

Project Number: S18-09

Project Title: BiRD-EMANN (Bird Recognition and Detection through Embedded Systems, Microphone Arrays, and Convolutional Neural Networks)

Team Members: Milton Collins, Luis Garrido, Patrick Karol, Eric Jiang

Advisors: Athina Petropulu, Vikram Padman, Manoj Viswambharan

Keywords: Nocturnal Flight Call, Microphone Array, Convolutional Neural Network, Embedded Systems, Signal Processing

Abstract:

Migration flights of songbirds occur mainly at night throughout the United States, with many of these birds giving short vocalizations during flight. These Nocturnal Flight Calls (NFCs) are distinct between species and consistent among individuals of a species, providing a reliable way to identify unseen birds. This project aims to track and identify migrating birds based on their calls, and specifically acquire spatial information regarding direction and altitude of migratory flights, while gathering important data on bird migration patterns. In addressing the problem of identifying NFCs, a Convolutional Neural Network (CNN), trained on a dataset of previously identified spectrograms, will be used to identify recorded bird calls. In addition, the performance of this method will be compared with other approaches to speech recognition. A hemispherical microphone array will be used to record calls and acquire spatial information; beamforming and source localization techniques will be used to determine direction and altitude of the birds. A Zybo-Z7 development board running embedded Linux will be connected to the microphone array to record calls and perform the necessary audio processing. Then, the calls are sent to the CNN on a separate computer for identification. Finally, an SQL database will be used to curate the worthwhile migration data obtained from field recordings of migration flights.