LITERATURE SURVEY

Title: Image Classification Using Deep Learning and Neural Networks

Journal: International Journal of Engineering Research & Technology (IJERT),2003

Methodology:

- The paper uses deep learning, deep neural networks, image classification, and TensorFlow to identify and classify bird species from images1.
- The paper employs a large dataset of 400 bird species, with 58388 training images, 2000 test images, and 2000 validation images2.
- The paper applies convolutional neural networks (CNNs) to extract features from the images and reduce their dimensionality.
- The paper compares the performance of different CNN architectures, such as VGG-16, MobileNet, and ResNet-50, on the task of bird species classification.
- The paper evaluates the accuracy, precision, recall, and F1-score of the models, as well as the confusion matrix and the classification report.

Advantages:

- **Powerful Models:** The paper uses special computer models (neural networks) that are really good at understanding images. These models can learn complex features from the pictures, just like how we learn to recognize faces or objects.
- **Lots of Examples:** By using a large dataset, the computer learns from many different bird species1. It's like learning about birds from a diverse group of experts.

Disadvantages:

- **Computational Complexity:** Training these models takes a lot of computer power and time. It's like solving a really hard puzzle—it requires a powerful computer.
- **Data Bias:** If the dataset mainly has certain types of birds, the computer might struggle with less common species. It's like studying only popular birds and missing out on the rare ones

Title: Automatic Bird Species Identification for Large Number of Species

Journal: IEEE Explore journal,2011

Methodology:

- The input is a sequence of video frames of a flying bird taken by an unknown camera.
- The output is a ranked list of candidate bird species based on their likelihood.
- The method consists of four steps:
- Motion segmentation: Extract the bird boundary from each frame using optical flow, background motion model, Mahalanobis distance, and active contour algorithm.
- Salient extremities recognition: Find the inter-wing tip distance (IWTD) from the bird boundary by searching for the maximum distance across frames in a wingbeat period and along the wing spreading direction (WSD).
- Periodicity analysis: Apply Fast Fourier Transformation (FFT) to the IWTD series to obtain the wingbeat frequency (WF) and its error bound. Use a kinematic model of the bird wing and prove that the WF is invariant to camera parameters and motion trajectory3.
- Species prediction: Use a likelihood ratio-based metric to compare the extracted WF with the prior knowledge of WF distributions for different bird species. Return a short ranked list of candidate species4.

Advantages:

- **It helps quickly and effectively monitor bird populations without disturbing them.**
- **By using recorded bird songs, it avoids the need for direct interaction with the birds, minimizing disturbance.**

Disadvantages:

- Accuracy depends on the quality of recorded bird songs, and noise in the environment can make identification challenging.
- The identification model may not work well for bird species not included in its training set, limiting its applicability.

Title: Bird Species Identification Using Deep Learning

Journal: International Journal of Engineering Research & Technology (IJERT),2019.

Methodology:

- The paper uses a deep convolutional neural network (DCNN) to classify bird species from images.
- The paper uses the Caltech-UCSD Birds 200 (CUB-200-2011) dataset, which contains 11,788 images of 200 bird categories, with annotations such as part locations, binary attributes, and bounding boxes2.
- The paper converts the bird images into grayscale format and generates an autograph, which is a network of processing nodes that calculates a score sheet for each node and predicts the bird species based on the score sheet analysis3.
- The paper uses the GoogLeNet framework, which is a DCNN architecture with 22 layers and multiple inception modules, to train and test the model on the bird images.
- The paper uses Tensorflow, which is a software library for deep learning, to implement the DCNN model and perform parallel processing using GPU technology.

Advantages:

- It presents a novel method for bird species classification based on deep convolutional neural networks (DCNN) and autograph generation.
- It achieves high accuracy (90.93%) on the Caltech-UCSD Birds 200 (CUB-200-2011) dataset, which is a challenging benchmark for fine-grained recognition.

Disadvantages:

- It does not compare its results with other state-of-the-art methods for bird species identification, such as pose-normalized models or attribute-based models.
- It does not provide any analysis or discussion on the limitations or challenges of its approach, such as the computational cost, the data augmentation techniques, or the generalization ability.

Title: Prediction of species richness of breeding birds by landscape-level factors of urban woods

in Osaka Prefecture, Japan

Journal: IEEE Explore journal,2011

Methodology:

- The authors used bird records from various sources to obtain the species richness of forest birds in 28 urban parks and three mountains in Osaka Prefecture, Japan.
- The authors measured the environmental variables of the urban parks, such as woodland area, elongation, distance to mountain, distance to nearest woods, and percentage of woodland and field cover within 25 km2 outside the parks.
- The authors compared the fitness of three models to describe the species-area relationship: the power function, the exponential function, and the logistic function.
- The authors performed multiple regression analysis and principal component regression analysis to predict the species richness by the environmental variables and selected the best models based on the adjusted R2 and Akaike's information criterion (AIC).
- The authors conducted canonical correspondence analysis (CCA) to examine the relationships between species occurrence and environmental variables and identified the nested subset pattern of species composition.

Advantages:

- **Learned a Lot:** The study looked at what makes different birds live in city woods. It thought about things like how big the woods are, where they are, and what kinds of homes birds like. It also compared different ways of guessing how many bird types there are.
- **Good Ideas for City Planning:** The research gives good ideas for making cities better for nature. It says it's important to have bigger woods, different kinds of homes for birds, and to connect city woods to other areas where birds come from.

Disadvantages:

- **Not Enough Info:** The study only looked at 28 parks in one part of Japan. So, what it found might not be true for other places. It also didn't think about how things change over time or how people and other animals can bother birds.
- **Old Info:** The study is from 1999, so it might not show what's happening now with birds in cities. Some of the ideas and ways they checked things might be old and not used anymore.

Title: Hierarchical Classification of Bird Species Using Their Audio-Recorded Songs

Journal: IEEE Explore journal,2013

Methodology:

- The authors use a hierarchical classification approach to the bird species identification problem from audio recordings12. They compare three types of approaches: flat, local model, and global model.
- They use the MARSYAS framework to extract acoustic features from the audio signals, such as spectral centroid, rolloff, flux, zero crossings, and MFCC.
- They use the Global-Model Naive Bayes (GMNB) algorithm as the global-model classifier, which is an extension of the classic Naive Bayes algorithm that takes into account the hierarchical class structure of the bird species taxonomy.
- They use the flat Naive Bayes and the Local Classifier Per Parent Node (LCPN) approach as the baselines for comparison. The LCPN approach trains a flat classifier for each non-leaf node in the hierarchy and uses a top-down strategy for testing.
- They use the hierarchical precision, recall, and F-measure as the evaluation metrics, which are adapted from the standard precision, recall, and F-measure to account for the hierarchical nature of the problem.
- They conduct experiments on a dataset of 1320 bird song records from 48 bird species, which are organized in a hierarchical tree according to the scientific classification of birds.

Advantages:

- It addresses a challenging and practical problem of recognizing bird species from their vocalizations, which can have applications in bioacoustics, ecology, conservation, and education.
- It explores a novel and effective approach of using a global-model hierarchical classifier, the GMNB algorithm, which can leverage the taxonomic structure of the bird classes and achieve higher accuracy than flat or local-model classifiers.

Disadvantages:

- It relies on a limited and imbalanced dataset of 48 bird species, which may not cover the diversity and variability of bird vocalizations in the real world. It also does not consider the effects of noise, interference, or environmental factors on the audio signals.
- It uses a simple and fixed feature extraction method, based on MARSYAS, which may not capture the rich and dynamic information contained in the bird sounds. It also does not compare its features with other state-of-the-art methods, such as deep learning or spectrogram-based features.

Title: Bird-SDPS: A Migratory Birds' Spatial Distribution Prediction System

Journal: IEEE Explore journal,2013

Methodology:

- The authors introduce Bird-SDPS, a system for predicting the spatial distribution of migratory birds based on GPS tracking data and remote sensing data12.
- The system consists of four main components: GPS records manager, remote sensing data manager, multi-model manager, and visualization controller34.
- The GPS records manager preprocesses and reformats the GPS data into spatial grids, which represent the frequency of birds' occurrence in a geographic area.
- The remote sensing data manager extracts environmental variables from remote sensing files, such as temperature, precipitation, land cover type, etc., and stores them in a NoSQL database (HBase) for efficient retrieval5.
- The multi-model manager integrates five different species distribution models: Maxent, SVM, GLM, RF, and DT, and provides an expansion interface for new models. It also evaluates the models using AUC and other metrics.
- The visualization controller uses Web-GIS to display the GPS data, the environmental data, and the prediction results on a map, and provides interactive functions for users.

Advantages:

- **Helps Birds:** The system uses GPS and remote sensing to track birds' travels. This helps us understand where they go, where they like to live, and what they need. This info is super useful for studying nature, planning to protect birds, and preventing diseases they might get.
- **Compares Different Ideas:** The system is like a smart tool that can use many ways to understand bird movements. It can compare different ways of figuring things out, helping us choose the best methods.

Disadvantage:

- **Needs Big and Good Data:** The system relies on lots of info about bird travels and the environment. Handling and storing this big and complicated data is a challenge. If the data isn't good, it can make the system less accurate.
- **Might Miss Some Things:** The system uses models that guess where birds might be based on the environment. But it might not understand all the reasons or interactions that affect birds. It also might not consider how things change over time or in different places.

Title: SIMULTANEOUS SEGMENTATION AND CLASSIFICATION OF BIRD SONG USING CNN

Journal: IEEE Explore journal,2017

Methodology:

Researchers used a smart computer program to find and identify bird sounds in audio recordings. The program, like a special brain (CNN), could do both jobs at once. It looked at graphs of sound intensity over time (spectrograms), labeled pixels as background or bird species, and learned to do this by looking at many examples.

The program predicted labels for each pixel and identified bird sounds by looking at connected groups of labeled pixels. It combined multiple bird species if they were in the same recording.

Advantages:

1. **Innovation:** This method is new and combines finding bird sounds and identifying species in one step, unlike traditional methods.

2. **Better Results:** It performs better than other methods, giving more accurate results.

Disadvantages:

1. **Needs a lot of computing power:** Training the computer model is computationally expensive and requires a lot of labeled examples.

2. **Limited use:** It's good for finding bird sounds in certain recordings but might not work well for other tasks or environments. Success depends on having good examples to learn from.

Title: Automatic Bird Species Detection Using Periodicity of Salient Extremities

Journal: IEEE Explore journal,2013

Methodology:

- The authors develop a kinematic model of the bird wing using three revolute joints and derive the inter-wing tip distance (IWTD) in 3D space and in the image coordinate system.
- The authors propose a method to extract the IWTD series from video frames by performing motion segmentation, finding the maximum IWTD across frames in a wingbeat period, and recognizing IWTD series for the entire period using the wing spreading direction (WSD).
- The authors show that the IWTD series is a periodic function that reflects the wingbeat frequency (WF) of the bird, which is invariant to camera parameters and a reliable feature for bird species filtering.
- The authors conduct a frequency analysis on the IWTD series by applying Fast Fourier Transformation (FFT) and a high pass filter to obtain the WF and its error bound.
- The authors propose a species prediction metric using likelihood ratios based on the extracted WF and the prior knowledge of WF distributions for different bird species.

Advantages:

- It can provide a non-invasive and efficient method to identify bird species from a distance, without requiring physical capture, tagging, or audio recording.
- It can exploit a reliable and invariant feature of bird flight, the wingbeat frequency, which is related to the bird's morphology, physiology, and ecology.

Disadvantages:

- It requires high-quality video data with sufficient resolution, frame rate, and contrast to capture the wingbeat motion and extract the inter-wing tip distance.
- It may not be able to distinguish between closely related or similar-sized bird species that have overlapping wingbeat frequency ranges.

Title: Bird Species Identification Using Deep Learning on GPU platform

Journal: IEEE Explore journal,2020

Methodology:

- The paper uses a deep convolutional neural network (DCNN) to classify bird species from images1.
- The paper uses the Caltech-UCSD Birds 200 (CUB-200-2011) dataset, which contains 11,788 images of 200 bird categories, with annotations such as part locations, binary attributes, and bounding boxes2.
- The paper converts the bird images into gray scale format and generates an autograph, which is a network of processing nodes that calculates the score sheet for each node and predicts the bird species3.
- The paper uses the GoogLeNet framework and the Tensorflow library to implement the DCNN and train it on the bird images. The paper also uses GPU technology to speed up the parallel processing of the images.
- The paper evaluates the performance of the DCNN by measuring the classification accuracy and the processing time for different numbers of workers. The paper compares the results with other existing methods and reports the advantages and limitations of the proposed approach.

Advantages:

- It can achieve high accuracy and fast processing for bird species classification from images, using a novel method of autograph generation and deep convolutional neural network (DCNN).
- It can leverage the power and efficiency of GPU technology and Tensorflow library to perform parallel processing and optimization of the DCNN model.

Disadvantages:

- It may not be able to handle the variations and complexities of bird images in different scenarios, such as different sizes, forms, colors, angles, backgrounds, etc.
- It may not be able to generalize well to other datasets or tasks, such as audio or video based bird recognition, or fine-grained recognition of bird sub-species or individuals.

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