

ABSTRACT

“Data mining for soundscape content using a multi-label k NN approach”

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1: Scientists are using acoustic monitoring to assess the impact of altered soundscapes on wildlife communities and human systems. In the soundscape ecology field, monitoring and analyses approaches rely on the interdisciplinary intersection of ecology, acoustics, and computer science. Combining theory and practice of each field in the context of Knowledge Discovery in Databases (KDD), soundscape ecologists provide innovate monitoring solutions for ecologically-driven research questions. We propose a soundscape content analysis framework for improved knowledge outcome using the new concept of a multi-label (ML).

2: Here, we investigated the effectiveness of an ML k -nearest neighbor algorithm (ML- k NN) for labeling multiple classes simultaneously within a single soundscape recording. We manually labeled sounds and extracted ecological acoustic features, audio profile features, and Gaussian-mixture model features for each recording. Then, we tested the ML- k NN algorithm accuracy with well-established metrics adapted to ML learning.

3: We found that seventeen unique acoustic features could predict a set of biophonic, geophonic, and anthrophonic labels for a single field recording with an average precision of 0.767. However, certain labels were predicted incorrectly depending on the time of day and co-occurrence with other labels, suggesting further refinement is needed to improve the accuracy of predicted labels.

4: Overall, this multi-label classification approach could enable researchers to label field recordings more quickly and generate an “alert” system for monitoring changes in a specific sound class. Ultimately, the adaptation of the ML algorithm may provide soundscape ecologists with new metadata labels that are searchable in large databases of soundscape field recordings.