

Automated Bird Species Recognition System Based on Image Processing and Svm Classifier

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Article History: Received: 11 January 2021; Accepted: 27 February 2021; Published online: 5 April 2021

Abstract: Here, in this study we can learn about Bird species recognition. In forest areas cameras are fixed at various locations which capture images periodically. From those images the birds living in such dense forest areas can be identified. It would be useful if we can able to classify the species of birds with the help of those images. But that is not an easy task because of the variations in the light effects, illumination and camera viewpoints. So we need to involve image processing techniques for preprocessing the captured image and also deep learning techniques are to be implemented for classifying the images. For classification purpose training is to be done with the help of image data set. Here we propose a method of discriminating birds by means of the ratio of the distance between eye and beak to that of the beak width. By combining this mythology with image processing and SVM classification technique a new bird species recognition algorithm is proposed. The proposed new methodology will improve the accuracy in classifying.

1. Introduction

The environmental changes and climatic conditions due to the technological and scientific advancements affect the organisms living in the world. In that one of the most affected are the birds which are especially living inside the forests. So it is necessary to protect some small and tiny bird species which are at the verge of extinct. For that purpose we need to identify the existence of certain species of birds inside the forest. And in turn this will also help in surveying the bird species which are residing in a particular forest area. So for this purpose certain surveillance cameras are fitted inside dense forest areas that capture videos and pictures of the surroundings periodically. With those images as reference the bird species living in that particular area are identified and classified. Here in this paper we use image processing algorithms for enhancing the captured images and deep neural networks for classification purpose. A system is developed which will accept a bird species name as input. The images of the input bird breed is collected and correlated from the web using image crawl. These images are used as training dataset in our system. Before that the images are preprocessed to remove noises and corruptions. Outliers are identified and removed from the set of obtained training images. The final preprocessed set of images is used as training data set. The different features are extracted from the captured images and compared with the training data set and classified using neural networks. To analyze the performance factors the system is involved in using an available Bird Breed Dataset CUB-200[1]. Partial images from this dataset is used as a training data set and the remaining data are used as testing data. The classification accuracy changes according to the consideration of various parameters applied in the classification process. This proposed method of using a web based training data set each time while searching bird species the accuracy of the classification process. The proposed system results in improved recognition rates.

2. Related Work:

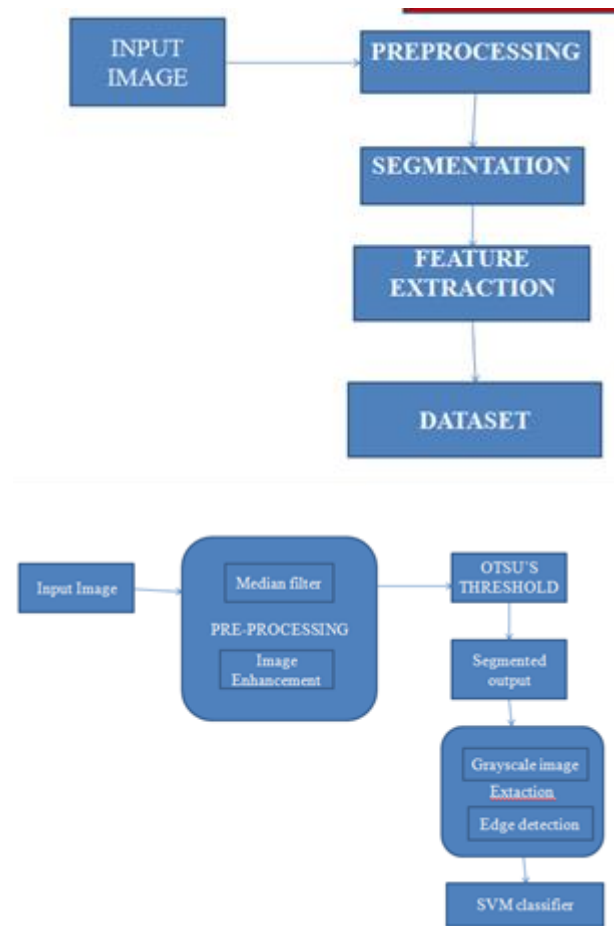
Wen Li and Dezhen Song “AUTOMATIC BIRD SPECIES FILTERING USING A MULTIMODEL APPROACH” – In this paper bird species recognition is done by taking videos captured using moving cameras. The important parameter of crowd sourced videos plays a vital role in this paper. The algorithm used in this paper analyzes the motion of the flying birds and its wing movements to deploy parameters for filtering of species. Here two kinds of parameters are taken into consideration. One is the full body movement of the bird and the other is the wing movement of alone. This combined parameter model resulted in better classification outputs.

Steve Branson, Grant Van Horn, Serge Belongie, Pietro Perona “Bird Species Categorization Using Pose Normalized Deep Convolution Nets” – In this paper classification is done by visually categorizing fine grained images. Here the parameter used for recognition is the pose of the bird species. This parameter in turn is used to extract local features of the image and then applied for classification purpose. Here for deep CNN are used for feature extraction. The pose normalization scheme is also employed as a pre processing mechanism. A graph based clustering algorithm is used for learning purpose.

Bird Species Identification from an Image Aditya Bhandari, Ameya Joshi, Rohit Patki. – In this paper the bird species recognition is done with the help of images of variety of birds captured by a still camera. With these images as input and by applying Caltech-UCSD Birds-200-2011 dataset, different machine learning algorithms are applied for classification purposes. The algorithms tried in this paper are 1. Naive Bayes 2. K-nearest

Neighbors 3. One versus Rest classifiers with Logistic Regression 4. Decision Trees 5. Linear Discriminant Analysis (LDA) 6. Support Vector Machines 7. Random Forests.

System Implementation:



PRE-PROCESSING- MEDIAN FILTER

Before using the obtained image for classification preprocessing is to be done for every image so as to enhance the image quality. Several filters are useful for preprocessing the images. Here we are using the median filter for that purpose which will perform noise reduction in the images. The median filter process the image pixel by pixel, and for every pixel it compares itself with its neighborhood pixel for similarity. Then the pixel value is replaced with the median value of both the pixels. The pixel values from all of the surrounding pixels are sorted in numerical order and from that median value of those entire sorted pixel values is calculated. This median value is used to replace the value of the current pixel which is taken into consideration.

Figure 1 illustrates an example calculation

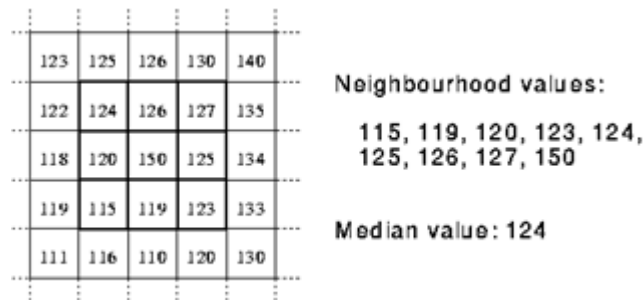


Figure 1 Here a 3x3 square matrix in the middle of the image is used for neighborhood calculation. The centre pixel value 150 is not representing the values related to the surrounding pixel and so it can be replaced with the median value which is 24 here. The median value is calculated by considering the values of all surrounding eight neighborhoods of the central pixel 150. And so the value 150 is replaced with the calculated median value. If we use a larger neighborhood matrices like 4x4 or 5x4 the smoothing effect will still improve as the mean value will be more accurate.

IMAGE SEGMENTATION-:

The images captured using the camera might be little clumsy to apply classification algorithms directly. To make the images more meaningful and for easy analyzing of images segmentation is to be done. Several algorithms are there for image segmentation process. For easy locating of edges and boundaries in the image segmentation is useful. It is done by partitioning the image into several segments.

OTSU'S METHOD

Here in our method image thresholding is a key feature which is to be done by using clusters. OTSU's method perform image thresholding based on clustering. And also the grey scale images are reduced as binary image formats in order to process further. The captured image consists of two types of pixel values as foreground and background values[12-14]. So an ideal threshold value is set so as to distinguish the two pixels and their boundaries clearly. The captured image is converted into a histogram which is having sharp and deep valley between two curves. The histogram also has binomial distributions and therefore exhibits bimodality which acts as an important and useful feature for achieving better segmentation results. For this algorithm to perform better the image size should match with the background size and should not be too small as compared the background size. The bimodal histogram will not be efficient if the calculated mean difference value is much smaller than the background intensity value. In some cases the image quality is very poor with more additive noises where the quality of histogram is also degraded. Segmentation error may occur as a result of this kind of poor quality histograms which uses wrong threshold values.

EDGE DETECTION:

Edge detection process involves several analytical and mathematical processes which are used to identify certain points in an image which are considered as edges or boundaries. The boundaries are points where the pixel intensity varies sharply. Edges are called as boundaries between two different pixel texture features. It is also defined as discontinuities found in picture intensity from one pixel to its neighbor pixel. At the boundaries or edges the pixels intensities are large. Edges are to be detected so that the image can be compressed effectively and the edge detection also enhances the performance of image segmentation and pattern recognition. Several edge detection mechanisms are available. Here in this paper edge detection is performed by calculating the differentiation of the image. That is the first order and second order derivatives of the image intensity values are computed by applying gradient and laplacian transformations. Along with these two transformations Hilbert transformation technique is also applied. Finally an Orthogonal polynomial expansion technique is applied for the purpose of corner detection in the image. This will enhance the performance to a certain extent. All these algorithms are simulated using MATLAB and the simulation results are effective for both edge detection and corner detection.

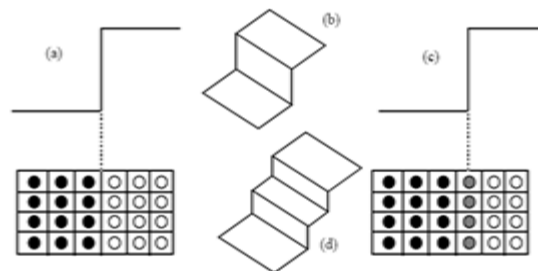


Figure 2 - Sampling effect. (a) A perfect edge. (b) 3D view of the edge. (c) Sampling at the center position (d) Staircase effect of the obtained 3D result

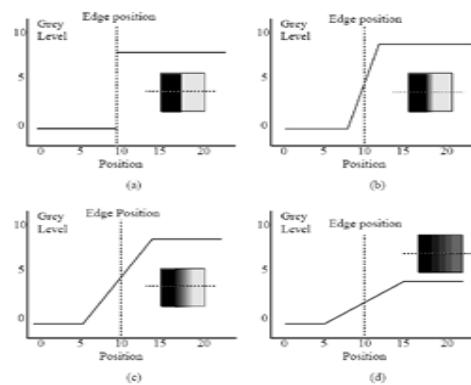


Figure 4 - Step edges. (a) Intensity value change at 10th pixel (b) A ramp edge at pixel value 14. (c) Ramp edge at 10. (d) Minor change after 10 pixels.

Feature Extraction

In our proposed method the new feature which is area between the eye and beak of the bird image is to be identified. In image processing techniques Feature extraction plays an important role which performs

dimensionality reduction. That is it localizes the feature which is to be concentrated for analysis. When the input image size is too large to process the image is reduced to focus only the area between the eye and the nose. This area is then transformed into a reduced set of features which will be considered for image classification. The analysis and classification will be performed on this reduced and extracted features rather than on the whole image. Here Columnar mean method is used for feature extraction process.

3. Methodology:

An input image is given. Our system is trained with several image datasets. So based on the features of the input image a corresponding image from the data set is identified. The mean value for each column of the input image is calculated and these values will be compared with that of the column values of the image identified from the data set. If both values are almost same the identified image will be retrieved as a result or output. This empirical columnar mean is calculated using the below formula.

$$\text{Empirical mean: } g = 1/MN \left(\sum_{m=0}^{M-1} \sum_{n=0}^{N-1} g_{mn} \right)$$

MATRIX REPRESENTATION:

A = [15 2 1 12; 4 9 15 7; 8 5 6 10; 3 12 13 2]

MATLAB output will be like

A =
 15 2 1 12
 4 9 15 7
 8 5 6 10
 3 12 13 2

This matrix correlates exactly with the engraved numbers. Once the matrix is entered, it is stored in the MATLAB workspace. It can be referred in future as s A.

4. Experimental Analysis

In this section we present the experimental implementation of various algorithms used for edge detection and segmentation process. Various detectors have different effect on the analyzed images. Different Detectors can detect edges in different methods (Gradient method, Laplacian Method etc) and even some detectors can detect mire number of zero crossings. The choice of detector and the threshold values set determines the effectiveness of the detection results. The experiment results are generated by matlab as shown on the below mentioned Figures:

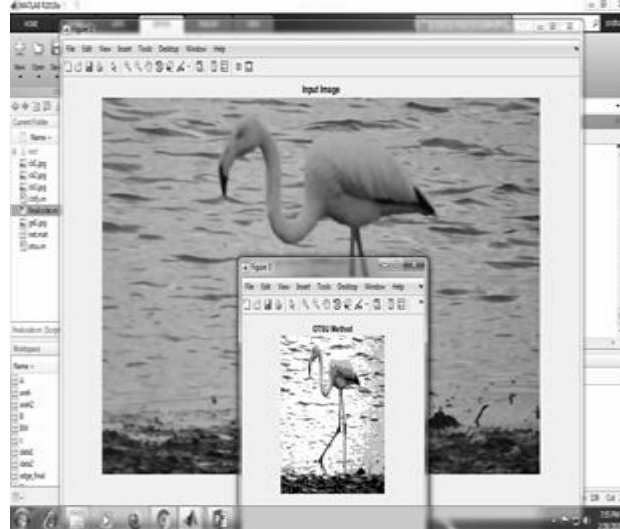


Figure 5: Gradient method: Three different parameters are under process



Figure 6: Laplacian Detection Method

SVM Classification

After all the preprocessing like image segmentation, edge detection and feature extraction the image is now ready for classification purpose. That is now the image can be compared with the training data set and an accurate match is to be identified and reported. For this purpose we use SVM classification. SVM classification is one of supervised learning methodology. SVM classification is a popular machine learning technique. This uses training data set and assigns the images to one or more categories. And when a new input image is given to this classifier algorithms based on the training it classifies the input image into any of the available category.

Conclusion:

In this paper bird species are classified based on the input image obtained from the cameras fixed in various locations within forest areas. Those images are used as training datasets in our system. And these captured images are compared with the web images. And based on the comparison the captured input images are classified as any bird breed. So if we give an input image to the system, the system will check for that breed of bird whether it is present in that particular forest area or not. Here this model learns from refined training image data set. This refinement is done by various image processing mechanisms like image segmentation, edge or boundary detection and feature extraction. Fine grained image classification based on multi dimensional and multi scale texture learning is implemented to enhance the performance.

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