to capture discriminate visual patterns. Their performances are then strongly correlated to the quality and completeness of the datasets on which they are trained. Unbalanced, biased, or otherwise poor-quality training datasets will lead to underperforming algorithms in real conditions. During the learning phases, particular attention must be given to any relevant limitations of the training data, and the gap between these and the test data on which the developed algorithms will be evaluated

LITERATURE SURVEY:

1. **TITLE** : "BIRD CLASSIFICATION USING CNN"
   AUTHOR : PIYUSH BIDWAI, VAIBHAV MAHALLE, ESHAN GANDHI , SHARDA DHAVALE
   ALGORITHM : DEEP LEARNING CNN ALGORITHM
   DESCRIPTION:

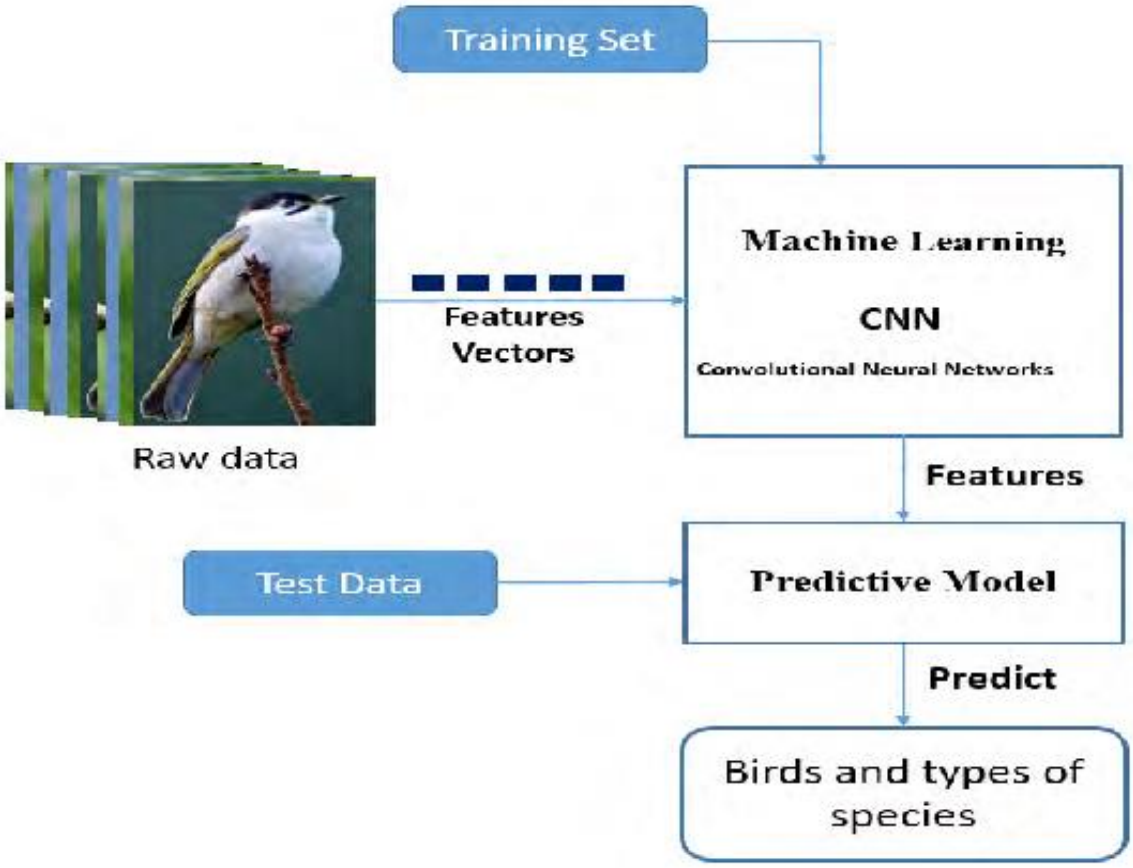
   This work presents a scenario with classification of birds using CNN technique based on color features. They used color

images of birds with almost similar types. Image segmentation is carried in various stages. At first, the pixels are arranged and segmented on the basis of edges and spatial segmentation, where clustering is done. Next, the blocks are segmented using edge detection. The computational efficiency increases for image and training becomes easier. This approach provides with better and robust results for different images. Here they took sparrow for the case study and evaluated the features of it using the steps up listed. The experimental results classify the effectiveness of proposed approach to improve the segmentation quality in aspects of precision and computational time .

EXISTING SYSTEM:

From ancient times, bird identification has been a difficult task for many Ornithologists. They are required to study all the details of birds such as their existence in environment, their biology, their distribution etc. Bird classification is usually done by ornithology experts based on classification proposed by Linnaeus: Kingdom, Phylum, Class, Order, Family and Species.

PROPOSED SYSTEM:



1. Raw Data: It is the data in unstructured form. We cannot predict some relevant information from it. It represents a single, implicitly structured data item in the table.

2. Training set: The training dataset comprises of raw data samples that were incorporated into the training model to determine specific feature parameters, Perform co-relational task.

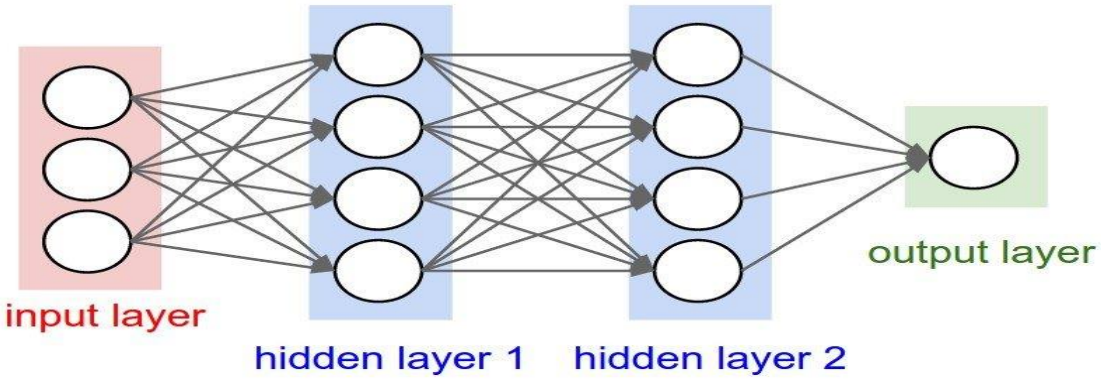
3. Deep learning CNN: It module for extracting unique features of birds with the CNN and predicting the most classified labels for the input images. The model of CNN conjuration for bird identification utilized a stack of convolutional layers comprising of input layer, two FC layers and one final output layer.

4. Test Data: The test dataset will used to test the classifier parameters and access the performance of actual prediction of the network model. Once the features will be extracted from the raw data, the trained prediction model will be deployed to classify new input images.

5. Feature Extraction: Firstly, extracting features from raw input images is our primary task where extracting relevant and descriptive information for fined grained object recognition. However, because of semantic and intra class variance, feature extraction will be challenging. We are going to separately extract the features in relevant positions for each part of an image and subsequently learning the parts of the model features that were mapped directly to the corresponding parts.

6. Predictive model: The proposed model can predict the uploaded image of the bird as a bird. The proposed system will predict and differentiate various birds' images.

BLOCK DIAGRAM:



ALGORITHM:

Deep learning algorithm has been used for developing the system, because the inputted image is not known. CNN is a class of deep neural network mostly used for analyzing visual images. It consists of an input layer and output layer as well as multiple hidden layers. Every layer is made up of group of neurons and each layer is fully connected to all neurons of its previous layer. The output layer is responsible for prediction of output. The convolutional layer takes an image as input, and produces a set of feature maps as output. The input image can contain multiple channels such as color, wings, eyes, beak of birds which means that the convolutional layer perform a mapping from 3D volume to another 3D volume. 3D volumes considered are width, height, depth.

DRAWBACKS:

This System can be only used for the birds classification. Not a use for the Plants Classification.

2. **TITLE :**“DIGITAL NATURALIST USING DEEP LEARNING”

AUTHOR : APARNA, SALONI M P, CHANDANA M, NEHA U K , BANUSHREE D J.

ALGORITHM: CNN CLASSIFIER ALGORITHM

DESCRIPTION:

A naturalist is someone who studies the patterns of nature identify different kingdom of flora and fauna in the nature. Being able to identify the flora and fauna around us often leads to an interest in protecting wild species, collecting and sharing information about the species we see on our travels is very useful for conserving groups like NCC. Deep-learning based techniques and methods are becoming popular in digital naturalist studies, as their performance is superior in image analysis fields, such as object detection, image classification, and semantic segmentation. Deep-learning techniques have achieved state of-the-art performance for automatic segmentation of digital naturalist through multi-model image sensing. Our task as naturalist has grown widely in the field of natural-historians. It has increased from identification to saviours as well. Not only identifying flora and fauna but also to know about their habits, habitats, living and grouping lead to fetching services for protection as well.

PROPOSED SYSTEM:

We propose a web application to predict the given images from dataset using CNN. The segmentation refers to the process of partitioning a digital image into multiple segments. So here we come up with the system, where system will detect (Robin, Dove, Peacock) from given images. User has to select the image system which will process the image by applying image processing steps. We applied image processing algorithms to detect the classes from given image. Here we proposed image segmentation process for accuracy. In this firstly we train the model with some of the Birds images which predict that which bird is present. Based on the extracted features our model detects the type of bird.

Data Collection: Here data set used is the Digital Naturalist Dataset. This dataset contains two folders: test set and training set. In test set folder, we have three categories called dove, peacock and robin, where, dove has the images having dove bird, peacock has the images having peacock bird, robin has the images having robin bird. Similarly, in the training set folder. Having 309 images belonging to 3 classes and 134 images belonging to 3 classes.

Data Pre-processing: Images are converted into gray scale image. System will process the image by applying image processing steps. A unique algorithm is applied to detect images from the specified image. But edges of the image are not sharp in

early stage of specification. So, image segmentation is applied on image to detect edges of the images. In this method image segmentation is applied to detect the species. Here the proposed image segmentation process many image filtering techniques for accuracy. Importing the Image Data Generator Library and configure the class. Now applying Image Data Generator Functionalities to Train set and Test set and building the Python Code.

Model Building: Firstly, importing the Model Building Libraries. Now initializing the Model and adding the CNN Layers Max Pooling layer, Flatten layer and Dense layers. Configuration of the Learning Process is done and after that model is trained and tested. Finally, optimization of the Model is done and lastly it is saved.

Application Building: Application Building is done by using the Flask Interface and for Documentation and design to be displayed HTML is made used. Thereafter loading of the Model in the Web Application is done. Finally, the Clicked Images are sent to the Trained Model and the result is displayed through the prediction made by the Model in the form of text and information is obtained.

ALGORITHM:

Deep learning algorithm has been used for developing the system, because the inputted image is not known. CNN is a class

of deep neural network mostly used for analyzing visual images. It consists of an input layer and output layer as well as multiple hidden layers. Every layer is made up of group of neurons and each layer is fully connected to all neurons of its previous layer. The output layer is responsible for prediction of output. The convolutional layer takes an image as input, and produces a set of feature maps as output. The input image can contain multiple channels such as color, wings, eyes, beak of birds which means that the convolutional layer perform a mapping from 3D volume to another 3D volume. 3D volumes considered are width, height, depth.

DRAWBACKS:

This system is only use for 3birds classification.

3. TITLE: "CLASSIFICATION AND GRADING OF IMAGE USING TEXTURE BASED BLOCK-WISE LOCAL BINARY PATTERNS"

AUTHOR : PAUL VIOLA, MICHAEL JONES

ALGORITHM: SUPPORT VECTOR MACHINE ALGORITHM

DESCRIPTION:

They proposed approach makes use of global textural feature viz., Local Binary Pattern for feature extraction. Initially, an image is divided into k number of blocks. Subsequently, the texture

feature is extracted from each k blocks of the image. The k value is varied and has been fixed empirically. For experimentation purpose, the bird dataset is created using 4 different classes and experimentation is done for whole image and also with different blocks like 2, 4 and 8. Grading of Bird is done using Support Vector Machine classifier. Finally, the performance of the grading system is evaluated through metrics like accuracy, precision, recall and F-measure computed from the confusion matrix. The experimental results show that most promising result is obtained for 8 blocks of the image.

ALGORITHM:

SVM can be understood with the that we have used in the KNN classifier. Suppose we see a strange cat that also has some features of dogs, so if we want a model that can accurately identify whether it is a cat or dog, so such a model can be created by using the SVM algorithm. We will first train our model with lots of images of cats and dogs so that it can learn about different features of cats and dogs, and then we test it with this strange creature. So as support vector creates a decision boundary between these two data (cat and dog) and choose extreme cases (support vectors), it will see the extreme case of cat and dog. On the basis of the support vectors, it will classify it as a cat.

DRAWBACKS:

This system Only used for Birds image classification.

4. TITLE: IDENTIFICATION OF BIRD SPECIES USING CONVOLUTION NUERAL NETWORKS

AUTHOR: J MARTINSSON

ALGORITHM:NEURAL NETWORK

DESCRIPTION:

In our world, there are above 9000 bird species. Some bird species are being found rarely and if found also prediction becomes very difficult. In order to overcome this problem, we have an effective and simple way to recognize these bird species based on their features. Also, the human ability to recognize the birds through the images is more understandable than audio recognition. So, we have used Convolutional Neural Networks (CNN).

EXITISTING 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.

PROPOSED SYSTEM:

Convolution neural network algorithm is a multilayer perception that is the special design for the identification of two-dimensional image information. It has four layers: an input layer, a convolution layer, a sample layer, and an output layer. In a deep network architecture, the convolution layer and sample layer may have multiple. CNN is not as restricted as the Boltzmann machine, it needs to be before and after the layer of neurons in the adjacent layer for all connections, convolution neural network algorithms, each neuron doesn't need to experience the global image, just feel the local region of the image. In addition, each neuron parameter is set to the same, namely, the sharing of weights, namely each neuron with the same convolution kernels to the deconvolution image. The key era of CNN is the local receptive field, sharing of weights, sub sampling 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. The same neuron weights on the surface of the feature mapping, thus the network can learn parallel, and reduce the complexity of the network Adopting sub-sampling structure by time robustness, scale, and deformation displacement. Input information and network topology can be a very good match. It has unique advantages in image processing.

ALGORITHM:

Unsupervised learning algorithm has been used for developing the system, because the inputted image defined is not known. Also, the data which is given to unsupervised learning algorithm are not labelled, i.e. only the input variables(X) are given with no corresponding output variables. In unsupervised learning, algorithms discover interesting structures in the data themselves. In detail, clustering is used for dividing the data into several groups. In depth, deep learning models used to find vast number of neurons. Deep learning algorithms learn more about the image as it goes through each neural network layer. For classifying Neural Network is used. Figure 5 represents layers of neural networks for feature extraction. The neural network is a framework for many machine learning algorithms. Neural networks consist of vector of weights(W) and the bias (B).

DRAWBACKS:

This system only used for birds classification**.** Not Used for Plants & Animals Classification.

5. **TITLE:** "CLASSIFICATION OF BIRDS SPECIES USING ARTIFICIAL NEURAL NETWORK"

AUTHOR: PRATIK GHOSH , ANKIT AGARWALLA

ALGORITHM: ARTIFICIAL NEURAL NETWORK

DESCRIPTION:

Classification of birds species using Artificial Neural Network is proposed by carefully selecting a combination of features from shape, color and texture feature. A detailed and up to date study of bird species would help us to transform entire landscape, control pests and pollinate plants. In this paper experiment is performed on a datasets of 56 birds and by selecting the most appropriate features a good accuracy was recorded. The main motive of the paper is to optimize the features required for bird classification when the dataset contains birds at various viewpoint s and configurations.

EXITISTING SYSTEM:

A deep learning based technique for bird recognition using the concept of image processing was proposed. Image recognition system using Pytorch Model was proposed. An inception neural network model to improve bird classification accuracy was proposed. Shape feature based bird classification using KNN and SVM classifier was proposed. Automatic Bird Recognition system by their vocalization using Support Vector Machine was proposed. White-tailed Eagle and Lesser Black backed Gull bird species was classified using CNN. Bird detection and scaring system to protect ripening fruit was proposed. 27 bird species was detected using a mobile app named Internet of Birds (IoB) and classified using CNN and SVM was proposed. An automatic bird

sound detection using deep learning. Bird acoustic detection using CNN and RNN was proposed. An animal recognition system based on Bilateral Convolutional Network (BC Net) so as to be exploited in mobile devices was proposed. Recognition of animal species based on combination of features using ANN was proposed.

PROPOSED SYSTEM:

Bird recognition is one of the research areas in which few useful technologies have been suggested. Classification of bird species using artificial neural network is done by taking the most relevant features that is independent of view-point.

1. MEDIA ACQUISITION:

A customized dataset is created for both training and testing images by downloading images from the internet. To introduce sufficient alteration, the images are shown from different viewpoints.

2. PRE-PROCESSING:

It includes steps to make image suitable for feature extraction to reduce the computational load by resizing the images to standard dimensions of horizontal 256 and vertical 256 pixels.

3. SEGMENTATION:

After resizing the images to standard dimensions, the color image is converted to gray scale image for binary thresholding and for color thresholding, the image is splitted into three separate color channels Red, Green, Blue, and thresholding for the individual channel is done. The Otsu's Binarization technique is used for thresholding and the threshold level is maintained at 0.94. The threshold level is estimated on the basis of trial and error method by observing the histograms for the individual channels.

4. FEATURE EXTRACTION:

After the completion of segmentation steps, the individual features like shape, color and texture are extracted. Shape Features: The most relevant shape features for bird classification includes Area, Centroid, Major Axis Length, Minor Axis Length, Perimeter and Filled Area are collected. Color Features: The image is splitted into three color channels. The H(Hue), S(Saturation), V(Value) rather than R(Red), G(Green), B(Blue) channel for feature extraction due to the robustness of HSV over RGB in getting the luminance information. Mean and Standard Deviation for those individual color channels are collected. Texture Features: Texture indicates the variations of gray level over the image. Hence it is computed from gray-level co-occurrence matrices (GLCM) along four directions, 0 degree, 45 degrees, 90 degrees and 135 degrees. The GLCM based features

includes Energy (GE), Correlation (GN), Homogeneity (GH) and Contrast (GC) respectively.

ALGORITHM:

Unsupervised learning algorithm has been used for developing the system, because the inputted image defined is not known. Also, the data which is given to unsupervised learning algorithm are not labelled, i.e. only the input variables(X) are given with no corresponding output variables. In unsupervised learning, algorithms discover interesting structures in the data themselves. In detail, clustering is used for dividing the data into several groups. In depth, deep learning models used to find vast number of neurons. Deep learning algorithms learn more about the image as it goes through each neural network layer. For classifying Neural Network is used. Figure 5 represents layers of neural networks for feature extraction. The neural network is a framework for many machine learning algorithms. Neural networks consist of vector of weights(W) and the bias (B).

DRAWBACKS:

This system is only used for birds species classification.

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