Project Summary: The Dr. Dolittle Project:
A Framework for Classification and Understanding of Animal Vocalizations

Overview

The fundamental goal of this research is to develop a broadly useable framework for pattern analysis and classification of animal vocalizations, by integrating successful models and ideas from the field of speech processing and recognition into bioacoustics.

Current approaches to automated methods for analyzing and classifying animal vocalizations are still significantly behind the capabilities that exist in the field of human speech processing, and cross-fertilization with other fields offers a tremendous opportunity for making advancements in this area. The proposed framework, based on robust feature analysis and selection and Hidden Markov Model classification, is an innovative cross-disciplinary strategy, aimed at bringing together expertise from such fields as psychology, biology, linguistics, machine learning, and signal processing, for the purpose of making significant advancements to the current state-of-the-art in bioacoustics algorithms and animal communications research.

The algorithms developed through this process will be applied to a wide range of important tasks, including automatic vocalization classification and labeling, individual identification, call type classification, behavioral-vocalization correlations, stress analysis, language acquisition, and seismic infrasonic communication. Species being targeted for study include domestic and agricultural animals, marine mammals, and several endangered species.

Intellectual Merit

The primary contribution of this work is the development of well-founded models and methods for improving our understanding of animal communication and behavior. The proposed experimental tasks are of significance to a wide variety of research problems within this field. In addition, many of the aspects of the HMM classification framework, including hierarchical feature analysis and selection, variable frame sizing, and learnable model topologies, offer the potential for advances in machine learning and speech and signal processing.

Broader Impact

The development of an easily adaptable framework to apply speech-processing techniques to animal vocalizations will allow other researchers to easily create systems that pertain to the specific species they are studying. This will speed the development effort of these systems and allow those not familiar with speech and signal processing techniques to incorporate advanced methods in their research. One of the primary underlying motivations for such research is the preservation of endangered species and the improvement of care and habitats for animals in captivity, and this research has the potential for significant, long-term impact toward these goals.