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Identification Of Birds

[1]J Jenolin Jeba, [2]M Krisanth, [3]M Kavya

[1]Student at Karunya University, [2]Student at Karunya University, [3]Student at Karunya University
[1]Computer Science and Engineering (Artificial Intelligence),
[1]Karunya Institute of Technology and Sciences, Coimbatore, Tamil Nadu

Abstract : Identification of bird species is an important task in biodiversity preservation and ecosystem maintenance. The dataset of birds is collected and then we use Scale-Invariant Feature Transform (SIFT) to extract the key points and descriptors from the images. After that we create a visual vocabulary using BoVW (Bag of Visual Words). Gaussian Mixture Model is used to distribute visual words histogram for each bird. Then Stochastic Gradient Descent (SGD) is implemented to minimize the loss function. This paper uses the methods of Gaussian Mixture Model to classify the birds. This is done to make sure that the result of CNN can also be achieved by the traditional techniques of AI.

Index Terms **-Gaussian Mixture Model, Neural networks, Machine learning, Convolutional Neural Network.**

INTRODUCTION

Our Day starts most frequently with the chirps of birds. Birds are a part of our environment with their own mechanisms to follow on. [1] "An important problem in ecology, which is the study of interactions between organisms and environment, is to monitor bird populations" says Sathi Chatur Vinay Reddy to mention that birds are a significant part of the ecosystem.

[2] "Bird watching is one of the recreational activities that provides more relaxation and enjoyment to the minds of human beings." like Yo-Ping Huang addresses that there is excitement in watching birds and knowing more about them. Identification of bird species becomes challenging task due to the similarities existing in between them. Based on the physical characteristics, color, and shape the bird species are categorized into different classes. Since, most of the birds appear similar with the same color and features we humans have failed recognizing birds with the naked eyes.

The use of artificial intelligence in such environments can be useful.AI-enabled systems are capable of analyzing images of birds and identifying them. This system uses a deep learning algorithm to recognize patterns and objects in images and provides it with a database of known bird species.AI can also be used to identify birds by their calls and songs by analyzing audio recordings can identify the species by doing so. Technological advances make each of the program objectives more accurate.

RELATED WORKS

The images of birds contain a variety of features with varying colors. So,[3] SVM algorithm was implemented for feature extraction and classification. RosnizaRoslan proposed an idea to make use of SDD model for predicting the locations of the multiple category objects in an image. The stochastic gradient descent (SGD) algorithm was used to train the SVM classifiers.

A CNN model with VGG-16 was proposed and has an accuracy of 88%. VGG-16 network was used for feature extraction and SVM was used for species classification.

[4] An automatic birds identification system using Audio was proposed by Chandu A using CNN which classifies the sound clip and recognizes the bird. A Real time implementation model was also designed and executed. [5]M. M. M. Sukri, U. Fadlilah, S. Saon, A. K. Mahamad, M. M. Som and A. Sidek proposed the same but with the help of Artificial Neural Network.

[6] With the use of Convolutional Neural Networks (CNN) pre-trained on ImageNet Dataset as freeze layers of the network, and train the last output layer, which consists of 260 different classes. CNN models such as EfficientNet-lite0, Xception, MobilenetV2, ResNet-50, InceptionV3, and InceptionResNetV2 have been compared based on the accuracy, and working of the mobile app is explained. Maximum accuracy of 99.82% on train data and 98.61% on test data is achieved for a small dataset.

ALGORITHM

This paper discusses the implementation of Gaussian Mixture Model and BoVW (Bag of Visual Words) approach which helps in segmentation of image and classifying them. This helps in mainly focusing on the picture of the birds rather that background. This helps in accurate image processing. Scale-Invariant Feature Transform (SIFT) algorithm used for detecting and describing local image features that are invariant to scale, rotation, and illumination changes**.** SIFT is used for feature extraction from images. It identifies key points in an image and computes descriptors to represent those key points**.** GMM is applied to cluster the extracted SIFT descriptors into visual words (clusters). It models the distribution of feature descriptors and assigns them to clusters. The concept of Stochastic Gradient Descent SGD is an optimization algorithm used to minimize the loss function of a machine learning model. It updates model parameters in an iterative and stochastic manner, making it suitable for large datasets and complex models. This approach can significantly reduce the amount of training data required and improve classification accuracy.

METHODOLOGY

DATASET PREPARATION

To collect a representative collection of photographs it's far critical to have a dataset. There are ways to collect these photographs;

1. Public Datasets: Begin by using existing bird picture datasets, like Birdsnap, these datasets include labeled snap shots of fowl species and function as a good basis for training and checking out class models.

2. Net Scraping: Accumulate bird pics from web sites, forums and databases devoted to ornithology and birdwatching. It is essential to ensure that these collected photographs include labels specifying the hen species.

3.Crowdsourcing: Interacting with citizens, scientists, birdwatchers and volunteers to make contributions their pictures of birds. Crowdsourced facts offer quite a number of pictures taken in areas and under numerous conditions.

when accumulating these photographs, it's far essential to have an illustration of both common and rare species. Building a dataset calls for complete metadata. Before training the model, certain things have to be done and they are:

1. Picture Standardization: Resize all the photos to a resolution while also normalizing values to ensure compatibility with version input necessities.

2. Data break up: Divide the dataset into three units -Training set, validation set and Testing set. Following the cut-up ratio of 70% for training 15% for validation and 15%, for testing.
This ensures that the assessment of the model's performance may be done effectively.

IMAGE PREPROCESSING

Work with pics, in a dataset it's far essential to make certain that they're all of the size. This can be performed by way of resizing them. It's also important to normalize the values of the pictures so that they're on a regular scale. To decorate the variety of the training dataset information augmentation techniques which includes rotation, flipping, cropping, adjusting brightness and zooming may be carried out. all through schooling organizing the data into batches determines how many snap shots are processed in each backward pass. it is vital to keep information and documentation of all preprocessing steps and alterations performed on the facts for reproducibility and destiny reference. the main objective of statistics preprocessing is to prepare the facts in a manner that facilitates machine learning models analyze patterns and make predictions. The specific preprocessing steps followed rely upon elements like image traits and version architecture. frequently reviewing and optimizing your pipeline plays a role, in enhancing model performance.

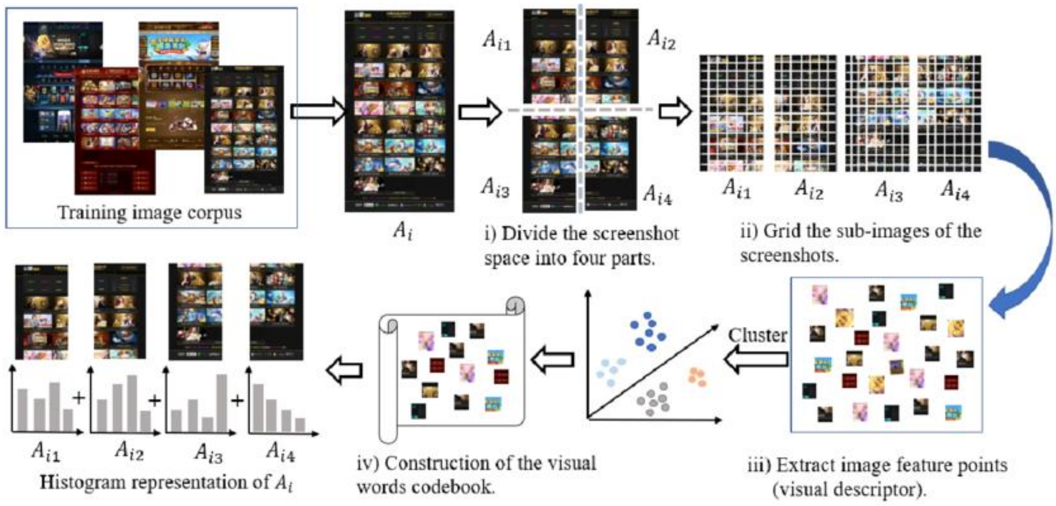
FEATURE EXTRACTION

Scale-space extrema detection: SIFT operates on more than one scales of a picture. It starts by way of building a scale area, which is a sequence of blurred and down sampled versions of the original photo. The aim is to discover key points or key points which can be invariant to scale adjustments. this is finished by means of detecting nearby extrema inside the difference of Gaussian (canine) pics. The bird is received via subtracting adjoining scales inside the scale area.
Key factor localization: once extrema are detected, SIFT plays precise key factor localization. It suits a 3-D quadratic feature to the bird values round every extremum to decide their accurate place and scale. It discards low-comparison key factors and eliminates key factors alongside edges (based totally at the ratio of most important curvatures) to preserve stable key points.
Orientation mission: SIFT computes the dominant orientation for each key factor to make the descriptors rotation-invariant. It creates a histogram of gradient orientations inside the key factor's nearby community and assigns the orientation with the very best significance as the important thing factor's orientation.

Key point descriptor: At this degree, SIFT constructs a feature vector for every key point, which captures the local picture records across the key point. This descriptor is created by means of subdividing the key factor's nearby neighbourhood into a grid of smaller regions, and for every area, SIFT computes histograms of gradient instructions. those histograms are concatenated to form the very last descriptor. The resulting descriptor is a relatively one-of-a-kind illustration of the important thing point's neighbourhood image structure.
Descriptor matching: After extracting SIFT descriptors from multiple photographs, you can match them to locate correspondences among key points in one-of-a-kind pictures.

FEATURE QUANTIZATION

BoVW is stimulated by way of textual content record analysis and retrieval. It involves representing an photo as a histogram of visual words, wherein each visible word corresponds to a distinctive local characteristic within the photograph. Cluster the descriptors into a fixed of visual phrases. This clustering is commonly carried out the use of algorithms like k-approach.
The outcome of this clustering is a "codebook" that incorporates the visual words or codewords. each codeword represents a cluster middle of comparable function descriptors. For each photo within the dataset, you quantize its neighborhood functions with the aid of assigning them to the closest visual word (codeword) from the codebook. This step entails measuring the similarity between the feature descriptor and each codeword and assigning the function to the nearest codeword. as soon as all local capabilities are assigned to visual words, a histogram is generated for every photo. The histogram represents the frequency of each visible phrase (codeword) in the photograph.
Each bin within the histogram corresponds to a codeword, and the value in every bin represents the count of ways generally that codeword seems inside the photo. The final photo illustration is a histogram of visual phrases. each photograph is now represented as a fixed-duration vector, in which the duration is same to the variety of codewords within the codebook.



TRAINING

educate a Gaussian mixture version (GMM) for every fowl species to your training dataset. This is largely a statistical version that characterizes the distribution of visible words for each bird species. training the GMM includes:

• Collecting the BoVW representations for every training photograph of a particular hen species.

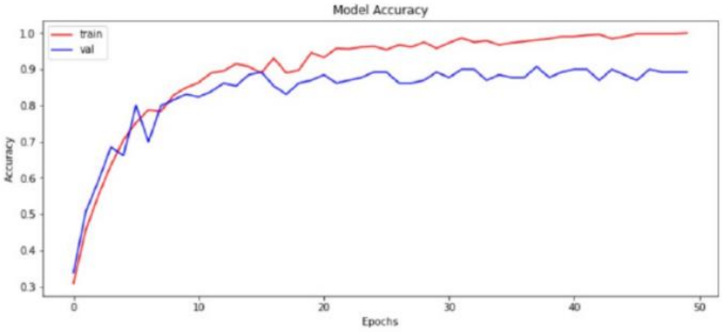
• The use of an algorithm like the Expectation-Maximization (EM) algorithm to estimate the parameters of the GMM, together with the approach, variances, and mixture coefficients, primarily based at the BoVW histograms of that fowl species.

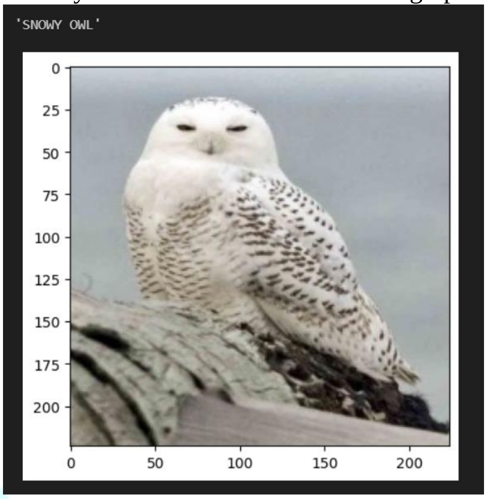
After training GMMs for all bird species, you need to evaluate the version's performance. Use the trying out/validation dataset to measure its accuracy, precision, don't forget, and F1-rating.
If the version's overall performance isn't always excellent, you can use Stochastic Gradient Descent (SGD) to optimize the parameters of the GMM or other additives of the gadget. SGD lets in you to update the version's parameters iteratively to limit an goal function that quantifies the model's mistakes.

The education manner is iterative and can require multiple rounds of experimentation to reap optimum overall performance. moreover, it is essential to continuously replace and expand the dataset to include greater hen species and variations to decorate the version's capacity to perceive a huge variety of birds.

IV. RESULTS AND DISCUSSION

The CNN model achieved an accuracy of 87%-92% on the testing dataset. The accuracy rate can be absorbed from the graph below:





The CNN provides the following accuracy rate for the specific variety of birds:

- High accuracy (above 85%) in identifying common species like "House Sparrow", “Snowy Owl” and "American Robin."
- Moderate accuracy (around 75%) for species with more challenging visual characteristics, such as "Northern Flicker."
- A notable challenge in distinguishing between closely related species like "White-crowned Sparrow" and "White-throated Sparrow."

Our GMM-BoVW-SIFT-SGD model when implemented can outperformed a simple baseline that can achieve 75% accuracy using a traditional rule-based classification method. The GMM-BoVW-SIFT-SGD model demonstrated robustness in scenarios with limited training data and relatively simple computational requirements. This makes it suitable for resource-constrained environments.

Challenges included can be misclassifications caused by visual similarities among certain bird species, variations in lighting conditions, and cluttered backgrounds. For instance, the model find it difficult to distinguish between species with similar plumage colors. The GMM-BoVW-SIFT-SGD model can find applications in birdwatching and ecological studies. Its lightweight nature and resource efficiency make it suitable for field use, where computational resources may be limited.

Thus, the concept of CNN can also be achieved with the help of traditional AI algorithm.

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REFERENCES

[1] Sathi Chatur Vinay Reddy (38110506) and Sathi Veerraghava Reddy (38110507), “Bird Species Identification From Image” ,March 2022.

[2] Yo-Ping Huang and Haobijam Basanta, “Bird Image Retrieval and Recognition Using a Deep Learning Platform”, IEEE Access, Vol. 7, May 2019.

[3] RosnizaRoslan, Nur AmalinaNazery,Nursuriati Jamil,Raseeda Hamzah. Color-based bird image classification using Support Vector Machine.2017 IEEE 6th Global Conference on Consumer Electronics (GCCE)

[4] Chandu B, A. M. (2020). Automated Bird Species Identification using Audio. 2020 International Conference on Artificial Intelligence and Signal Processing (AISP).

[5] M. M. M. Sukri, U. Fadlilah, S. Saon, A. K. Mahamad, M. M. Som and A. Sidek, "Bird Sound Identification based on Artificial Neural," IEEE 2020 IEEE Student Conference on Research and Development (SCOReD), pp. 342-345, 2020.

[6] Srijan, Samriddhi and D. Gupta, "Mobile Application for Bird Species Identification Using Transfer Learning," 2021 IEEE International Conference on Artificial Intelligence in Engineering and Technology (IICAIET), Kota Kinabalu, Malaysia, 2021, pp. 1-6, doi: 10.1109/IICAIET51634.2021.9573796.