BIRD SPECIES IDENTIFICATION USING DEEP LEARNING

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ABSTRACT:

Bird watching is a common hobby but to identify their species requires the assistance of bird books. To provide birdwatchers a handy tool to admire the beauty of birds, we developed a deep learning platform to assist users in recognizing 27 species of birds endemic to Taiwan using a mobile app named the Internet of Birds (IoB). Bird images were learned by a convolutional neural network (CNN) to localize prominent features in the images. First, we established and generated a bounded region of interest to refine the shapes and colors of the object granularities and subsequently balanced the distribution of bird species. Then, a skip connection method was used to linearly combine the outputs of the previous and current layers to improve feature extraction. Finally, we applied the softmax function to obtain a probability distribution of bird features. The learned parameters of bird features were used to identify pictures uploaded by mobile users. The proposed CNN model with skip connections achieved higher accuracy of 99.00 % compared with the 93.98% from a CNN and 89.00% from the SVM for the training images. As for the test dataset, the average sensitivity, specificity, and accuracy were 93.79%, 96.11%, and 95.37%, respectively.

Keywords:

Bird image recognition, convolutional neural network, deep learning, mobile app.

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INTRODUCTION:

The everyday pace of life tends to be fast and frantic and involves extramural activities. 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.

Numerous people visit bird sanctuaries to glance at the various bird species or to praise their elegant and beautiful feathers while barely recognizing the differences between bird species and their features. Understanding such differences between species can enhance our knowledge of exotic birds as well as their ecosystems and biodiversity. However, because of observer constraints such as location, distance, and equipment, identifying birds with the naked eye is based on basic characteristic features, and appropriate classification based on distinct features is often seen as tedious. In the past, computer vision , and its subcategory of recognition, which use techniques such as machine learning, have been extensively researched to delineate the specific features of objects, including vegetables and fruits , landmarks , clothing , cars , plants , and birds , within a particular cluster of scenes. However, considerable room for improvement remains in the accuracy and feasibility of bird feature extraction techniques. Detection of object parts is challenging because of complex variations or similar subordinate categories and fringes of objects. Intra-class and inter- class variation in the silhouettes and appearances of birds is difficult to identify correctly because certain features are shared among species.

LITERATURE SURVEY:

TITLE: Bird Species Categorization Using Pose Normalized Deep Convolutional Nets.

DESCRIPTION:

- In this paper they used two different Techniques for Classification of Image.
- The accuracy of these algorithms is 53%.

TITLE: **Scikit-learn**: Machine Learning in Python.

DESCRIPTION:

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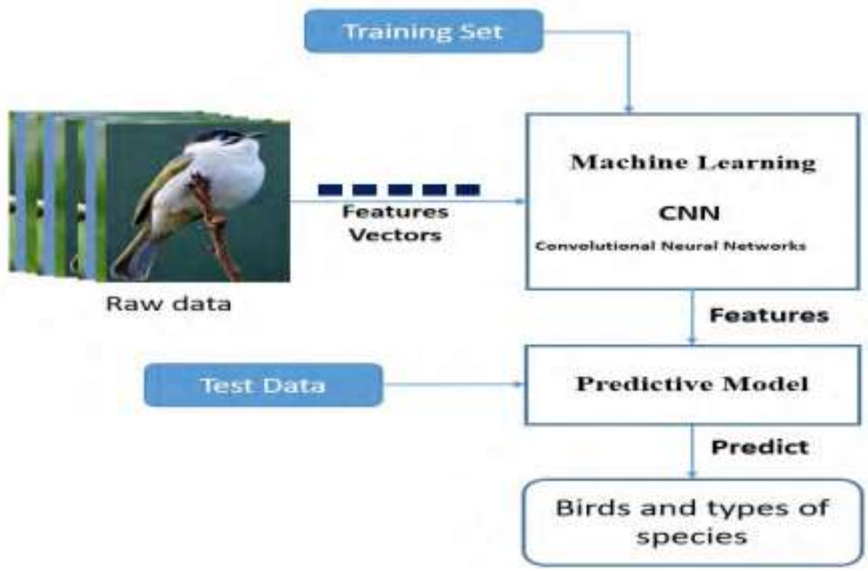
- These features are aggregated and then given to the classifier for classification purpose.
- On basis of the results which have been produced, the system has provided the 80% accuracy in predicting the bird species.

PROPOSED SYSTEM:

The emergence of deep learning algorithms has resulted in highly complex cognitive tasks for computer vision and image recognition. Recently, deep learning models have become the most popular tool for big data analysis and artificial intelligence, outperforming traditional image classification algorithms, and they are currently being down- scaled for feasible mobile implementation. The proposed deep learning model for bird image classification using the CNN Framework is described follows.



CNN ARCHITECTURE:

The model of CNN configuration for bird identification utilized a stack of convolutional layers comprising an input layer, two FC layers, and one final output softmax layer. Each convolutional layer comprised of convolution, BN, ReLU activation, and pooling layers. This section explains how to construct an optimized CNN model, why the parameters and hyper parameters must be tuned before training, the total number of convolutional layers, the size of the kernels for all relative convolutional layers, and the likelihood of retaining the anode during dropout regularization for the dataset.

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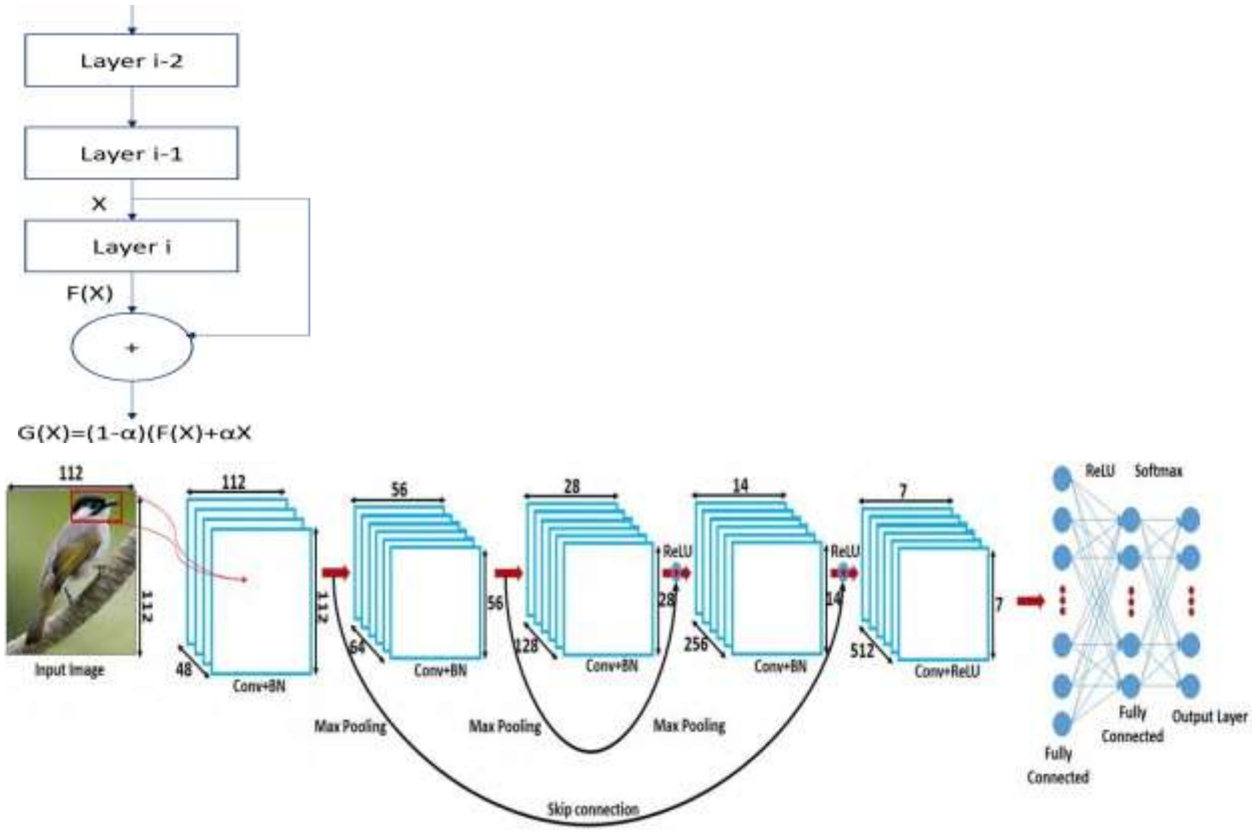

Fig: CNN Architecture for detecting bird images.

FEATURE EXTRACTION:

Extracting features from raw input images is the primary task when extracting relevant and descriptive information for fine- grained object recognition. However, because of semantic and intra-class variance, feature extraction remains challenging. We separately extracted the features in relevant positions for each part of an image and subsequently learned the parts of the model features that were mapped directly to the corresponding parts. The features were calculated using ReLU 5 and ReLU 6. Localization was used to find object parts defined by bounding box coordinates and their dimensions (width and height) in the image. For the localization task an intersection over union score >0.5 was set for our model. An FC layer with a Rely was used to predict the location of bounding boxB_x. Subsequent step the learning algorithm were for learning the map of the feature vectors of the input image, deciding whether the region fit an object class of interest, and then classifying the expected output with the correct labels in the image.

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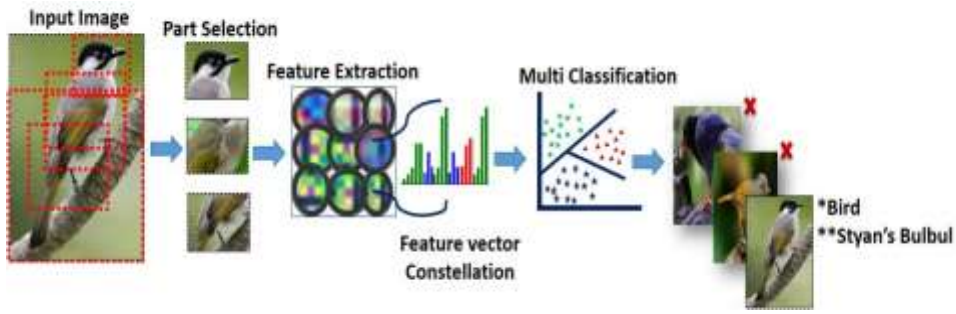

SYSTEM IMPLEMENTATION:

In this subsection, we explain using a high-resolution smart- phone camera to identify and classify bird information based on deep learning. To complete the semantic bird search task, we established client–server architecture to bridge the communication gap between the cloud and mobile device over a network. The entire setup was executed in the following manner:

- Raw bird images were distilled to remove irrelevant parts and learned by the CNN to yield parameters on the GPU platform. Subsequently, a TF inference model was developed in the workstation for deployment in the Smartphone.
- The output was detected using an Android app platform or through the web.

Fig: Client-Server architecture for bird detection.

EXPERIMENTAL RESULTS AND ANALYSIS

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Fig: Dataset of Bird Species.

Prediction results of images uploaded from smart phones.

Subjects	Predicted Bird	Predicted Non-bird
Bird	100%	0%
Non-bird	0%	0%

Fig: Hardware/software specifications used to execute the object detection model.

Hardware/Software	*Specification*
GPU	12 Intel Xeon CPUs, 32 GB memory, NVIDIA GeForce 2, 11GB GTX 1080Ti graphic cards.
Android Phone	5.0 or higher devices.
Android SDK, NDK	SDK is Android interface for main activity, and NDK helps to bridge the SDK and TF platform.
TensorFlow	Execute numerical computation using data flow graphs.
PyCharm	Python IDE programmers coding interface.

CONCLUSION:

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This study developed a mobile app platform that uses cloud- based deep learning for image processing to identify bird species from digital images uploaded by an end-user on a Smartphone. This study dealt predominantly with bird recognition of 27 endemic bird species. The proposed system could detect and differentiate uploaded images as birds with an overall accuracy of 98.70% for the training dataset. This study ultimately aimed to design an automatic system for differentiating fine-grained objects among bird images with shared fundamental characteristics but minor variations in appearance.

In the future, we intend to develop a method for predicting different generations of specific bird species within the intra-class and interclass variations of birds and to add more bird species to our database.

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