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Exploring ecosystem dynamics by hypotheses-driven soundscape information retrieval

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Soundscape information retrieval represents the technique to extract meaningful information relevant to geophysical, biological, and anthropogenic activities from field recordings. Supervised source separation and audio recognition techniques have been widely employed in the past, but the performance depends on the quantity of training database and the complexity of testing data. To counter this issue, unsupervised learning approaches, such as blind source separation and clustering tools, have been recently introduced to analyze the dynamics of marine and terrestrial soundscapes. However, the performance of unsupervised learning relies on a proper hypothesis for the input data. Until now, it remains a challenge for ecological researchers to integrate proper hypotheses in soundscape information retrieval. In this presentation, we will demonstrate the integration of acoustic niche hypothesis, which predicts soniferous species will avoid acoustical competition by shifting acoustic niche in time or frequency domains, in the analysis of soundscape dynamics in the shallow waters off western Taiwan. In the future, more advanced techniques of source information retrieval are necessary to facilitate the soundscape-based ecosystem monitoring. The domain knowledge of ecological science and bioacoustics will be essential for the future development of soundscape information retrieval.

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