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BIRD SPECIES CLASSIFICATION USING STATISTICAL FEATURE ANALYSIS OF AVIAN FLIGHT CALLS

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Detecting bird species through avian flight calls is essential for monitoring biodiversity and assessing the sustainability of ecosystems. This method provides a non-invasive way to study bird populations and their migratory patterns, aiding conservation efforts and ecological research. This study aimed to explore three research questions: the effectiveness of statistical feature extraction methods in bird identification, the classification of birds using supervised machine learning methods, and selecting the best model that classifies the birds. The study used the CLO-43SD dataset with multi-class species identification in avian flight calls. The dataset consists of 5428 audio clips of avian flight calls from 43 different species of North American wood warblers in the family Parulidae and is split into training and testing sets for analysis and validation. The analysis is conducted using R and Python. Statistical features such as the number of samples, length, root mean square error (RMSE), zero crossing rate, chromatogram, tempo, spectral centroid, spectral contrast, and Mel frequency cepstral coefficient (MFCC) were extracted for each avian flight call. These features are used with classification methods, such as random forest (RF), classification trees (CT), support vector machines (SVM) and Naïve Bayes (NB), to classify bird sounds. Results indicated that the RF and CT models with all statistical features provide high accuracies at 0.9960 and 0.9988, respectively, reassuring the audience about the reliability of the research. The Boruta analysis, the mean and standard deviation of MFCC, and the number of samples were selected as important features for classification. After downscaling the number of features, the accuracy is 0.9958 for RF and 0.9544 for CT. Kappa statistics are higher for the above classification techniques. Support Vector Machines and NB classifiers showed low accuracies compared to RF and CT, suggesting the RF and CT models would be more appropriate for classifying bird sounds. The results obtained using machine learning techniques for statistical features demonstrate the potential for automated and accurate species identification. This approach enhances the ability to monitor avian biodiversity and opens new directions for ecological research and conservation strategies.

Keywords: Mel frequency cepstral coefficient, Ornithology, Random Forest, Supervised learning