Acoustic Monitoring in Environmental Studies Using Automated Bird Song Recognition

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Acoustic monitoring is a rising solution to survey wildlife as required by environmental impact studies and biodiversity management schemes. Sound is particularly well-suited to difficult visual environments (forests, night time, underwater). On land, the state of wild fauna can be inferred from bird populations - and birds can be tracked using their vocalizations. Territorial songs, mating songs and alarm calls all bear markers of species and individuals. The algorithms from the blossoming field of human voice recognition are now expected to process large data streams of nature sounds to yield information about the presence and quantity of bird species at a given location. However, existing studies using state-of-the-art technology stall at a performance of roughly 70% accurate recognition, whereas the numbers exceed 99% for marine mammal sounds. A typical solution involves mel-frequency cepstral coefficients (MFCC) as markers and hidden Markov models (HMM) or artificial neural networks (ANN) as classifiers. Tests were run on a limited database of songs from birds found in the Hainaut province in Belgium and using research software AudioCycle. MFCC are designed to characterize the human voice and fail to discriminate songs that typically operate in a higher frequency range and are recorded in noisy conditions. The neural networks in AudioCycle base their analysis on MFCC and other human voice indicators and consequently produce a flawed map of bird sounds, although classification remains accurate for the most straightforward data. The search for proper bird sound indicators must take into account elements of bird intra- and interspecies communication.

Tags: bird sounds, song recognition, song classification, acoustic monitoring, wildlife monitoring, neural networks