Applying Statistics to "Bird Listening"

by Sunny Tseng

It was an early morning in spring; the party in Pacific Spirit Regional Park had just begun. At four o'clock, the first Swainson's Thrush started his fluting song. The cold air carried the upward-spiraling melody through the dense hemlocks, breaking the silence of the forest. Then a Pacific Wren joined in with his tumbling, trilling, complex song. Oh, a Purple Finch also flew in with his slurred warbling characteristic of finch songs. All these birds revealed their existence, even when hidden by dense foliage and the dim light, with their song.

Many people agree that most birds in the field are heard rather than seen. Previous studies have shown that the majority of the birds in a breeding survey were detected aurally (~70% in suburban landscapes and ~90% in closed-canopy deciduous forests). Given this high reliability of aural detection and the development of technology, in recent decades ornithologists started putting audio recorders in the field to remotely monitor bird sound activity. Simply by listing to sound recordings, ornithologists can determine the bird biodiversity in an area.

Despite increasing interests and the wide use of audio recorders for bird surveys, analyzing the sound recordings is a current challenge. Manual inspection of sound recordings is extremely time- and labour-consuming, especially when the data amount to terabytes in large monitoring projects. This made me think it would be a huge help if we can teach the computers to "listen" to the sound recordings and analyze the data for us. But, is it possible?

Pacific Wren by Sunny Tseng.

As an MSc student in the University of British Columbia's Faculty of Forestry, I am currently developing a statistical model which can distinguish bird sounds from other noises such as sounds from weather, traffic or human speech. Bird sound has its distinct sound frequency and timbre; these are called "features" in computer science terminology. Those features enable the statistical model to search for a similar pattern and capture bird sounds in a sound recording. When analyzing a long recording, the statistical model I developed can label each recording period with 1/0 to indicate the presence/absence of bird sounds. After that, ornithologists only need to check the periods with bird sounds and save the processing time. To build the model, I used 15,000 audio recordings provided by an IEEE Bird Audio Detection challenge. It turns out that the model has 90% accuracy in detecting bird sound when a bird is actually calling in a recording. More importantly, the model took less than one hour to analyze 44 hours of recordings, which means the model can "listen" to the audio 50 times faster than a human being.

So, can statistics be applied to "listen" to birds? The answer is yes, and I am excited about developing more statistical tools to assist avian acoustic studies in the future.

Sunny was born and raised in a beautiful country called Taiwan. During her graduate studies at UBC, she pursues her passion in developing mathematical methods for conservation ecology. For further information, please contact Sunny at ***sunnyyctseng@gmail.com****.*

Sunny recording bird sounds in Williams Lake, BC with her Telinga parabolic microphone.